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 lifelong 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
  Appendices:
  Skills Awareness Program: Preliminary Report on the pilot, 2002
  TIF 2003 Application
  TIF 2004 Application

Chapter 2: Project plan ..............................................................4
  Appendices:
  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
  Appendices:
  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
  Appendices:
  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](http://lifelonglearning.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).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Budget in $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project management salary for half-time over 1.5 years</td>
<td>35,000</td>
</tr>
<tr>
<td>Teaching/administrative relief for academic team members</td>
<td>13,000</td>
</tr>
<tr>
<td>Web construction</td>
<td>10,000</td>
</tr>
<tr>
<td>Consumables</td>
<td>2,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td><strong>60,000</strong></td>
</tr>
</tbody>
</table>

References
Kemmis, S. (1998) System and lifeworld, and the conditions of learning in late modernity Curriculum Studies 6(3), 269-305
Faculty of Science Skills Awareness Program

Preliminary Report and Comments on the 2002 pilot program

Original rationale and background

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 2000). 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 original proposal envisioned three outcomes for the program, whereby students:

- developed an awareness of the significance of skills as part of their education and subsequent career
- practised specific skills through tailored self-help programs or within the degree curriculum
- were provided with opportunities to demonstrate improvement and competence in such skills as part of the degree assessment and feedback process

Proposed Structure of the Program

The Dean of Science requested a group comprising a team from the library (Judy Campbell, Debbie Eriksen, Julie Olsen), a member of the faculty Teaching and Learning Committee (Charlotte Taylor) and the coordinators of the Environmental Science degree (Phil McManus, Craig Barnes) trial a Skills Awareness Program with, primarily, first year students enrolled in the Env. Sci degree.

It was decided to focus on 7 skills areas:

- Information literacy
- Problem solving
- Communication skills
- Numeracy
- Critical thinking skills
- Group and team skills
- Learning and self management skills

Raising student’s awareness of these areas would be effected through:

- Self-appraisal tools (in the form of multiple choice quizzes) provided for each skill area.
- Automated grading of student responses provides a profile of the student, such that an appropriate feedback response can be released. This will explain the elements that constitute possession of the skill and demonstrate advantages of improving these areas.
- Links to suitable resource materials are made available to allow the student to develop and improve their skills in these areas.

- A timeline for completing the self-assessment for each skill will be developed so that students have the opportunity to create a pre- and post-profile of their skills awareness.
- Review of curriculum explanation, development, assessment and feedback of skills is carried out. Information on outcomes fed back to course developers and appropriate Faculty policy on skills development created.

The steps to be set in place during 2002 were as follows:

1. Students would be targeted at the beginning and end of each academic year. They would be asked to complete an online self appraisal quiz where progress could be monitored by administrators and feedback given to students on the outcome of their quizzes.
2. Students would also be involved in the design process through ongoing evaluation. In this way the learners and potential users could have ownership of the program and see it as a relevant component of their undergraduate degree. This process is essential to the success of the proposed program if students are to actively participate on a voluntary basis in the future and subsequently make use of self help resources to improve their skills.
3. The library had an existing program incorporating a series of quizzes and self help modules, which could be used (perhaps with some modifications – I’m not sure) for the information literacy skill area. No other resources etc existed in the faculty to cover the other skills areas, so quizzes needed to be created and appropriate self help resources made available. 
4. Consultations with academic staff involved in teaching and curriculum design for the Bachelor of Environmental Science (Phil McManus and Craig Barnes) established that demonstrating competence in most of the skills areas is impossible to test in a web-based self assessment mode and is best achieved through the integrated assessment inherent in all units of study. Review of existing assessment of skills within ENVI curricula would therefore be necessary as part of the program.
5. Some skills areas are very difficult to work with using this self appraisal format ie critical thinking, without very carefully designed questions?
6. There was not a final consensus on exactly how quizzes questions would be ‘standardised’ across all skills areas – the library had their existing format - Beryl wants very few questions for each skill – I think more are needed to allow students to see the complexity of the concepts and for us to be able to give useful feedback and direction to students with different levels of awareness.

Library Input (this information provided by Debbie earlier this year – their new report should have been sent to Beryl)

Debbie Eriksen has collaboratively developed an online Information Literacy Program with Julie Olston (Co-ordinator, Physical Sciences cluster of libraries) and other librarians in the cluster, under the auspices of Judy Campbell and Sue Hanfling. National Information Literacy Standards have been applied in its development. A self-assessment quiz that reflects these standards has been developed and is to be completed by students at the beginning and again at the end of the year. Its purpose is to act as a self evaluation tool that raises students’ awareness of information literacy skills and indicates the skill level that they possess. As an adjunct to this, a partial mediated quiz, that will be monitored and managed by the Library, will be made available to test students’ grasp of the concepts contained within the online Information Literacy Program.
Communication skills, Learning and Self Management skills
I chose to cover two skills areas for which I already had some information ie access to quiz questions and ideas about possible self help resources. I created quizzes for writing and learning styles using 30 questions for each and categorizing students into three groups depending on their “mark” for the quiz (which isn’t revealed to the student). One of three feedback responses is then released explaining our assessment of their level of awareness (and competence?) before providing access to appropriate self help web materials. For this year these were mainly materials already existing in biology units for first and second year plus websites form American Universities. I was not able to cover the post testing aspects of quizzes or to extend the quiz process to higher years – I find it very difficult to develop detailed criteria for progression through the stages of competence for these skills – there don’t seem to be such obvious milestones as those decided for information literacy??

It became obvious during this process that we have very few self help resources available (or they’re possibly not well advertised since I suspect there is more around on campus than we know eg Arts faculty is creating a (compulsory) writing program with credit points attached which appears to be totally separate to the courses currently offered by the Learning Centre – why the apparent duplication or overlap). Therefore we need to decide where we have resources already integrated into individual units of study, where we create resources as required for all science students, or whether the university provides centralized resources eg through Maths Learning Centre, The Learning Centre etc. Depending on how this is achieved how do we make sure all students have equitable access to these? A review of a number of other universities via their web sites shows that professional degree programs eg Medicine, business schools etc tend provide all their own resources while the general degree students are more likely to access university-wide resources or centres?

A range of ‘testing’ processes and materials was reviewed eg the program conducted at Adelaide University (which is currently being reviewed by their team - they will get back to me with results) and the materials and tests from the skills quality program in UK (I sent Mary the URL), to determine whether we could use existing testing or self appraisal materials. However they are much more detailed and extensive than that envisaged by Beryl??

Outcomes of the pilot program
The following were steps were carried out using 2002 and outcomes of each are discussed below (in italics)

- Defining skills in the context of both the science degree program and their subsequent transferability to the workplace
  
  We didn’t have the time or expertise to do this in 2002 but we need to agree on our interpretations, with relevant examples, of the university generic attributes in the science context. These then need to be made explicit both in the program and in each unit taken in the faculty; there is no fixed policy or guidelines at present.

- Creating, or incorporating existing, instruments, to measure student awareness of skills and personal competence/confidence

Based on what we used this year and the ensuing problems and discussions - we have to agree on a format for this and then create a standardized set of questions for each skill area – it may not be possible to use the format for all skills areas? How do we work with this?

- Providing feedback to students on their perceived awareness and possible problems
  
  We eventually agreed on a format for this although it took a lot of work to get WebCT and its designers to make it work (SOBS TDU helped a lot here). It wasn’t possible to evaluate how well this worked for student responses because we had so few students and all with a relatively high level of awareness.

- Providing links to courses or other resources for self-help in practising and improving skills
  
  It was worrying to see how few existing resources we seem to have to which students can be referred. This is our main responsibility if the program is to be successful.

- Reviewing the degree program units to catalogue the extent/degree to which relevant skills development is communicated to students and their learning and assessment integrated into curricula
  
  As Mary has pointed out Physics have been through this process and we should do the same for Biology in 2003. It’s the other big area where work is needed before we can provide something useful for the students.

- Providing feedback to academic staff on curriculum and resource provision with reference to the skills component
  
  See above.

- Investigating the progress of the Academic Board working party on Generic Attributes within the University
  
  I heard bits about this at the First Year Experience meetings but I need to find out how far this project has gone and what information they have. We should be incorporating their findings into our explanations and materials for students.

- Future credit-based assessment of skills competency may be part of the science degree program
  
  Where are we going on this front? What is the Arts Faculty doing with their writing unit?

- Students in ENVI 1001 will be approached as part of their degree seminar series to discuss the concept of skills and an awareness program. Will participate in workshop training their thoughts on skills and levels of competence, adequacy of curriculum input and assessment
  
  We conducted a seminar with first year students in Env Sci (though relatively few attended) and explained what we were doing. We discussed their appreciation of skills as part of their degree program training using data from the UK study (Dunne 2000) of environmental graduates. Students are very aware of the data on skills, particularly in terms of getting jobs. All first year students were then asked to trial the quizzes etc. and the library have the figures for participation. One student provided interesting feedback and would be a good contact in the future. She is a former skills training manager and her initial comments suggested that “basically we’re way behind but it’s good to see we’re getting going in this area” and the acknowledgment of the significance of skills development is as important as working with content knowledge!! I haven’t had any other feedback from students on the curriculum and skills incorporation other than that from evaluations of our biology units. Generally it’s difficult for students to comment objectively on these issues until they’ve moved on to the next level and see the relevance of earlier units.

- We presented a talk at the Faculty Forum in June 2002, to discuss the rationale for the project and raise staff awareness of the goals and progress.
The Dean of Science will provide certificates of participation for students in the trial program

The library staff are processing this?

General comments on progress for 2002 and thoughts for 2003

1. There was a distinct divergence of paths for the library team and myself during the year – I think we had different agendas and we never sorted this out, I also could not contribute as much as I wanted, since Semester 1 has a high course admin and teaching load and I was on study leave from June onwards.

2. There were also problems with an understanding of WebCT and its capabilities – we need more input from tech people to make it do what we want, rather than fitting our expectations to the fairly limited basic structure of the program.

3. Students are very aware of skills, though not perhaps aware of their competence, and this requires that we make these explicit – do we know what we want / expect and can we explain this to the students? We need a very clear coordinated effort to direct them to areas within the curriculum and show where we are going to work on these areas.

4. Key areas requiring action are a review of the curriculum in terms of skills awareness in the context, provision of help and assessment of skills and determining competence

5. I think the concept and the web format we put in place this year will work – we need to expand it to a few more skills areas for 2003 (numercy is an obvious one) and trial again with the whole Science cohort. Until we’ve sorted out resources problems and worked with curriculum it’s hard to see where we can offer more next year.

6. We don’t necessarily have the experience in many of these skills areas – ie group work is very problematic requires lots of time and effort to set up - has serious follow on effects on the curriculum content?

7. Search of web materials for students in our units (not exhaustive by any means) shows that the basics are covered quite well in many places but things like critical thinking can’t be taught and self appraised very easily. Testing also requires complex feedback.

8. If we are going to provide remedial help for some of these areas the University is going to have to provide more resources eg in the Learning Centre (approx 6 staff for 30 000 students (?) it was embarrassing to tell the Americans this at the FYE conference!!)

9. We are going to have to change the way we give feedback to students in units of study, with these skills specifically in mind eg essays etc. At present I don’t think we do??

This is a preliminary report only on the pilot program. I will prepare a complete report on our activities for 2002, with the supporting documents etc when I have the data and report from the library.

Charlotte Taylor
2 December 2002

Teaching Improvement Fund 2003 (Faculty of Science)

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

This project will put in place processes to encourage students to take responsibility for developing generic attributes required for future employment, and the mechanisms to self-assess the development of these attributes during the duration of a degree program. The project will build on the work of the 2002 pilot program (Faculty of Science Skills Awareness Program), and take into account the difficulties encountered. The recent review by the Academic Board of the Faculty’s Teaching, Learning and Research Training commented on the pilot program and noted that an appropriate Faculty-wide approach would follow.

The target group

The Faculty aims, in the long term, to include all undergraduate on-campus students in Faculty of Science degree programs. In 2003 segments of the project will be trialed using students in one of the “smaller” degree programs.

Background

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 own productivity and income-earning prospects. These require the ability to compete effectively in the job market and being 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.

Goals of the project

To help students develop a suitable set of attributes by the time they graduate, this project has the immediate goals of:

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

Overview
Generic attributes include generic skills (such as communication skills, thinking skills etc., discipline specific skills (these would be different for each discipline) and life-long employability skills (self-management, teamwork, taking responsibility, leadership). The development of these attributes cannot occur in isolation and is therefore seen to be from within the curricula of degree programs. The project is particularly interested in the universal attributes and so will focus on two sets of skills: (i) portable generic skills; and (ii) life-long employability skills. The project will elaborate on the required skills and define staged levels of competence that can be achieved during a degree program. So that students can recognise these skills and identify opportunities within the curriculum for their development, a set of typical tasks will be documented. To be able to self-assess levels of competence, students will be provided with benchmarking opportunities, including the use of the ACER Graduate Skills Assessment (GSA) test. Students will also be given instruction on how to keep a personal audit.

Project requirements
Project manager half time for one year $25,000
Teaching/administrative relief for key personnel in the Schools $13,000
Web work $10,000
Consumables $2,000
Total $50,000

Justification:
Project manager – to coordinate and implement the project’s administrative activities and to advise and help with the design of pedagogically sound methodologies for implementation.

Time relief – for academics to be seconded into the project at the rate of four academics for one day per week for the duration of the year-long project. The money represents time for laboratory teaching relief.

Web work – it is envisaged that much of the information for students will be delivered via the Web, possibly including a self-appraisal mechanism for some of the skills.

Consumables – includes the paper production of materials for students to help them develop and maintain a portfolio of skills.

References
Kemmis, S. (1998) System and lifeworld, and the conditions of learning in late modernity Curriculum Studies 6(3), 269-305
Mary Peat for the Faculty Group

Teaching Improvement Fund 2004 (Faculty of Science)
Title: Enhancing the employability of Science graduates: increasing the awareness of staff and students to the needs of the employers – continuing Faculty project

The purpose of this project, funded in 2003 by a TIF grant, was to 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. In addition students will also be provided with mechanisms to allow them to self-assess the development of these attributes throughout their degree program. The project aimed to build on the work of the 2002 pilot Faculty of Science Skills Awareness Program, and take into account the difficulties encountered.

Whilst the project is progressing well it is not finished. The continuing development has now taken into account the Institute for Teaching and Learning’s current skills project (commissioned by Paul Ramsden) and it has been necessary to make certain modifications to the Faculty of Science project for alignment purposes (Chris Stewart is the Faculty’s representative on the ITL’s project). This has taken up some of our funded time. In addition the group will need to develop appropriate staff guidelines for the inclusion of generic skills in curriculum reforms. The ITL project is also addressing this and will inform the ways in which we will develop guidelines (hoping not to re-invent the wheel). Thus there is a need for additional funds in 2004 to continue with the work, which has taken longer than expected.

To date the project has reported to the Faculty Teaching and Learning Committee in March, April, June, August and October. The outputs currently include:

• Literature review (which enabled the project to define its status within the higher education sector)
• Articulation of generic attributes and skills to be included in student product
• Development of the scaffolding for students to make linkages relating to generic attributes
• Development of language-related case scenarios covering several "majors" within science
• Documentation of typical tasks in a student oriented format
• Articulation of a process for students to develop a personal audit using a template to record records of achievement/attainment and a log format for checking the breadth of the attainment
• Development of the functionality of a web site
• Implementation of two successful pilots with students in May and August

Publicity for the project has been in the form of:

• A seminar given to the Science Librarians in August, 2003; A poster presented at the November, 2003 VC’s Showcase
• Web site with all development information and outputs – http://science.uniserve.edu.au/projects/skills/

A web designer (from Architecture) is currently working on the web design. It is expected that this design process will be finished in mid-February, 2004. After that the content will be entered into the templates.

The plan for 2004 is:

• Complete the web design process and fill web pages with content; Assess the functionality of the web design with mini pilots (small groups of students)
• Beta test the site (June-July) and launch it in Semester 2; Develop a set of guidelines for staff for the inclusion of generic skills in curriculum reforms

Budget:

• Teaching relief for Chris Stewart and Charlotte Taylor $4,000
• Administrative support $2,000
• Web design $4,000

TOTAL $10,000

Mary Peat, Chris Stewart, Charlotte Taylor February 2004
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**

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

**Timeline 2004**

<table>
<thead>
<tr>
<th>Month – April</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Creating web pages</td>
</tr>
<tr>
<td></td>
<td>Writing materials for more attribute groups</td>
</tr>
<tr>
<td></td>
<td>Collecting examples and models from students</td>
</tr>
<tr>
<td>May–August</td>
<td>Trials with students and focus groups</td>
</tr>
<tr>
<td></td>
<td>Re-working materials, relative emphasis and ‘look’ of web pages</td>
</tr>
</tbody>
</table>
Collecting more examples from students
Incorporation of Employer interviews
Incorporation of interviews with students in the workforce

<table>
<thead>
<tr>
<th>September - November (i.e., 2nd semester)</th>
<th>Evaluation of new web site with students in targeted degree programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing project report</td>
<td></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Jane Doe’s Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
</tr>
<tr>
<td>Information Literacy</td>
</tr>
<tr>
<td>Research and Inquiry</td>
</tr>
<tr>
<td>Ethical, Social and Professional Understanding</td>
</tr>
<tr>
<td>Personal and Intellectual Autonomy</td>
</tr>
<tr>
<td>Oral ✓</td>
</tr>
<tr>
<td>IT literacy</td>
</tr>
<tr>
<td>Critical thinking ✓</td>
</tr>
<tr>
<td>Responsibility ✓</td>
</tr>
<tr>
<td>Independent learning ✓</td>
</tr>
<tr>
<td>Written ✓✓</td>
</tr>
<tr>
<td>Information evaluation ✓</td>
</tr>
<tr>
<td>Problem solving ✓</td>
</tr>
<tr>
<td>Understanding</td>
</tr>
<tr>
<td>Self management ✓</td>
</tr>
<tr>
<td>Non-verbal</td>
</tr>
<tr>
<td>Information searching</td>
</tr>
<tr>
<td>Analysis ✓</td>
</tr>
<tr>
<td>Awareness</td>
</tr>
<tr>
<td>Goal skills</td>
</tr>
<tr>
<td>Teamwork ✓✓</td>
</tr>
<tr>
<td>Library skills</td>
</tr>
<tr>
<td>Dissemination</td>
</tr>
<tr>
<td>Sensitivity</td>
</tr>
<tr>
<td>Leadership ✓</td>
</tr>
<tr>
<td>Networking ✓✓</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Graduate Careers within the ABS (Australian Bureau of Statistics)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Selection Criteria</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>1. Sound conceptual, investigative and analytical skills, together with an ability to undertake statistical research projects.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>3. Good interpersonal and liaison skills, including the initiative, drive and flexibility to achieve results.</td>
</tr>
<tr>
<td>4. An ability to organise tasks, work effectively in teams or individually and meet deadlines.</td>
</tr>
<tr>
<td>5. A demonstrated understanding of the role of the ABS.</td>
</tr>
<tr>
<td>6. Relevant tertiary qualifications and a demonstrated level of academic achievement.</td>
</tr>
</tbody>
</table>

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.lifelonglearning.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.
Teaching Improvement Fund 2003 (Faculty of Science)

Methodology of the project
The project consists of the following steps:

Preliminary phase:
- 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 phase:
- Articulation of generic attributes and skills to be included in the project
- Definition of levels of competence within the attributes and skills
- Identification of opportunities within degree programs where skills may be practiced
- Identification of ways to integrate add-on and embedded generic skills into curricula
- Articulation of the scaffolding for students to make linkages relating to generic attributes
- Development of language-related case scenarios
- Documentation of typical tasks
- Articulation of student benchmarking opportunities
- Articulation of process for student personal audit

Implementation phase:
- Pilot

Evaluation and reporting phase:
- Evaluation of project
- Documentation of project and reporting of outcomes

The project team will report formally to the planning/steering committee at the end of each phase.

Preliminary phase

Literature review
A literature review will focus on published papers relating to generic attributes in higher education. In the first instance this will be primarily online publications and will include academic papers and government reports.

The literature review will cover four main areas:
- employability attributes (and skills) of graduates;
- integration of graduate attributes into higher education curricula;
- teaching and assessment of graduate attributes; and
- resources and staff development implications of introducing graduate attributes.

Identification of University of Sydney graduate attributes
The ITL is currently conducting research in the area of graduate attributes and is carrying out a review of the University’s graduate attributes policy. The introduction of a new policy will require much general debate by the University community before its adoption. Even though the University’s policy statement issued by the Academic Board is to be superseded, the current documents will be used.

Identification of existing generic attributes projects within The University of Sydney
This will involve the identification of generic attributes projects within The University of Sydney and the collection of position papers, policy statements, staff guidelines and student materials relating to the projects. A contact person will be sought for each project. The ITL project has collected a number of case studies from within the University and these will be added to those we identify.
Identification of generic attributes projects at other universities
This will involve the identification of generic attributes projects within other Australian universities, and overseas universities, particularly those in the United Kingdom and New Zealand. For those projects which are seen to be of special interest, a contact person will be sought.

Establishment of a Skills Reference Group
This will involve the identification of individuals, both within and external to The University of Sydney, who will be invited to provide valuable discussion and comments as members of a Skills Reference Group. Many of these individuals would be those involved in the previously identified generic attributes projects. The Skills Reference Group will be an e-reference group – no meetings are expected, all communication will take place electronically.

A web site will be set up and maintained to disseminate information to the Skills Reference Group and other interested parties (http://science.uniserve.edu.au/projects/skills/).

Articulation of related language used by employers
This will involve 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. Some specific examples will be included.

Development phase
Articulation of generic attributes and skills to be included in the project
This will involve the compilation of an extensive list of generic attributes and skills from the literature review and existing generic attributes projects, followed by the identification of the generic attributes and skills that the Faculty of Science is interested in fostering in science graduates. The Faculty list is expected to be a subset of the full set of identified skills and attributes. The lists will include a description of the attribute or skill and associated keywords, for example:

| Team work | The ability to interact effectively with others in order to contribute to a common outcome, and to take a leading 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. 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 is integrating global and professional attributes with skills to define a working model suitable for the Faculty.

Discipline specific skills (e.g. ability to carry out a titration, ability to dissect a frog, ability to perform a particular calculation) are seen to be part of the content for a particular discipline and are therefore not part of the Faculty project (or the ITL project).

Having identified the required attributes and skills, the project will use the ITL hierarchical model as a guide to map the attributes and skills. This is expected to clarify the relationships between the attributes and skills, assist in identifying gaps within the set and present a picture of where the skills fall in terms of integration within the students’ learning experiences. This mapping will also allow us to decide if the ITL model, or a modification of it, is appropriate as a guide for this project. If the ITL model is found to be inappropriate other models will be sought and trialled. This mapping is expected to lead to the development of a model that the Faculty of Science can use for this project and beyond. A similar mapping process may be used as a visual representation to assist students in recognising, and understanding the value to them of mastering, the appropriate skills and thus acquiring the attributes.

A more detailed explanation for each attribute and skill, within the final mapping, will then be produced.

Definition of levels of competence within the attributes and skills
The development of these attributes and skills cannot occur in isolation and is seen to be 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 will be defined for each attribute and skill. Students will need to monitor their own progress in attaining the skills and developing the attributes. It is expected that levels of development for the attributes will fit a three-level scale, such as unsatisfactory/satisfactory/outstanding, while levels of competence in the skills will be stated as unable to perform task x/able to perform task x/excels at task x.

Identification of opportunities within the degree program where skills may be practiced
Generic skills are 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). Foundation skills are those that students would normally be expected to bring with them to university or are outside the degree program structure. If students are not competent in these they would be directed 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. Add-on skills are usually associated with units of study but 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 skills may be developed within a unit of study, or from material available from the Learning Centre (e.g. Writing a Laboratory Report), or from continuing education (e.g. Microsoft Office). Embedded skills are usually associated more directly with units of study and are often incorporated into assignments and assessments. Students will need to be offered a range of opportunities within their degree programs for practising the embedded skills. Opportunities for practising the embedded skills within degree programs will be identified.

Identification of ways in which the add-on/adjunct and embedded generic skills can be integrated into curricula
As previously noted, attributes are seen to be acquired through the mastery of one or more generic skills. Integrating opportunities for practising the add-on and embedded generic skills into curricula is a major focus of this project. This will involve the identification of activities within degree programs that could allow for such opportunities. For example, team member skills may be practised in laboratory activities, in a group presentation, in a group project, during PBL activities, and so on. These opportunities will need to be spread across and throughout the degree programs. Examples to illustrate the linkage between the skill and the opportunity will be sought from the previously identified existing generic attributes projects. These examples will 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 will be produced.

Articulation of the scaffolding for students to make the linkages relating to generic attributes
Students acquiring these generic attributes will need to identify their value, and to take responsibility for practising them and monitoring their progress. To facilitate this process a scaffold will be produced for students which is well-structured but at the same time welcoming and encouraging.

Students need to:
- understand the language associated with the generic attributes and skills, so that they can recognise the link between ‘employer speak’ and the attributes and skills;
- recognise opportunities within their degree programs to develop and practise the skills;
• self-assess their awareness and competence for the various skills; and
• keep a personal record of their progress in developing the attributes.

This stage of the project will involve the documentation of a package (the graduate employability attributes package) that includes a framework in which students will be made aware of the value of the generic attributes, introduced to the associated language, shown how to recognise appropriate learning opportunities, provided with tools for self-assessment, provided with guidelines for producing a personal audit, and strongly encouraged to embrace the package from orientation through to graduation. In addition, the graduate employability attributes package will itself provide students with first-hand experience of being independent learners.

To assist students in understanding the language associated with the generic attributes and skills a series of case scenarios will be developed. So that students can recognise the skills and identify opportunities within the curriculum for their development, a set of typical tasks will be documented. To enable them to self-assess their levels of competence, students will be provided with benchmarking opportunities. Students will also be given instruction on how to keep a personal audit.

Development of language related case scenarios
In order to see the value of acquiring the generic attributes students need to understand what employers are referring to when they talk of ‘employability skills’ and to see the relationship between these and the generic skills they practise at University. To assist students in understanding the language associated with these generic attributes and skills a series of case scenarios will be developed. Sample job advertisements and media articles will be used with University documentation, such as course outlines and policy documents, to illustrate the linkages. There may also be existing scenarios from existing generic skills project materials that are suited to this purpose.

Documentation of typical tasks
To help students recognise these skills and identify opportunities within the curriculum for their development, a set of typical tasks will be documented. A series of case scenarios that illustrate the development of these skills will also be compiled. The ITL has already collected several case studies which may be used by this project.

Articulation of student benchmarking opportunities (self-assessment)
To be able to self-assess levels of competence, students will be provided with benchmarking opportunities. This will involve the identification and documentation of available benchmarking tools, including the ACER Graduate Skills Assessment (GSA) test, and the production of benchmarking guidelines, including case scenarios, where necessary.

Articulation of process for student personal audit
Students need to keep a personal portfolio to demonstrate the progress of their competence. 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.

Implementation phase
Pilot
A pilot will be conducted during second semester. The details of this require further investigation but will include answers to the following questions.
What student group are we using?
Do we plan to do anything that requires ethics clearance?
How is it to be introduced to students?
Which aspects will be trialled?

Outcomes of the project
The project will produce:
• a mechanism for introducing students to the skills and attributes at the start of their university studies;
• a mechanism for providing student access to skills materials, this is most likely to be a web site;
• a series of case scenarios to help students learn the language;
• documentation for students that clearly explains the identified core generic attributes and associated levels of competence;
• guidelines for helping staff to create/identify skill development opportunities for students within curricula;
• a mechanism for students to self-assess their awareness and competence of the various skills; and
• a mechanism to show students how to keep a personal audit.

Timeline
<table>
<thead>
<tr>
<th>January</th>
<th>Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection and explanation of attributes and skills</td>
<td></td>
</tr>
<tr>
<td>Development of model</td>
<td></td>
</tr>
<tr>
<td>February – June</td>
<td>Definition of levels of competence</td>
</tr>
<tr>
<td>Design of scaffolding</td>
<td></td>
</tr>
<tr>
<td>Development of case scenarios</td>
<td></td>
</tr>
<tr>
<td>Development of typical tasks and case studies</td>
<td></td>
</tr>
<tr>
<td>Mechanism for self-assessment</td>
<td></td>
</tr>
<tr>
<td>Mechanism for personal audit</td>
<td></td>
</tr>
<tr>
<td>July – October (i.e. 2nd semester)</td>
<td>Pilot</td>
</tr>
<tr>
<td>Evaluation</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>Recommendations to Faculty</td>
</tr>
</tbody>
</table>

How long will the trial run?
How is it to be trialled?
What method of delivery will be used, e.g. focus groups?
Students may be asked to fill in some of the holes in the model.

Evaluation methodology
Evaluation and reporting phase
This will involve the identification and use of an appropriate methodology for evaluating the level of success of the pilot and the project outcomes. Feedback may be sought from students, staff, and employer groups, using surveys, questionnaires, interviews, reflective journals, sample audits, and audits of opportunities developed within the disciplines.

Documentation of project and reporting
This will include a written report to Faculty with recommendations on packaging and implementation.
## Project plan

<table>
<thead>
<tr>
<th>Project goals</th>
<th>Methodology</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To identify the core generic attributes and skills of interest to Faculty of Science</td>
<td>Identification of University of Sydney graduate attributes</td>
<td>List of generic attributes and skills to be included in project</td>
</tr>
<tr>
<td></td>
<td>Identification of existing generic attributes projects at the University of Sydney</td>
<td>Mapping of the relationship between the skills and attributes</td>
</tr>
<tr>
<td></td>
<td>Identification of generic attributes projects at other universities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Articulation of generic attributes and skills to be included in the project</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discussion with Skills Reference Group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presentation to Faculty Teaching and Learning Committee</td>
<td></td>
</tr>
<tr>
<td>2. To develop clear explanations of these core generic attributes and skills</td>
<td>Articulation of generic attributes and skills to be included in the project</td>
<td></td>
</tr>
<tr>
<td>3. To define levels of competence for these core generic attributes and skills</td>
<td>Definition of levels of competence within the attributes and skills</td>
<td></td>
</tr>
<tr>
<td>4. To provide students with a framework to understand the nature of the core generic attributes and skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. To help students learn the language of these attributes and skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. To help students identify opportunities for building these skills and attributes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. To help students self-assess their awareness and competence of the attributes and skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. To help students keep a personal record of their competence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. To help staff identify students' development opportunities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. To offer recommendations to Faculty</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Appendix 2: Skills Reference Group

### Members:

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrianne George</td>
<td><a href="mailto:george@chem.usyd.edu.au">george@chem.usyd.edu.au</a></td>
</tr>
<tr>
<td>Bjorn Landfeldt</td>
<td><a href="mailto:bjorn@it.usyd.edu.au">bjorn@it.usyd.edu.au</a></td>
</tr>
<tr>
<td>Carol Sheldrake</td>
<td><a href="mailto:Carol.Sheldrake@oac.usyd.edu.au">Carol.Sheldrake@oac.usyd.edu.au</a></td>
</tr>
<tr>
<td>Craig Barnes</td>
<td><a href="mailto:craigb@mail.usyd.edu.au">craigb@mail.usyd.edu.au</a></td>
</tr>
<tr>
<td>Cyril Latimer</td>
<td><a href="mailto:cyril@psych.usyd.edu.au">cyril@psych.usyd.edu.au</a></td>
</tr>
<tr>
<td>David Livesey</td>
<td><a href="mailto:davidd@psych.usyd.edu.au">davidd@psych.usyd.edu.au</a></td>
</tr>
<tr>
<td>Elizabeth May</td>
<td><a href="mailto:emayo@mail.usyd.edu.au">emayo@mail.usyd.edu.au</a></td>
</tr>
<tr>
<td>Erica Sainsbury</td>
<td><a href="mailto:Ericas@pharm.usyd.edu.au">Ericas@pharm.usyd.edu.au</a></td>
</tr>
<tr>
<td>Fiona White</td>
<td><a href="mailto:fionaw@psych.usyd.edu.au">fionaw@psych.usyd.edu.au</a></td>
</tr>
<tr>
<td>Gareth Denyer</td>
<td>gareth@rmm�.usyd.edu.au</td>
</tr>
<tr>
<td>Geoffrey Kennedy</td>
<td><a href="mailto:gkennedy@cs.usyd.edu.au">gkennedy@cs.usyd.edu.au</a></td>
</tr>
<tr>
<td>Hilary Lloyd</td>
<td><a href="mailto:hgelloyd@pharmacol.usyd.edu.au">hgelloyd@pharmacol.usyd.edu.au</a></td>
</tr>
<tr>
<td>I. <a href="mailto:Johnston@physics.usyd.edu.au">Johnston@physics.usyd.edu.au</a></td>
<td></td>
</tr>
<tr>
<td>Keiran Passmore</td>
<td><a href="mailto:kpassmore@careers.usyd.edu.au">kpassmore@careers.usyd.edu.au</a></td>
</tr>
<tr>
<td>Mike Proser</td>
<td><a href="mailto:M.Proser@itl.usyd.edu.au">M.Proser@itl.usyd.edu.au</a></td>
</tr>
<tr>
<td>Peter O’Carrol</td>
<td><a href="mailto:poc@mail.usyd.edu.au">poc@mail.usyd.edu.au</a></td>
</tr>
<tr>
<td>Phil McManus</td>
<td><a href="mailto:pnmcmamoo@mail.usyd.edu.au">pnmcmamoo@mail.usyd.edu.au</a></td>
</tr>
<tr>
<td>Sandra Britton</td>
<td><a href="mailto:sandrab@maths.usyd.edu.au">sandrab@maths.usyd.edu.au</a></td>
</tr>
<tr>
<td>Simon Barrie</td>
<td><a href="mailto:S.Barrie@itl.usyd.edu.au">S.Barrie@itl.usyd.edu.au</a></td>
</tr>
<tr>
<td>Su Hanfling</td>
<td><a href="mailto:S.Hanfling@library.usyd.edu.au">S.Hanfling@library.usyd.edu.au</a></td>
</tr>
<tr>
<td>Tim Bedding</td>
<td><a href="mailto:T.Bedding@physics.usyd.edu.au">T.Bedding@physics.usyd.edu.au</a></td>
</tr>
<tr>
<td>Tom Hubble</td>
<td><a href="mailto:tom@cs.usyd.edu.au">tom@cs.usyd.edu.au</a></td>
</tr>
</tbody>
</table>

### Students involved in the trials

<table>
<thead>
<tr>
<th>Given Name</th>
<th>Surname</th>
<th>May-03</th>
<th>Aug-03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong</td>
<td>Renee</td>
<td>Nichajak</td>
<td>Treseslayawet</td>
</tr>
<tr>
<td>Andrew</td>
<td>Rebecca</td>
<td>Lachlan</td>
<td>Young</td>
</tr>
<tr>
<td>Zoe</td>
<td>Keith</td>
<td>Hornh</td>
<td></td>
</tr>
<tr>
<td>Peter</td>
<td>Buchanan</td>
<td>Alexandra</td>
<td></td>
</tr>
<tr>
<td>Renee</td>
<td>Phillip</td>
<td>Butler</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Christine</td>
<td>Lindstrem</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gerald</td>
<td>Tang</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alessandro</td>
<td>Fois</td>
<td></td>
</tr>
<tr>
<td>Luke</td>
<td>Barnes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jamie</td>
<td>Vahn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tara</td>
<td>Cooke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paula</td>
<td>Vaz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Therese</td>
<td>Au</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nicole</td>
<td>St Vincent-Welch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hermon</td>
<td>Sunjoya</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hong</td>
<td>Yan, Larn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valerie</td>
<td>Tan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Students who provided portfolio materials:

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lisa Ashley</td>
</tr>
<tr>
<td>Alex Yeung</td>
</tr>
</tbody>
</table>
18 February, 2004

Dear ***

The University of Sydney is currently revising its statement of the generic attributes of graduates. The revision is based on a framework identified through educational research at the University of Sydney and embodies the University’s scholarly values as a research-intensive university. The revised institutional statement of generic attributes also allows for disciplinary interpretation of the attributes, and the Faculties have also developed their own interpretive statements based on the institutional statement.

As part of the revision process, we are conducting extensive consultation, both of the faculty statements through disciplinary and professional networks identified by the Faculties, and of the central statement through peak national higher education bodies. The aim of the consultation process is to ensure the relevance of our statement of generic attributes to future employers of our graduates and to society at large.

We would be very interested in your comments and feedback on our revised graduate attributes statement. A copy is enclosed.

Further information about our Graduate Attributes Project is available on the project website:

http://www.itl.usyd.edu.au/GraduateAttributes

The Faculty of Science interpretation of the central university statement is available at

http://www.itl.usyd.edu.au/GraduateAttributes/facultyGA.cfm?faculty=Science

I hope you will be able to spare a few moments to provide us with your feedback and thoughts on the University’s revised statement of generic attributes.

Kind regards,

Yours sincerely

Mary Peat

Email sent to employers:

Dear*****

I previously wrote to you (22 March) asking for your help in a project we are doing on graduate skills in which we are trying to identify what employers are looking for in Science Graduates. I have not heard from you, so I am trying again. This time I wonder if you could answer the following questions by email:

1. Describe the type of science graduate you look to recruit for your various areas of responsibility

2. What are the generic attributes you require in an employee and why are these important in the workplace?

3. What do you look for when you are interviewing a science graduate for a position? What to do/what not to do.

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

5. Do you have any other insights from an employer’s perspective?

I do hope this time you can help us. Many thanks

Mary Peat
Teaching Improvement Fund 2003 Interim Report
Faculty of Science Project

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

The purpose of this project was to 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. In addition, students will also be provided with mechanisms to allow them to self-assess the development of these attributes throughout their degree program. The project aimed to build on the work of the 2002 pilot program (Faculty of Science Skills Awareness Program), and take into account the difficulties encountered.

The target group
In the long term, the project outputs will be delivered to all undergraduate on-campus students from Faculty of Science degree programs.

Goals of the project
To help students develop a suitable set of attributes (encompassed in three higher order attributes of good global citizen, professional scientist and life-long learner) by the time they graduate, this project had the immediate goals of:

• developing clear explanations of the core 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;
• the longer term goals of:
  • developing a mechanism for students to self-assess their awareness of and competence in the various attributes;
  • offering recommendations to Faculty about how to mandate an audit process whereby students self-assess and keep a personal record of their development.

Students need to:
• understand the language associated with the generic attributes and skills, so that they can recognise the link between ‘employer speak’ and the attributes and skills;
• recognise opportunities within their degree programs to develop and practise the skills;
• self-assess their awareness and competence for the various skills; and
• keep a personal record of their progress in developing the attributes.

Outputs from the project will include:
• a mechanism for students to self-assess their awareness of and competence of the various skills; and
• a mechanism to show students how to keep a personal audit.

Planning/Steering committee developed a planning document in January 2003. This was approved by the Dean (Professor Beryl Hesketh). A Reference Group was set up and has been asked to comment on the developments and documentation at all stages of the project.

The outputs to date: The project has reported to the Faculty Teaching and Learning Committee in March, April, June, August and October. These status reports are available on line http://science.uniserve.edu.au/projects/skills/. The outputs currently include:

• Literature review
• Articulation of generic attributes and skills to be included in the web material
• Articulation of the scaffolding for students to make linkages relating to generic attributes
• Development of language-related case scenarios
• Documentation of typical tasks
• Articulation of a process for students to develop a personal audit
• Development of the functionality of a web site
• Implementation of two successful pilots with undergraduate students
• Publicity for the project has included
  • A seminar given to the Science Librarians in August, 2003
  • A poster presented at the November, 2003 VC’s Showcase

A web designer (from Architecture) is currently working on the web design. It is expected that this design process will be finished in mid-February, 2004. After that the content will be entered into the web templates.

The plan for 2004 is:

• Complete the web design process
• Input the skills materials into the designed templates
• Assess the functionality of the web design with mini pilots (small groups of students)
• Beta test the site
• Launch the site in Semester 2 and trial with small groups of first year, second year and third year students.

Additional funds will be needed to complete this project. A TIF (small grant) application will be made.

Mary Peat, Chris Stewart, Charlotte Taylor
December 2003

©UniServe Science
Teaching Improvement Fund 2003 (Faculty of Science)

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

Status report No. 1
4 March 2003

Project team meets fortnightly

Preliminary phase:
- Literature review – in progress, draft review of literature will be available March 12
- Identification of University of Sydney graduate attributes – completed
- Identification of existing generic attributes projects at the University of Sydney – in progress, documentation from those of interest to be available March 12
- Identification of generic attributes projects at other universities – completed
- Establishment of a Skills Reference Group – completed
- Articulation of related language used by employers – in progress

Development phase:
- Articulation of generic attributes and skills to be included in the project – in progress, draft model of the identified attributes and skills is attached, definitions are being developed for each of the attributes and skills, the model and definitions will be circulated to the reference group
- It is vital that this step is completed before the project moves forward. Completion is expected before the end of March.

The next step will be to define levels of competence within the attributes and skills.

The project is on schedule.

Anne Fernandez & Mary Peat
March 2003

The project team meets fortnightly.

The preliminary phase has been completed.

Development phase:
- Articulation of generic attributes and skills to be included in the project – completed
- Discipline-specific skills identified and documented – in progress

To test if the planned development can be achieved and will produce the envisaged outcomes the project team has decided to complete all the steps in the development phase with one of the higher order skills, Interpersonal skills, before embarking on the full set.

Interpersonal skills trial:
- Description of higher order skills and background skills – higher order completed, background in progress
- Relate ‘employer speak’ to higher order skills – on hold until other stages have progressed further
- Definition of levels of competence within the skills – levels of competence for higher order skills will take the form of ‘satisfactory’ or ‘not satisfactory’, background skills will take the form of ‘evidence’ or ‘no evidence’ – recognisable levels of competence for each of the skills are yet to be defined
- Identification of opportunities offered within the degree program where skills may be practised – not yet commenced
- Identification of ways in which the skills can be integrated into curricula – not yet commenced
- Articulation of the scaffolding for students to make the linkages relating to generic attributes – not yet commenced
- Development of language related case scenarios – not yet commenced, these will be used by the students to match ‘employer speak’ to ‘university speak’
- Documentation of typical tasks – in progress
- Articulation of student benchmarking opportunities (self-assessment) – in progress
- Articulation of process for student personal audit – in progress

The project is on schedule.

Anne Fernandez & Mary Peat
April 2003
Teaching Improvement Fund 2003 (Faculty of Science)

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

http://science.uniserve.edu.au/projects/skills/

Status report No. 3
18 June 2003

The project team meets fortnightly. The preliminary phase has been completed.

Development phase:
- Articulation of generic attributes and skills to be included in the project – completed
- Discipline-specific skills identified and documented – awaiting input from Biological Sciences, otherwise completed
- Interpersonal skills trial
  - Description of higher order skills and background skills – completed
  - Documentation of some typical tasks where the skills might be practised – completed
  - Template for the students to record identified activities – completed
  - Template for the students to log their progress – completed
  - Two student focus groups were conducted to test if the process and templates would lead to the envisaged outcomes. Students were from three different disciplines and were not from first year. Feedback from the first focus group was implemented before conducting the second.

The Interpersonal skills trial was very successful – the discussion was frank and considered and we were given a number of valuable suggestions which we have acted upon.

The next step in the project will be to test the planned student scaffolding, i.e. the information that will be delivered to students and the way in which it will be presented. The information will be delivered electronically to students and so the next trial will be testing a pilot of the site. To conduct an effective test we need to have more than just one of the higher order skills in place, so we are in the process of filling out two more of the higher order skills, namely communication skills and research skills.

Scaffolding trial:
- Description of generic attributes, i.e. good world citizen, professional scientist, lifelong learner – in progress;
- Description of higher order skills and background skills for communication skills and research skills – draft sent to the Reference Group for comment
- Articulation of the scaffolding for students to make the linkages relating to generic attributes, i.e. storyboarding the process – in progress
- Documentation of typical tasks for communication skills and research skills – in progress
- Description of online tutorial(s) that will be provided for the students – not yet commenced
- Trial is scheduled for 29 August.

The project is on schedule.

Anne Fernandez & Mary Peat

June 2003
Teaching Improvement Fund 2003 (Faculty of Science)

Enhancing the employability of Science graduates: increasing the awareness of staff and students to the needs of the employers
http://science.uniserve.edu.au/projects/skills/

Status report No. 5
October 2003

The project team meets fortnightly when possible. Anne Fernandez has left UniServe Science to work in the Registrar’s section and this has caused some disruption to the project timelines.

The preliminary phase has been completed.

Development phase:
Articulation of generic attributes and skills to be included in the project – completed
Discipline-specific skills identified and documented – still awaiting input from Biological Sciences, otherwise completed
Interpersonal skills trial – first trial completed and feedback incorporated into the second trial.
Second trial of interpersonal skills completed, and feedback on the functionality of the web site incorporated
Description of higher order skills and background skills for perspectives, personal skills and business skills currently being done
Web design is being investigated. This will be the next process and will be outsourced, possibly to the School of Biological Sciences Teaching Development Unit (depending on cost and availability of designers).

Whilst the framework is essentially in place, and the design on the horizon, there is still a lot of material to collect and present through the web pages.

The project is behind schedule.

Mary Peat
October 2003

Teaching Improvement Fund 2003 (Faculty of Science)

Enhancing the employability of Science graduates: increasing the awareness of staff and students to the needs of the employers
http://science.uniserve.edu.au/projects/skills/

Status report No. 6
May 2004

The preliminary phase has been completed.

Development phase: The Skills Project has made much progress in the last few months with the arrival of a new UniServe Science team member, Danielle Merrett who is now coordinating the project.

- Discipline skills for Biology are now included
- Website outsourcing has been initiated
- All written content has been completely overhauled and edited for the website.
- The title for website “Life Long Earning: Match your talents with employers’ expectations” has been finalised. This title was created with the intention of marketing the site to students.
- Student website trial discussion sessions have been set for: Wed 5th, Thurs 6th, Fri 7th May 2004 and trial information packs have been given to participants as they register.
- Fliers for recruiting 2nd and 3rd year science students to participate in the On-line trial have been posted around campus and on 2nd and 3rd year lab notice boards.
- Overheads have been given to lecturers in 2nd and 3rd year courses to recruit trial participants and signal faculty endorsement of the project to students.

The short term plan:
- Site to be sent to the Reference Group for review
- Conduct student website trial
- The site is currently being developed on the Architecture server but will become part of the UniServe Science site and thus move on to the ITS server once complete. This will give the site 24/7 server support.

The long term plan:
- Implement changes suggested from feedback
- Launch the site in Semester 2
- Explore possibilities of advertising the site on MyUni, Web CT and Careers Centre site
- Monitor student use with automatic system
- Evaluate student use and perceptions of usefulness of the site by means of surveys sent out to first year, second year and third year students during 2005.

Danielle Merrett
Mary Peat
May 2004
Chapter 3: Literature review and other generic skills websites

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


Striving for Quality: Learning, Teaching and Scholarship. Submission by the Victorian Language and Learning Network.

Frommer, M. (undated) No frills generic skills for Physiology.
http://www.physiol.usyd.edu.au/students/current/tips/


http://www.dfes.gov.uk/dfee/heqe/ks_salford.htm


University of Sydney (2002b) Faculty of Rural Management, Orange Campus. Plan for First Year Academic Orientation and Transition


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](image)

**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.
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.
<table>
<thead>
<tr>
<th>Summary of questionnaire responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Home Page</strong></td>
</tr>
<tr>
<td>How would you use this site?</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>Generic Attributes Page</strong></td>
</tr>
<tr>
<td>What are generic attributes, and what are some of the generic attributes of a science graduate?</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td><strong>Skills Pages –(Communication)</strong></td>
</tr>
<tr>
<td>What are the background communication skills?</td>
</tr>
</tbody>
</table>
| 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’.
| **Portfolio –Building a Portfolio page** |
| What is the first step in building a portfolio? |
| 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. |
| **Portfolio – Reflection Page**     |
| What are some of the ways you can reflect on your skills? |
| 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. |
| **Portfolio –Putting in together**  |
| List some things that Jane has put into her portfolio? |
| 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. |
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.](image)

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:

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

Firstly we would like to thank you very much for agreeing to be involved in the early trials for this Faculty project. Without the help of willing participants we could not develop our ideas and create useful and useful materials for students and staff.

The project is entitled: Enhancing the employability of Science graduates: increasing the awareness of staff and students to the needs of the employers. We aim to make available to students web-based materials that will help you to recognize and improve your development of employability skills. We also want to show you how to assess your performance of each skill, identify skill deficits that might need working on, and document the skills you have developed, so that you can use this information as evidence when applying for a job.

The project is being developed around a skill matrix, included in this package so that you can see it before we meet. We are in the process of defining skills and identifying skill-developing opportunities in both your academic and non-academic pursuits.

At our meeting, we will concentrate on the vertical column labelled ‘Interpersonal Skills’ on the matrix. We have chosen this subset of skills to test if our model and planned procedures work for students. We will be providing you with definitions of all the higher order skills and background skills that we have identified for the Interpersonal Skills group. We have also prepared examples of typical tasks within units of study and co-curricular activities where opportunities to practice some of these skills may be found. Using the definitions and examples we would like to see if you can identify opportunities within your university experience where you might develop some of these skills. As mentioned above we plan to provide students with a method that they may use to audit their progress towards the acquisition of these skills. We have prepared templates to record individual experiences and achievements and a log for summarizing progress so that students can see at a glance where their strengths and weaknesses lie.

To assist us in this project, we ask you to spend about two hours with us performing a trial and evaluation of the process we have designed. The aim is to get your feedback on the process - your input as students is invaluable to the design of useful information for your peers.

To assist us in this project, we ask you to spend about two hours with us performing a trial and evaluation of the process we have designed. The aim is to get your feedback on the process - your input as students is invaluable to the design of useful information for your peers.

During the two-hour session, we would like to achieve the following:

1. Initial discussion of the project — Why are we doing this? What are the generic skills? How do we propose students track and evaluate their development of these skills?
2. Trial of Record of Achievement: Interpersonal skills — a brief trial of the process of keeping a Record of Achievement (RoA) in one area of the skills matrix, centred around the interpersonal skills of teamwork, leadership and networking.
3. Feedback on Record of Achievement process — we will discuss your feedback on the clarity, the ease-of-use and the perceived benefit (or otherwise) of the RoA process.
4. Further discussion of project — now that you have had a chance to experience what we aim to do, we value your input on the aims of the project, any modifications to the material you suggest and any problems you anticipate with the process.

Again, thank you very much for your involvement and we look forward to seeing you soon.

Mary Peat
Anne Fernandez
Chris Stewart
Charlotte Taylor
May 2003
Title: Enhancing the employability of Science graduates: increasing the awareness of staff and students to the needs of the employers

Interpersonal Skills Trial Definitions

Higher order skills definitions:

Leadership is the process of successfully influencing the activities of a group towards goal achievement. A leader has the ability to influence others by presence, charisma, command of language, expertise, and engendering respect to achieve group objectives ethically. Background skills required are mentoring, decision making, delegating appropriately, motivating others, using persuasive and clear communication, and being empowered by knowledge.

Networking is the ability to actively seek, identify and create effective contacts with others and maintain those contacts for mutual benefit. Background skills required are self-confidence, effective communication, building, maintaining, and expanding networks and collegial relationships.

Teamwork involves group problem solving, cooperation with others, responsiveness to others’ ideas, harmonious engagement in collaborative learning, taking individual responsibility within the group for developing and achieving group goals. Background skills required are mentoring, group work, decision making, delegation, and collaboration.

Background skills definitions:

Mentoring is:
- being a trusted advisor and helper who has experience in a particular field, who actively supports and guides someone who is less experienced in this area in the development of their knowledge and experience base, or the achievement of their career or personal goals;
- a protected, non-judgemental relationship which facilitates a wide range of learning, experimentation and development; and
- a relationship that may be formal or informal, but must involve trust, mutual respect, and commitment as both parties seek to work together to achieve a goal.

Group work is:
- any activity in which students work together;
- any activity which has been specifically designed so that students work in pairs or groups, and may be assessed as a group (referred to as formal group work); or
- when students come together naturally to help each other with their work (referred to as informal group work).

Decision making is:
- taking responsibility for a decision and its outcomes; and
- identifying appropriate evidence and weighing up that evidence to make a choice.

Delegation is:
- taking responsibility for determining when it is appropriate to ask someone else to make a decision or carry out a task;
- giving someone else the discretion to make decisions that you have the authority to make; and
- the process by which authority and responsibility is distributed from the project leader to an individual working on the project.

Collaboration is:
- working cooperatively and productively with other team members to contribute to the professional outcomes of the team; and
- task-related interactions with colleagues that involve sharing, assistance, and interdependence.

Network building is:
- creating contacts with other persons and maintaining those contacts;
- acquiring and maintaining information of persons that can operate as contacts for specific purposes if needed; and
- using contact persons in an ethical manner for the purpose of meeting specific goals, e.g. collaboration in projects, finding information, etc.

Motivating others is:
- selling ideas and winning commitment to goals;
- generating enthusiasm and energy by being positive: ‘we can do this’;
- maintaining a positive attitude even when things aren’t going well;
- encouraging others to come up with solutions;
- involving the whole team;
- including everyone: listening and taking views on board;
- giving people new challenges and trusting them to deliver;
- encouraging others to perform well;
- being prepared to support others in taking agreed, calculated risks; and
- not blaming others when things go wrong: avoiding creating a ‘blame culture’.
**Student Record of Achievement**

**RoA ID**

**Date** March 2002

**Title** Student Point of Contact (SPOC)

**Description**
Orientation of new students – answered enquiries about the campus, courses, events and other aspects of the university. Acted as a tour guide.

**Associated skills**
Background: mentoring, group work, collaboration, network building
Higher order: leadership, teamwork

**Evidence**
Letter certificate

<table>
<thead>
<tr>
<th>If you attained a result what was it?</th>
<th>Who gave it to you?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Names of other people directly associated with this achievement (e.g. supervisor, employer, team members)
Faculty marketing

**Reflection**
Helped new students make a smooth transition from school to university.
Gained more confidence
Made new friends
Completed RoAs may be used as:
• evidence of a particular achievement;
• a memory trigger for satisfying essential criteria when applying for a job; or
• a memory trigger when looking for references or contacts.

Students may require different portfolios for different job applications or other purposes. The student creates a portfolio by collecting together the relevant Records of Achievement, and associated attachments.

Reflecting on your learning

Judging your abilities
As you keep a record of the activities and experiences, you will need to make personal judgements about those experiences and about your development of the various generic skills.

Rather than merely keeping a list of experiences or grades, you will need to reflect on how your skills have improved. You’ll need to think about the most important things you have done to develop your skills, about how confident you are in your abilities.

This is because, in the end, the only judgement of your abilities that makes a difference is your own judgement. No one else’s opinion of you matters as much as yours; and no one can decide where your strengths and weaknesses are as well as you can.

Write down your thoughts
This is why, for each entry in your Record of Achievement, we have included a Reflection space for your thoughts and feelings about the activity or experience. Use this space to write down your thoughts – exactly how you do this is up to you, but you might like to start with the following questions:
• How important was this activity or experience to me? Has this experience or activity improved my skills significantly?
• How have I changed as a result of this activity or experience?
• What did I do particularly well in this activity/experience?
• What can I do now to develop my skills further?
• What did I do particularly well in this activity/experience?
• What could I have done better?
• What can I do now to develop my skills further?

These are just examples to get you going – you should find your own way of thinking back on your learning.

Make a habit of it
The reflective process is a vital part of any kind of learning – it is only when we think about what we have done, and how we have done it, that we realise we have learned something.

So, if you develop the habit of reflecting on your experiences at university (and elsewhere in life), you’ll actually be helping yourself to be a better learner. You can do this in many ways. Some people keep a regular journal or diary of their learning. Others keep an online log. Find something that works for you.
### Higher Order Skills Examples (RoA ID number, date)

<table>
<thead>
<tr>
<th>Higher Order Skills</th>
<th>Examples (RoA ID number, date)</th>
<th>Satisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Networking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Background skills Samples (RoA ID number, date, activity) Evidence

<table>
<thead>
<tr>
<th>Background skills</th>
<th>Samples (RoA ID number, date, activity)</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decision making</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delegation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network building</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivating others</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

UniServe Science is looking for students to participate in a **WEBSITE TRIAL**

You will receive a: **$20 Coop Book Voucher**

You must be:

- a Syd Uni *Science* student
- in 2<sup>nd</sup> or 3<sup>rd</sup> Year
- able to attend a 1h discussion session at 1-2pm on either the 5<sup>th</sup>, 6<sup>th</sup> or 7<sup>th</sup> May 2004.

Ph 9351 5783 to register
APPENDIX 4

[STUDENT WEBSITE TRIAL QUESTIONNAIRE MAY 2004]

WEBSITE TRIAL

Life Long Earning: matching your talents with your employers’ expectations.

Thank you for participating in this website trial. This website is a project that aims to help science undergraduates identify and improve their generic skills. We also want to show you how to assess your performance of each skill, identify skill deficits that might need working on, and how to document the skills you have developed, so that you can use this information as evidence when applying for a job.

In doing this trial we aim to test the navigation, relevance and clarity of this new site. In this trial we ask you to view the site, complete some exercises and questions using the site, and participate in a discussion group.

Name:      Discussion Session:  
Degree:     (Carslaw Rm 535A) Year:  
Email:     Address (to send voucher):  

STEP 1 Before attending the Discussion Session please view the following website and answer the questions below.
http://www.arch.usyd.edu.au/~stevec/Science/

QUESTION 1 How would you use this site? 
Is this clear from the introduction? 
If not how could we improve it? 

QUESTION 2 What are generic attributes, and what are some of the generic attributes of a science graduate? 
Was this information easy to find? 
Did the information make sense? Please explain. 
Is this information useful? Please explain. 
If not how could we improve it? 

STEP 2 Read the portfolio section. Following the instructions, record one of your own activities, using the template provided.

QUESTION 4 What is the first step in building a portfolio? 
Was this information easy to find? Please explain. 
Did the information make sense? Please explain. 
Is this information useful? 

QUESTION 5 What are some of the ways you can reflect on your skills? 
Was this information easy to find? 
Did this information make sense? Please explain. 
Is this information useful? Please explain. 
If not how can we improve it? 

QUESTION 6 List some things that our example person, Jane, has put into her portfolio. 

APPENDIX 4
APPENDIX 4

APPENDIX 4

Was the example portfolio and C.V easy to find and access?

Did this information make sense? Please explain.

Is this information useful? Please explain.

If not how can we improve it?

STEP 3

Attend your designated discussion session in Rm 535a, lv 5
Carslaw Bld at 12.50-2.00pm on 5th, 6th, or 7th May 2004.

You should think about the following questions on the website before you attend the discussion session:

OVERALL NAVIGATION
Was the homepage easy to get back to?
Was the site structured logically?
Was it easy to navigate?

OVERALL SITE CLARITY
Was the language and writing easy to read?
Did you find grammatical errors?
Was the layout and colours appropriate?

OVERALL SITE RELEVANCE
How would you use this site as a student?
How can we improve this site?

To receive your voucher you are required to submit these questions and participate in the discussion session. Your attendance will be recorded and your voucher will be promptly mailed to your address.

Regards,

Danielle Merrett
Educational Technologist
UniServe Science
Carslaw Building
The University of Sydney
NSW 2006

PhySciCH@mail.usyd.edu.au
http://science.uniserve.edu.au/
Tel: +61 2 9351 5783
Fax: +61 2 9351 2175

Hi All,

I would like to thank you for participating in the Faculty of Science Life Long Earning Website Trial in May. Your comments were invaluable and they have been taken on board to re-design the entire site. We plan to launch the site in week 2 or 3 of this semester and would like to invite you to make some further comments and feedback on the new site.

We will send another $20 Coop book voucher to all those who answer the questions below and submit them by email to this address by 2.00pm Friday 30th July 2004. Don’t forget to include your mailing address in your email.

The new website is located: http://www.lifelonglearning.science.usyd.edu.au
Please view all sections of the site before answering the questions below.

NAVIGATION
1. Was the site easy to navigate?
2. Was the site structured logically?
3. Were there any sections that could be improved, and if so how?

CLARITY
1. Was the language and writing easy to read?
2. Was the layout and colours appropriate? How would you make it better?
3. Were there any sections/features that did not make sense? How would you make it better?

RELEVANCE
1. Do you think this site is more relevant than the last one we showed you? Please explain.
2. What are the 2 best and 2 worst features of the site?
3. Are there any other points you would like make on the site?

Best regards,

Danielle Merrett
Educational Technologist
UniServe Science
Carslaw Building
The University of Sydney
NSW 2006

PhySciCH@mail.usyd.edu.au
http://science.uniserve.edu.au/
Tel: +61 2 9351 5783
Fax: +61 2 9351 2175
Dear Student,

We would like to ask you a few questions about your use of our Life Long Earning web site: http://www.lifelongearning.science.usyd.edu.au

1. Have you looked at the site yet?
   Yes/No

2. If you have not looked at the site yet, why not?

3. If you have looked at the site, have you: (answer as many questions as relevant)
   - Only browsed the site to see what is in it
   - Concentrated on a specific part of the site
   - Downloaded a template
   - Started to prepare a portfolio as suggested by the site

4. Did you find the information prepared by the students (the CVs for example) useful?
   Yes/No
   If yes, in what way does the information help you?

5. Having seen what is available on the site do you have any comments about what else could be included that would help you in developing a portfolio, a CV and a job application?

PLEASE FORWARD YOUR RESPONSES AS AN ATTACHEMENT TO:

physcich@mail.usyd.edu.au
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).

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.
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
Faculty of Science TIF 2003

Employable Science Graduate

Attributes

Skill groups

Communication skills
Interpersonal skills
Information Management skills
Research skills
Perspectives
Business skills
Personal skills

CITIZEN
PROFESSIONAL SCIENTIST
LIFELONG LEARNER

Background skills

(Satisfactory
Not satisfactory)

Communication skills

Interpersonal skills

Information Management skills

Research skills

Perspectives

Business skills

Personal skills

Higher order skills

Oral communication
Written communication
Non-verbal communication
Teamwork
Leadership
Networking
Information Technology literacy
Information evaluation
Information searching
Library skills
Critical thinking
Problem solving
Analysis
Responsibility
Understanding
Awareness
Sensitivity
Empathy
Project Management
Business Management
Work ethics
Self awareness
Self management
Flexibility
Independent Learner
Reflection
Goal skills
Commitment
Self confidence

Foundation

English literacy refer to Learning Centre
Mathematics literacy refer to Maths Learning Centre
Personal wellbeing (e.g. stress management) refer to Counselling, Student Services
Computer literacy refer to Continuing Education
Examination skills refer to Learning Centre
Study skills refer to Continuing Education

Employment information skills

Job search
Resume/CV preparation
Job application
Interview
Refer to:
web sites

Copyright UniServe Science 2003

12 August 2003
Teaching Improvement Fund 2003 (Faculty of Science)

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

Business Skills: Definitions

Higher order skills:

Project Management
  • Possess the following skills and qualities:
    • Drive and determination
    • Technical credibility
    • Political and cultural sensitivity
    • Leadership and management skills
    • Ability to handle stress
    • Communication skills
  • Delegating project goals and effectively managing a team in planning, implementing and completing a project
  • Put into practice the concepts of cooperation and negotiation, based on contract provisions and the concept of fairness: taking authority as well as working in a team to achieve performance criteria, align people’s attitudes and develop a working level of professional trust and respect
  • Able to facilitate and synthesise when dealing with multiple stakeholders: the organisation, client, functional managers and project team members
  • Responsible for acquisition and conservation of adequate resources, as well as keeping the project on time, within budget and up to specifications
  • Understand what is best for the project when issues are confronted and able to evaluate conflicts and their resolutions on different levels: technically (professional/personal development of team members), organizationally (business) and strategically (project)
  • Team building: learning what motivates individuals to produce quality work and creating opportunities/incentives for team members to meet their needs, find areas of commonality and work for a common cause
  • Understand change management: determining when important changes have occurred in a system or are likely to occur; seeing the opportunities and threats that accompany the change; and observing elements in a work group that might slow down the project
  • Keep track of project schedules, tasks, to-do lists, project issues, risk, project resources, time and billing, support logs, status reporting, etc

Business Management
  • Managing information: applying strategies to promote more efficient work practices
  • Building trust in organizational relationships in order to maintain timely and consistent information and direction to the field
  • Maintain a focus on the business interests and well-being of the organisation – this will enhance promotion opportunities and advance career prospects, thus benefiting yourself and the organisation
  • Financial management: determining how money will be spent to get the work done

and accounting for such expenditures; managing your cash flow and making sure that all expenses are pre-approved, receipts are kept and all revenue is documented and deposited in a timely manner
  • Judgment and decision-making: weighing the relative costs and benefits of a potential action and deciding when potential outcomes are worth the risk
  • Obtaining and seeing to the appropriate use of equipment, facilities, and materials to do the job
  • Making decisions about how a business is run
  • Risk management: analyzing exposure to risk and determining how to best handle such exposure
  • Those systems needed to effectively manage actions resulting from the business intelligence gained. If Business Intelligence helps companies understand “what” makes the wheels of the corporation turn, Business Management helps “direct the wheels as the business landscape changes. To a large extent, these systems augment, extend, and eventually displace capabilities provide by business operations. Systems that exemplify business management include product management campaign management, inventory management resource management and customer information management. Source http://www.2computerguys.com/computers/terminology/terminologyA-E.htm

• Diversity management: focuses on managing the difference within a company’s workforce, capitalising on the benefits of diversity and minimising workplace challenges:
  • Improving the efficiency of HRM functions
  • Fostering superior decision-making, problem-solving, creativity, and innovation; key factors in the creation of knowledge companies
  • Developing cross-cultural capabilities that facilitate operations in culturally complex environments at home and abroad
  • Implementing new product/service developments and new sales/marketing strategies for diverse customer bases
  • Responsible for acquisition and conservation of adequate resources, as well as keeping the project on time, within budget and up to specifications
  • Understand what is best for the project when issues are confronted and able to evaluate conflicts and their resolutions on different levels: technically (professional/personal development of team members), organizationally (business) and strategically (project)
  • Team building: learning what motivates individuals to produce quality work and creating opportunities/incentives for team members to meet their needs, find areas of commonality and work for a common cause
  • Understand change management: determining when important changes have occurred in a system or are likely to occur; seeing the opportunities and threats that accompany the change; and observing elements in a work group that might slow down the project
  • Keep track of project schedules, tasks, to-do lists, project issues, risk, project resources, time and billing, support logs, status reporting, etc

Work Ethics
  • Professional and ethical responsibility: knowing and practicing the professional ethics involved with one’s discipline
  • Knowing how to make risk assessments and address health, safety and ethical issues
  • Take into account legal, economic, social, political and environmental implications of scientific and technological development
  • Abiding by and upholding the principles of conduct (behaviour) governing the organisation, but willing to back down if the decision is unpopular with the stakeholders or the majority of the organization
  • Building trust: keeping confidences, acting in a consistent manner and treating everyone with basic human dignity and respect
  • Conflict management: identify the conflict and effectively involving individuals or groups to reach mutually agreeable solutions; knowing when and if a higher authority should be consulted
Time Management

- Ability to manage time effectively
- Prioritisation: able to decide on the more important tasks and focus on completing these in order to maximise performance and results
- Analysing how you spend your time, knowing when you perform your best and using this time to your advantage, increasing your effectiveness by taking regular breaks and minimising routine distractions and stress
- Demonstrate ability to organise, delegate and schedule
- Managing one’s own time and the time of others: for example, using a planner to schedule obligations and following the planner to allocate your time and others

Goal Setting

- Able to set goals on a routine basis, know what you need to do to achieve these goals, and then move step-by-step towards the achievement of these goals
- By knowing precisely what you want to achieve, you know what you have to concentrate on to do it and what is merely a distraction
- Have long-term vision and short-term motivation: focus your acquisition of knowledge and organise your resources
- Able to set sharp, clear short-term goals, measure and take pride in your achievement of those goals - recognize your ability and competence in achieving the goals that you have set
- Gain an overall perspective from setting long-term goals in order to shape all other aspects of decision making and setting a series of smaller targets/lower-level plans culminating in daily tasks/achievements

Planning

- When given a task, is able to determine and document, the best approach and the time required to carry it out. Approaches the task in an organised and professional way and highlights revisions to the plan in a timely manner, based on the work already done and new factors. Ensures that the work is carried out in a way that conforms to the rules of the organisation. Delivers on time and works equally effectively on multiple tasks when necessary.
- Looking ahead and preparing in advance, anticipating problems, structuring tasks and setting deadlines. Taking a thorough approach, including attention to detail
- Able to prepare a plan that helps you to deal effectively with any problems or distractions that may occur, as well as perform in a positive and focused frame of mind, in achieving a goal or completing a task
- Develop a strategy, or alternative strategies, for a definite course of action or to accomplish an objective
- Develop approaches for implementing an idea; scheduling and coordinating

Budgeting

- Undertake the process of predicting and controlling the spending of money within the organisation, which consists of a periodic negotiation cycle to set budgets (usually annual) and the day-to-day monitoring of current budgets
- Understand the zero-base budgeting method used by a corporation or government, in which all expenditures must be justified each year, not just amounts in excess of the previous year
- Able to plan in advance and develop an itemized forecast of an individual's or company's income and expenditure expected for some period in the future
- In a project, predicting the time, effort and resources required to remain within anticipated costs
- Cash flow budgeting: summarise projected cash inflows and cash outflows for a business over a given time to answer such questions as – Is the project financially feasible? Will there be sufficient capital available at the specific times it will be needed? If not, how much capital will need to be borrowed and will the project generate enough cash to repay the loan?

Grant application

- A written request for financial assistance – essentially a project proposal that outlines and justifies the reason for the project. It may contain:
  - Project description – objectives, time frame/schedule and plan for carrying out objectives
  - Project budget period(s) and other budgetary information (costs), with supporting written justification sufficient to evaluate the costs of the proposed project
  - Biographies of project team members – backgrounds and experiences
  - Facilities and resources already available or required
  - Current and pending support
  - Supplementary documentation, such as collaborative arrangements or environmental impact assessments
  - Bibliography of literature
  - Proprietary information
- A compilation of objectives, policies, goals and agendas detailing the promotion of effective management of a project for award of financial assistance
- Planning on short and long-term scales and outlining specific approaches and implementation steps to achieve such plans. Use a planning approach such as: inventory and analysis of resources; link to other elements and goals of the organisation; address specific resources within the organisation; incorporate specific steps to achieve goals; implementation strategies and measures.
Teaching Improvement Fund 2003 (Faculty of Science)

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

Communication Skills: Definitions

Higher order skills

Oral communication — ability to explain and present your ideas to different groups of people in clear English. Includes the ability to tailor your delivery to a given audience, using appropriate styles and approaches, and an understanding of the importance of non-verbal cues (see below).

Written communication in English — ability to write effectively in a range of contexts and for a variety of different audiences and purposes with a command of the English language. Includes the ability to tailor your writing to a given audience, using appropriate styles and approaches. This encompasses electronic communication such as SMS, email, discussion boards, chat rooms and instant messaging.

Non-verbal communication — allows ideas and concepts to be expressed without the use of coherent labels, including the use of body language, gestures, facial expression and tone of voice, and also the use of pictures, icons and symbols.

Background skills

Revision and editing is:
- applying techniques to improve writing or presentation. Proofreading for spelling, grammar and style.

Presentation skills:
- oral presentations usually take place in tutorials or seminars;
- an oral presentation is a talk given to a group in which the speaker presents their views on an issue or topic based on their readings or research;
- presentations may be given as an individual or as part of a group.

Academic writing skills:
Writing in order to analyse a topic closely, develop a point of view in relation to that topic through research and thought, and persuade your reader that the point of view you have developed is well supported by the ideas and information you present, e.g. essays; writing a clearly structured document that presents an account of what has happened in a practical session or as part of an experiment, e.g. report; and writing in a succinct and clear manner, e.g. posters.

Audience awareness is:
- displaying sensitivity to your audience in organising and presenting ideas;
- communicating appropriately with professional colleagues and the public; and
- understanding the needs of an audience and applying appropriate styles of communication.

Critical listening/reading is:
- listening to spoken information to have a complete and accurate understanding of the communicated message;
- awareness of both the content of the message and the style and method of communication; and
- understanding of how the content and method combine to create the meaning of the message.

Personal presentation and body language is:
- understanding of and ability to use gestures, expressions and non-verbal cues to help communicate a message; and
- awareness of non-verbal communication techniques and their role in communication.
Teaching Improvement Fund 2003 (Faculty of Science)

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

Interpersonal Skills: Definitions

Higher order skills:

Leadership is the process of successfully influencing the activities of a group towards goal achievement. A leader has the ability to influence others by presence, charisma, command of language, expertise, and engendering respect to achieve group objectives ethically. Background skills required are mentoring, decision making, delegating appropriately, motivating others, using persuasive and clear communication, and being empowered by knowledge.

Networking is the ability to actively seek, identify and create effective contacts with others and maintain those contacts for mutual benefit. Background skills required are self-confidence, effective communication, building, maintaining, and expanding networks and collegial relationships.

Teamwork involves group problem solving, cooperation with others, responsiveness to others’ ideas, harmonious engagement in collaborative learning, taking individual responsibility within the group for developing and achieving group goals. Background skills required are mentoring, group work, decision making, delegation, and collaboration.

Background skills:

Mentoring is:
- being a trusted advisor and helper who has experience in a particular field, who actively supports and guides someone who is less experienced in this area in the development of their knowledge and experience base, or the achievement of their career or personal goals;
- a protected, non-judgemental relationship which facilitates a wide range of learning, experimentation and development; and
- a relationship that may be formal or informal, but must involve trust, mutual respect, and commitment as both parties seek to work together to achieve a goal.

Group work is:
- any activity in which students work together;
- any activity which has been specifically designed so that students work in pairs or groups, and may be assessed as a group (referred to as formal group work); or
- when students come together naturally to help each other with their work (referred to as informal group work).

Decision making is:
- taking responsibility for a decision and its outcomes; and
- identifying appropriate evidence and weighing up that evidence to make a choice.

Delegation is:
- taking responsibility for determining when it is appropriate to ask someone else to make a decision or carry out a task;
- giving someone else the discretion to make decisions that you have the authority to make; and
- the process by which authority and responsibility is distributed from the project leader to an individual working on the project.

Collaboration is:
- working cooperatively and productively with other team members to contribute to the professional outcomes of the team; and
- task-related interactions with colleagues that involve sharing, assistance, and interdependence.

Network building is:
- creating contacts with other persons and maintaining those contacts;
- acquiring and maintaining information of persons that can operate as contacts for specific purposes if needed; and
- using contact persons in an ethical manner for the purpose of meeting specific goals, e.g. collaboration in projects, finding information, etc.

Motivating others is:
- selling ideas and winning commitment to goals;
- generating enthusiasm and energy by being positive: ‘we can do this’;
- maintaining a positive attitude even when things aren’t going well;
- encouraging others to come up with solutions;
- involving the whole team;
- including everyone: listening and taking views on board;
- giving people new challenges and trusting them to deliver;
- encouraging others to perform well;
- being prepared to support others in taking agreed, calculated risks; and
- not blaming others when things go wrong: avoiding creating a ‘blame culture’.
Teaching Improvement Fund 2003 (Faculty of Science)

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

Personal Skills: Definitions

Higher order skills:

Self-awareness
- Feeling confident about yourself and what you can do
- Knowing what skills you have and what to expect from others and from yourself
- Focused, purposeful
- Awareness of your own individuality
- The capacity to be aware of oneself and one’s environment, evaluate alternative courses of action without actually engaging in them, identifying consequences of such actions and their potential affects on one’s behaviour
- Perception of one’s responsibility and value, professionally to their job and personally to their family – respect for one’s own knowledge, talent and skills, and how results are achieved, not only for ourselves but for others as well

Self-management
- Skills and behaviours relating to your capacity to manage yourself and your reactions to challenges in work and life
- Personal effectiveness: having self-esteem, managing your time and responsibilities and being confident in your own capabilities
- Professional effectiveness: being responsible for tasks and projects as well as yourself and other people
- Managing stress: applying strategies to control stress and get on with life by coping with difficulties and making the most of your life and what you have
- Self-help, overcoming procrastination, engaging in activities that promote health
- Able to apply a series of questioning on oneself in order to better understand what one is learning

Flexibility
- Being adaptable and willing to do lots of different kinds of work
- Ability to work with others – people with different values, backgrounds, views, levels of understanding, etc
- Skills relating to your capacity to learn effectively in a range of different environments
- An ability to adapt to a changing environment and learn new skills
- Displaying such traits as cooperativeness, pliability, resilience and manageability
- Responsive to change
- Maintaining effectiveness in varying environments and with varying tasks, responsibilities or people
- Able to adjust your style of operation to the needs of the situation

Independent Learner
- Able to recognise gaps in knowledge and acquire it independently

- Capacity and desire to continue to learn
- Resourcefulness: having drive, using your initiative and planning ahead
- Experience in the learning process through which knowledge is gained and disseminated
- Working out your preferences to maximise your learning
- Lifelong learning: recognise and accept continuous learning as being central to one's capacity to realise potential and live a fulfilling life; a propensity to continue learning, including self-management
- Proactive, self-starter
- Using multiple approaches when learning or teaching new things
- Information gathering and organisation: knowing how to find information, identifying essential information and finding ways to structure or classify multiple pieces of information
- Active learner: working with new material or information to grasp its implication.
- Working examples: determining the impact of a new policy on your organization; learning a management technique and applying it to your organization; and thinking about the implications of a leadership style on your group’s effectiveness

Reflection
- Able to revert the mind to that which has already occupied it; having thoughts and opinions arising from continued or attentive consideration; contemplation
- Conscious of your actions and state of mind
- The capacity for rational judgment, especially in view of a moral rule or standard
- Reflect upon your true self to identify and accept your flaws, positive attributes and how you want others to perceive you; learn from your flaws, identify how to improve on them and at the same time appreciate your good qualities
- The ability to accept, acknowledge, generate, manage, recognise and reconcile descriptions of one’s own conduct (behaviour)

Goal Skills
- Ability to plan and achieve goals (both personal and professional)
- Motivation: a desire to achieve a goal and the ability to induce oneself or others to perform a task in order to achieve a goal or objective
- Tenacity: staying with a position or plan of action until the desired objective is achieved or no longer attainable; continue trying to achieve your goal despite obstacles
- Able to set realistic and achievable goals in a clear, precise manner in order to meet your own and others’ expectations
- Understand the difference between, and able to develop, strategic (long-term) goals, short-term objectives, operational plans (activities required to achieve the goals) and procedures for monitoring performance

Commitment
- Being dependable, trustworthy and putting everything into your work
- Dedicated, loyal
- The trait of sincere and steadfast fixity of purpose
- Willingness to commit an obligation to your work, organisation and organisational goals; allegiance
• Possess a determination to achieve success, perseverance
• Ability to focus on the target of work or non-work related commitments: work related targets are organisation, projects, career or professional goals; non-work related targets are family, personal goals or improvement
• A state of attachment that defines the relationship between an individual, group or organization and an entity (commitment target). This relationships takes different forms (affective, continuance, normative and instrumental) which share certain common aspects, such as focus, strength, terms and durability of commitment (i.e. the extent to which a person or group is attached toward a target)

**Background skills:**

**Time Management**
- Ability to manage time effectively
- Prioritisation: able to decide on the more important tasks and focus on completing these in order to maximise performance and results
- Analysing how you spend your time, knowing when you perform your best and using this time to your advantage, increasing your effectiveness by taking regular breaks and minimising routine distractions and stress
- Demonstrate ability to organise, delegate and schedule
- Managing one’s own time and the time of others: for example, using a planner to schedule obligations and following the planner to allocate your time and others

**Goal Setting** (source [http://www.mindtools.com/pages/article/newHTE 06.htm](http://www.mindtools.com/pages/article/newHTE 06.htm))
- Able to set goals on a routine basis to decide what you want to achieve, and then move step-by-step towards the achievement of these goals, and in doing so choosing where you want to go in life
- By knowing precisely what you want to achieve, you know what you have to concentrate on to do it and what is merely a distraction
- Have long-term vision and short-term motivation: focus your acquisition of knowledge and organise your resources
- Able to set sharp, clear short-term goals, measure and take pride in your achievement of those goals - recognize your ability and competence in achieving the goals that you have set
- Gain an overall perspective from setting lifetime (long-term) goals in order to shape all other aspects of decision making and setting personal goals (a series of smaller targets/lower-level plans culminating in daily tasks/achievements)
- Capable of: deciding what is important for you to achieve in life; separating what is important from what is irrelevant; motivating yourself to achievement; and building your self-confidence based on measured achievement of goals

**Planning**
- Looking ahead and preparing in advance, anticipating problems, structuring tasks and setting deadlines. Taking a thorough approach, including attention to detail
- Able to prepare a plan that helps you to deal effectively with any problems or distractions that may occur, as well as perform in a positive and focused frame of mind, in achieving a goal or completing a task
- When given a task, is able to determine and document, the best approach and the time required to carry it out. Approaches the task in an organised and professional way and highlights revisions to the plan in a timely manner, based on the work already done and new factors. Ensures that the work is carried out in a way that conforms to the rules of the organisation. Delivers on time and works equally effectively on multiple tasks when necessary.
- Develop a strategy, or alternative strategies, for a definite course of action or to accomplish an objective
- Develop approaches for implementing an idea; scheduling and coordinating

**Monitoring**
- Periodically review longer term plans and modify them to reflect your changing priorities and experience
- Review (organizational, personal or professional) goals and budget, then develop a plan to attain goals, based on the review and within the budget
- Assess how well one is doing (yourself or others) when learning or teaching new skills
- Assess how well a development is meeting objectives, within time, resource and budget constraints, when implementing a project
- Identifying the key causes of problems and things that must be changed to achieve a goal

**Self-appraisal**
- Objectively analysing one’s own situation, skills and qualities
- Recognising your strengths and weaknesses and acknowledging areas for improvement as a positive step in your personal development
- Display a confident but realistic judgment of one’s capacity to achieve
- Pride in accomplishments, self-esteem and acknowledgement of one’s ability to perform
- Review of one’s progress to identify learning and career opportunities and set goals to facilitate personal and professional growth
- As a learner, reflect upon prior knowledge when coming across new information and applying it to newly acquired knowledge as much as possible – relates to self-management
Title: Enhancing the employability of Science graduates: increasing the awareness of staff and students to the needs of the employers

Higher order skills:

Responsibility
- Something for which one is responsible or accountable; a duty, obligation, or burden
- Ability or necessity to answer for or be responsible for one's conduct
- Involving personal accountability or ability to act without guidance or superior authority: a responsible position within the firm.
- Able to make moral or rational decisions on one's own and therefore answerable for one's behavior
- Able to be trusted or depended upon; reliable
- The social force that binds you to your obligations and the courses of action demanded by that force

Understanding
- To perceive and comprehend the nature and significance of; grasp, apprehend
- A disposition to appreciate or share the feelings and thoughts of others; sympathy, tolerance and compassion
- Characterized by or having comprehension, good sense, discernment, knowledge, empathy or ability to interpret
- To learn something indirectly or secondhand; gather
- The capacity for rational thought or inference or discrimination; reason, intellect
- An agreement of opinion or feeling; adjustment of differences; harmony; anything mutually understood or agreed upon; as, to come to an understanding with another

Awareness
- Aware implies knowledge gained through one's own perceptions or by means of information
- The recognition of something sensed or felt; consciousness*
- Knowledge gained through intuition or intellectual perception; sensible
- Quickness to recognize and respond; alert
- A sense of one's personal or collective identity, including the attitudes, beliefs, and sensitivities held by or considered characteristic of an individual or group

Sensitivity
- The ability to respond to affective changes in your interpersonal environment
- Sensitivity to emotional feelings (of self and others); emotivity
- Mental or emotional responsiveness to something
- Susceptible to the attitudes, feelings, or circumstances of others
- Receptiveness to impression, whether pleasant or unpleasant; sensibility

Empathy
- Identification with and understanding of another's situation, feelings, and motives
- The attribution of one's own feelings to an object
- Deep awareness of the suffering of another and the wish to relieve it; compassion
- The power of projecting one's personality into (and so fully comprehending) a person or an object of contemplation
- The ability to perceive the subjective experience of another person
- (1) The affective capacity to share in another's feelings, and (2) the cognitive ability to understand another's feelings and perspective
- The ability to communicate one's empathic feelings and understanding to another by verbal and/or nonverbal means
- Critical aspects: awareness of the state of being of another; understanding of this condition; a personal identification with the situation; appropriate affective response

Background skills:

Cultural is:
- Knowledge of other cultures and times which fosters inter-cultural communication and an appreciation of cultural diversity, historical consciousness and a global perspective
- Ability to work in an international cross-cultural context
- Perception of or relating to the shared knowledge, ideals, rules and values of a society
- In a functional sense, the way people solve problems of adapting to the working environment and working or living together
- Historical significance: a knowledge of the social heritage (or tradition) that is passed on to future generations e.g. within a company
- In a structural sense, an understanding of patterned and interrelated ideas, symbols or behaviours (of people and/or societies)

Global is:
- Demonstrate an awareness of the local and global context of their discipline or professional area
- Possessing an interdisciplinary approach to learning the concepts and skills necessary to function in a world that is increasingly interconnected and multicultural
- A respect of local allegiances and cultural differences; consideration for the viewpoints of individuals, and local, national and international communities
- Embracing values such as virtuous citizenship, effective leadership and shared decision-making responsibilities

Ethical is:
- Knowledge of ethical issues and standards in the discipline
- Value equity and diversity
- Know how to be sensitive to the feelings and background of others and to respect their views and practices
• Being aware of legal and moral obligations and of community and environmental issues
• Knowing and practicing the professional ethics involved with one’s discipline
• Knowing how to make risk assessments and address health, safety and ethical issues
• Awareness of the social implications of scientific and technological development
• Aware of and able to take into account legal, ethical, social and environmental issues
• Awareness of professional and ethical responsibility

Social is:
• Perceiving the interrelationship and comparative importance of political organization, economic conditions and cultural aspects of a society
• Identify with the internal structure and external relations of the nodes of social activity and the articulation of various channels of social communication
• Awareness of social interaction, values, ideals, customs and other matters affecting human welfare
• Practicing standards of social justice, equity and morality
• Demonstrate a commitment and sense of responsibility towards oneself and one’s community

Historical is:
• Take into account the background issues with respect to e.g. a discipline
• The capacity to conceive and represent the unity and significance of a past event or era, with respect to a discipline, organisation, industry, society, etc
• Possession of historical sense, the meaning which is deduced from the circumstances of time, place, etc
• Knowledge/study of a record of past events pertaining to some entity, incident or phenomenon
• Identification of past experiences or memories from the past and using these to develop perspectives for the future

Interdisciplinary is:
• Possession of a wide general knowledge, including an appreciation of the philosophical and social context of their major disciplines
• Appreciation of a variety of perspectives, critical in addressing complex real-world problems, involving historical, socio-economic, scientific and political dimensions
• Drawing from the experience of participating in two or more fields of study
• Able to maintain collaboration with diverse stakeholders – other departments, organisations, industries, government bodies, etc – in order to assess and evaluate complex, multifaceted systems
  Capacity to actively engage in a broad range of disciplines to address technological, management, design, economic, political and behavioural issues inherent in a system

• Identify interactions and conflicts among diverse requirements, such as performance, cost, environmental, regulatory and cultural, to ascertain constraints and opportunities for improvement

Political is:
• Understanding the nature of leadership, the institutional setting, allocation and use of power, decision making, the role of the individual citizen, and political and social ideology
• Able to identify policies and/or solutions to a problem, from the standpoint of a democratic, benevolent decision-maker, for the aggregate welfare of members of a society
• Compliant with the strive towards liberation and cultural integrity in a society
• Possess a view about, or aware of, social relationships involving authority or power
• Conforming to a settled system of administration
• Able to make decisions based on, or motivated by, partisan or self-serving objectives
• Knowledge of, or interest in, the structure or affairs of government, politics or the state
• Understanding the political system and social issues and having a set of moral and ethical values

Economic is:
• Awareness of the operation and institutions of economic systems
• Able to make reasoned decisions on economic issues as citizens, workers, consumers, business owners and managers, and members of civic groups
• Understanding of the patterns and networks of economic interdependence
• From a problem-solving perspective: able to identify the benefits and costs of each conceivable response to a problem, then to express these in terms of one common unit of measurement – such as current dollars or assets and liabilities – and after analysing and comparing options, decide upon the optimal solution

Legal is:
• Possession of the legal boundaries of the discipline with respect to the individual and the community
• Act in accordance with, or conformity with, the law, or official or accepted rules
• Loyal: steadfast in allegiance to one’s homeland, government or sovereign; faithful and true to a person, ideal, custom, cause or duty; upholding the lawful authority and the right to communicate – as well as the responsibility for others’ freedom and the obligation to respect the liberty of others. Thus individual freedom includes a social and legal commitment, towards the community in which we live and work. This also requires one to reflect on the different values of others and practice such responsibilities in order to avoid conflict with others’ interests, particularly in the areas of self-determination, personal integrity, privacy and professional liberties. Source: http://www.ucd.ie/law/bsl/selecture.html
Teaching Improvement Fund 2003 (Faculty of Science)

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

Research Skills: Definitions

**Higher order skills**

**Critical thinking** is accepting nothing at face value, and engaging in an examination of truth and validity in all argument and discourse and evaluating the relative importance of ideas. Critical thinking is evaluating and weighing different sides of an argument; applying reason and logic to determine the merits of arguments; and drawing and evaluating conclusions from logical arguments and data analysis.

**Problem solving** is the ability to identify, define and analyse problems, create solutions, evaluate opinions, innovate and improve current practices. Solution(s) need to be evaluated in the context of the identified problem, i.e. is the solution appropriate.

**Analysis** is gathering, evaluating and deploying relevant information.

**Background skills**

**Critique:**
- the ability to identify issues, apply critical reasoning, and make informed judgments, on a piece of work.

**Imagination and Creativity** is:
- initiating creative responses to problems and framing such responses as opportunities;
- producing work that embodies value, novelty, transformation, and condensation;
- producing work that is original and is valued by others in the discipline (value);
- producing work that is novel and useful (novelty);
- producing work that yields a new perspective – work that forces us to see reality in a new way (transformation);
- producing work that has an intensity and concentration of meaning (condensation);
- developed after extensive training in the field, when the student has acquired the confidence to be autonomous (independent and questioning), flexible and open to new experiences and interpretations, original and novel thought.

**Logic and reasoning** is:
- an understanding of the structure of deductive and inductive logical arguments;
- assessing the logical basis for scientific claims and conclusions; and
- drawing conclusions from scientific arguments or analyses.

**Data collection and analysis** is:
- data gathering – surveys, focus groups, interviews, experiments;
- design of data collection tool – survey design and experiment design;
- interpreting data;
- identifying an appropriate method (mathematical or otherwise) for analysis of data;
- techniques of statistical analysis including using statistics in research and the statistical analysis of surveys;
- awareness of the limitations of analysis techniques; and
- forming appropriate conclusions from results of analysis.

**Conceptual thinking** is:
- analyzing a big issue in its component parts and making judgements about the value and relevance of ideas and information;
- identifying concepts relevant to a problem, synthesizing concepts and available data to construct a solution.

**Reflection** is:
- thinking about what you have done, what you might have done differently, how you feel about it, and how you might change it to improve your learning;
- providing constructive comment about each others work; and
- making changes to improve the learning process.
Teaching Improvement Fund 2003 (Faculty of Science)

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

Discipline-specific skills: the skills NOT covered by the project

Physics
A graduate in physics should possess:
- problem formulation skills, the ability to apply physical laws to a wide range of physical situations;
- problem solving skills, the ability to perform calculations to draw conclusions from given data;
- data interpretation skills, the ability to organise information into a coherent framework and to relate it to previous results;
- data analysis skills, the ability to assess the statistical significance of experimental results;
- laboratory skills, the ability to design, assemble and use physics apparatus and to maintain written records; and
- computer skills, the ability to use computers for data acquisition, data analysis and information retrieval.

Chemistry
A graduate in chemistry should possess:
- problem formulation skills, the ability to apply chemistry theory to practice in order to design and carry out laboratory experiments;
- problem solving skills, the ability to identify relevant information and apply it meaningfully to solve a problem;
- data interpretation skills, the ability to use data appropriately to arrive at defensible conclusions; data analysis skills, the ability to perform data analysis, recognize error propagation and apply appropriate statistical treatment to data;
- laboratory skills, the ability to use chemistry specific apparatus and techniques, and to apply safe laboratory practices; and
- computer skills, the ability to use standard computer programs in the analysis of data and presentation of results.

Mathematics and Statistics
All graduates in mathematics should possess:
- problem formulation skills, the ability to formulate a wide range of problems in mathematical terms, the ability to recognise mathematical structures (such as groups) in a range of different contexts; and
- problem solving skills, the ability to apply logical thinking to problems, using appropriate geometric, topological and analytical techniques.

All graduates in statistics should possess:
- problem formulation skills, the ability to formulate a wide range of problems in mathematical and statistical terms; problem solving skills, the ability to apply logical thinking to problems, using appropriate statistical and analytical techniques;
- data presentation skills, the use of computers to present statistical data in appropriate form including graphical techniques; data interpretation and analysis skills, the ability to apply appropriate statistical techniques to the analysis and interpretation of data; and
- computer skills, the ability to use statistical software packages for the analysis and interpretation of data.

Many graduates will have other skills; all graduates will have the skills listed above.

Geosciences
A graduate in the geosciences should possess:
- problem formulation skills, the ability to perceive spatial and temporal relationships between individual objects and related groups of objects; the ability to apply social theory and/or natural science concepts to an understanding of relationships within and between society and environment;
- problem solving skills, the ability to apply theory and methods from either or both the natural and social sciences to earth processes and social systems; the ability to use relevant data to solve applied problems relevant to human interaction with the natural environment;
- data presentation skills, competence in map reading, map making and the interpretation of maps; use of common software in tabular and graphic presentation;
- data interpretation skills, the ability to recognize the significance of interrelated spatial and temporal changes, and to make decisions on the basis of absent, sparse or insufficient data; the ability to synthesize complex information;
- fieldwork skills, the ability to orient in the field, collect appropriate data and/or samples and observations and to take adequate notes; and carry out surveys;
- computer skills, knowledge of and competence in the use of appropriate software packages; and
- laboratory skills, the ability to use appropriate apparatus and techniques, and to apply safe laboratory practices.

Many graduates will have other skills more specifically relevant to the Geography, Geology and Geophysics sub-disciplines within Geosciences; all graduates will have the skills listed above.

Microbiology
A graduate in microbiology should possess:
- laboratory skills, the ability to design and implement microbiological experiments, and to handle micro-organisms in a safe and competent manner.

Biochemistry
A graduate in biochemistry should possess:
- problem formulation skills, the ability to apply theoretical principles to practice in order to design and carry out laboratory experiments;
- problem solving skills, the ability to apply logical thinking to a situation, and to use relevant information to solve the problem;
- data presentation skills, the ability to communicate results appropriately both in oral and written form; data analysis skills, the ability to organize and manipulate acquired data into a form from which conclusions may be drawn; data interpretation skills, the ability to recognize the significance of results and to draw appropriate conclusions;
- laboratory skills, the ability to use discipline-specific apparatus and techniques appropriately and to transfer these skills to new experimental situations; and
- computer skills, the ability to use computers for data analysis, information retrieval and presentation of results and to be competent in the use of standard programs.

Psychology
A graduate in psychology, in general, should possess:
- problem formulation skills, the ability to apply logical thinking to problems, using appropriate statistical and analytical techniques;
- problem solving skills, the ability to apply logical thinking to problems, using appropriate statistical and analytical techniques;
- data analysis skills, knowledge of and competence in the use of appropriate statistical methods;
- cognitive skills, familiarity with apparatus and standard psychophysical and psycho-physiological methods, and the ability to carry out histological analyses and electrode implantation in animals; and
- computer skills, competence with computer controlled experimentation.

Computer Science
A graduate in computer science should possess:
- problem formulation skills, experience in tackling problems without a clear specification, and in applying theoretical models (e.g. finite state machine, context-free grammar, graph algorithms);
- problem solving skills, the ability to learn new languages from manuals and tutorials, experience with planning, quality control and time management;
- data analysis skills, the ability to evaluate alternative programs or techniques when presented with a small number of well-defined alternatives; and
- computer skills, the ability to write well structured programs in a common object-oriented language, to develop software testing procedures and to write documentation for software, to modify and port existing programs.
A website for University of Sydney Science & Technology Students

LIFE LONG EARNING
Matching your talents with employers' expectations

About this website
What employers are looking for
Developing your skills
How to build a portfolio
Preparing job applications
Case studies
Employment links

Quick Links
Home
Glossary
Site Map

Credits:
Please read the University of Sydney web site Privacy Statement and Disclaimer.
This website is maintained by Life_Serve Science for the Faculty of Science, University of Sydney.
Please email feedback and comments to: PhysicsPhD@unsw.edu.au
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 Earning 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!