Practicum and work experience in microbiology and related disciplines

Kirsten Schliephake and Jennifer Mosse

School of Applied Sciences and Engineering
Monash University Gippsland Campus
Churchill, VIC 3842
Tel (03) 5122 6453
Fax (03) 5122 6738
Email Kirsten.Schliephake@sci.monash.edu.au
Jennifer.Mosse@sci.monash.edu.au

Gaining hands-on experience throughout an under graduate degree is regarded as a competitive advantage by science students. At the Gippsland campus of Monash University, the Industry Placement Program (IPP) allows students to gain industry experience throughout their entire course. Science students enrolled in the IPP undertake a practicum learning experience, equivalent to a 12-point unit, whose emphasis is on identifying and building transferable skills while gaining technical competency. The combination of academic studies, relevant paid work experience and professional development training produces capable, work-ready graduates.

The ability to develop transferable skills during undergraduate courses has become an important feature for students and employers alike. Students graduating from their academic course with skills obtained in a workplace setting have a competitive advantage in their search for employment [1]. At Monash University in Gippsland, the IPP integrates academic study with practical work experience. Similar cooperative or work-integrated learning (WIL) programs are also conducted across all academic sectors in other states of Australia and overseas [2, 3].

Cooperative programs provide a structured educational strategy that allows the student to integrate and apply academic concepts through productive work experience in a field related to their professional future [4]. Such programs help students relate theory to practice while providing the experience of working in a professional environment and, therefore, the opportunity to develop relevant professional skills. These experiences, at the heart of the program, involve a partnership between students, educational institutions and employers. This effective partnership must be embedded in the scheme's practice [5] with the responsibilities of each party agreed and clearly specified [6].

The IPP at Monash Gippsland combines academic study with periods of relevant work experience. Students enrolled in the Bachelor of Science and associated degrees are eligible to participate in the IPP; selection is based on academic merit and interview. The typical pattern of work placement involves an introductory, 2-week placement, followed by a 6-week placement in the second year of degree studies, then a 6-month placement in the final year of the degree. Work placements are preceded by extensive workplace training provided by the university. For example, students have often only held temporary or part-time jobs without receiving interview exposure. Trial interviews enhance students' performance in pre-placement interviews and assist in building students' self-efficacy to a level where comprehensive, formal interviews will not be a formidable challenge [7]. A range of other activities are conducted to assist in the development of competencies, including development and practice of communication skills, professional ethics and conduct, personal organisation and networks and industry or organisational knowledge and participation [4]. The 6-month placement is credited as a 12-point unit, so constitutes one-quarter of a year's study load. On an hourly basis, the study load for this unit greatly exceeds that of two 6-point academic units, yet demand for participation in the IPP exceeds the number of places. This reflects both positive feedback from previous participants in the program and the high value that students place on obtaining relevant work experience.

Science students participating in the program are required to work through a set of activities to identify learning objectives appropriate to the individual and to the placement. These fall into the following broad categories:

- Personal and professional development.
- Industrial understanding at the team, organisation and industry level.
- Scientific skills and knowledge.

Once the student's personal learning objectives have been identified, a learning contract that identifies these objectives, along with a pathway to achieving them, is produced. This is a consultative process resulting in an agreement between the student, the organisation and the academic advisor and is usually finalised within the first few weeks of placement. Martin and Leberman (2005) argue that the development of the learning contract is an important way to formalise student, university and organisation expectations by clearly establishing initial project objectives and anticipated outcomes [8].

Examples of personal learning objectives that students have identified, strategies to obtain them and resources they would require are provided in Table 1. Self-confidence is the competency most often referred to by supervisors and identified by students. Developing personal learning objectives around competencies identified allows the student to develop strategies to overcome specific challenges. The placement review comprises feedback from the industry supervisor and a self-assessment by the student. Upon completion of the industry placement, the student is required to provide evidence for his or her learning based on the identified objectives, by preparing a written report (approximately 3000 words) and delivering an oral presentation to university and industry members and peers, both of which are assessed by academic staff. Final assessment is by Pass Grade Only (PGO).

In general, the university manages the placement positions and engages with the industry partners. An initial screening by the university is done to match the type of employment or industry to the student's course and interest. Employers are invited to interview a number of students before selecting the most suitable candidate. Effective communication between the university and industry supervisors and the student is especially important during the early days of their placement, so that any issues that arise are recognised and suitable intervention measures implemented. It is important that students are given opportunities to discuss their transition to the workplace and are aware of support available should problems arise.

As students' exposure to workplaces can range from tackling a specific task or project within the workplace, to acting in a fully integrated workplace role, the students' scientific and technical skill development may vary accordingly. Aspects that feature prominently in any work experience situation are those of personal development; self-confidence; diversity and flexibility of the organisation; a greater awareness of regulatory environments and occupational health and safety requirements; and, in particular, identifying the role of teams and individuals within teams.

Technical skill development has required students to draw on generic skills to produce a successful outcome. For example, one project involved commissioning an instrument designed for affordable automated pathogen screening, such as *Salmonella sp.* in the dairy industry. This involved communication with technical staff, familiarisation with the instrument, developing operation protocols and finally a training program for other staff. In a different situation, a student was involved in monitoring the quality of drinking water released from a limited capacity

Table 1. Students are required to identify personal learning objectives for their industry placement and to demonstrate that these objectives have been achieved. A table, such as the one below, forms the basis for initial discussions between the student and the supervisory team and provides the framework for the formal learning contract, signed by all parties.

Category	Placement Learning Objectives	Strategies to Meet Objectives	Resources Required to Meet Objectives	Evidence
Team and Organisation	Identify the various positions and task within teams and learn to utilise current and new skills within a team	Become involved in different teams where possible Be responsive and aware of roles and duties within the team and at the organisational level	Supervisor/manager Work colleagues Peers	Participation in different management teams, with different personal roles Taking responsibility for team work when appropriate
Ethics	Adhere to practices that will maintain confidentiality of information	Understand the level of confidentiality needed for given scenarios/situations Become familiar with ethics policy.	Official policy documents Supervisor Higher ranking peers	Adherence to company code of conduct Ensure confidentiality when working, e.g. leave off names or addresses when sending out information
Scientific skills	Expand my knowledge and experience with scientific practices in the field and interpreting data from both the field and databases	Follow instructions given by supervisors in given situations Clarify doubt by engaging supervisors when unsure on given topics Where possible use material from tertiary studies in work situations	In-house training materials, Inter/intranet Supervisors, Work colleagues Books/journals Seminars, conferences	Field work and data collection Acquisition of specific skills, including workplace software, data management and LIMS systems
Scientific knowledge	I want to learn about the major impacts on water quality in significant catchments and how the issues can be minimised	Review the current literature Design and conduct a project studying catchment water quality issues	Books and journals Government or other official publications and documents Scientific experts Field visits	Written review of past research Produce project report
Personal development	To learn how to prioritise work, so that all projects are completed within a required timeframe	Create a 'to do' list on a regular basis, with priorities and dates where possible	Conversations with supervisors to determine relative priorities Have a copy of my 'to do' list with me all the time	Work diary Punctual completion of projects

water storage facility. This required the student to familiarise herself with the analytical and microbiological tests required on a routine basis, as well as researching some more unusual occurrences associated with the prevailing drought conditions.

During their placement, students obtain a deep understanding of how teams operate and how they, as individuals, best contribute in a team situation. Having seen a variety of teams in action, they appreciate that, in some instances, structured teams with clearly identified reporting lines are required, while more flexible team structures are appropriate in other situations.

Students enrolled in placement units are able to translate theory into practice and become acutely aware of the workplace framework. In particular, the importance of risk assessments and compliance with occupational health and safety legislation highlights the importance of these, often underappreciated, areas of study. In this regard, the advantages provided by the IPP extend to students not enrolled in the program. The classroom becomes informed by the practical experiences of students undertaking placements, who are often able to provide alternative examples and/or case studies that enrich the learning experience.

In summary, the IPP benefits the entire university community:

- **IPP students** acquire personal and technical skills that **enhance their employability.**
- Their ability to offer new perspectives and to contribute to class discussion enriches the learning experiences of **other students** and assists lecturers to provide theoretical information in an **applied context.**
- Communication between academic supervisors and employers highlights **opportunities for industry collaboration and community engagement**.
- The placement of capable students in industry situations assists in **marketing and promotion** of courses and programs.

While the organisation and management of such a program requires a significant commitment by university academics and administrative staff, this is adequately compensated by the advantages it provides to the students enrolled in their program and their peers. Students have been able to meet potential employers and form lasting networks while at the same time gaining broader knowledge and life skills. Interest in the program is high among students and the continued interest demonstrated by industry partners highlights the perceived value of such programs within the wider community.

References

1. Cleary, M. *et al.* (2007) *Graduate Employability Skills: Business, Industry and Higher Education Collaboration Council.* Precision Consultancy. At: http://www.dest.gov.au
2. Orrell, J. (2004) Work-integrated Learning Programmes: Management and Educational Quality. *Proc. Aust. Univ. Qual. Forum*. AUQA. At: http://www.auqa.org.au/auqf/pastfora/2004/program/papers/Orrell.pdf
3. McIlven, P. *et al.* (2008) *Career Development Learning & Work-integrated Learning in Australian Higher Education: A Discussion Paper.* Australian Learning & Teaching Council. At: http://eprints.usq.edu.au/4255
4. Martin, A.J., & Hughes, H. (2009) *How to Make the Most of Work Integrated Learning: A Guide for Students, Lecturers & Supervisors.* Ako Aotearoa, National Centre for Tertiary Teaching Excellence, New Zealand. Massey University Press. At: http://www.waceinc.org/papers
5. Martin, E. (1996) *The effectiveness of different models of work-based university education* (Rep. 19). Evaluations and Investigations Programme, DEETYA. Australian Government Publishing Service. At: http://www.dest.gov.au/archive/highered/eippubs/eip9619/front.htm
6. Fleming, J. & Martin, A.J. (2007) Facilitating reflective learning journeys in sport cooperative education. *J Hospitality Sport Tour. Leis. Educ.* 6, 115-121.
7. Coll, R.K. & Lay, M. (2001) Using trial interviews to enhance student self-efficacy towards pre-placement interviews. *J Coop. Educ.* 36, 25-36.
8. Martin, A.J. & Leberman, S.I. (2005) Keeping up with the play: Practicum, partnership and practice. *Asia Pac. J Coop. Educ.* 6, 17-25.

Biographies

Kirsten Schliephake is an industrial microbiologist with teaching and research interests in the area of environmental biotechnology and industrial application of micro-organisms. She has guided and supervised projects as diverse as investigating the remediation potential of surfactant wastewater from air force base firefighting equipment, removal of petroleum hydrocarbons by aerobic micro-organisms using composting technologies, decolourisation of paper mill wastewater using fungal enzymes and fungal biomass and anaerobic digestion of industrial wastewaters.

Jennifer Mosse is a molecular biologist, with a particular interest in molecular virology. Jennifer is currently involved in projects studying the expression of negative sense genes in HIV-1, investigating mechanisms of drug resistance and strategies for antiviral therapy in influenza viruses. Jennifer has a long-standing interest in science education, particularly in the flexible delivery of science programs to remote students and in designing science programs of both local and international relevance.