Transforming a university

The scholarship of teaching and learning in practice

Edited by Angela Brew and Judyth Sachs

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Editors

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Preface

The integration of research and teaching is a key challenge in a research-intensive university. We aspire to ensure that a distinctive feature of students' educational experience at the University of Sydney is research-enhanced teaching. In this context, we provide students with an opportunity to experience an intellectual environment that focuses on research in the content of courses, in the development of inquiry based learning, and by the engagement of staff and students in research into university learning and teaching. It is through this engagement in the scholarship of teaching and learning that academic teachers are able to develop an evidence-based approach to curriculum development.

This volume attests to the commitment of the University and its staff to the scholarship of teaching, and illustrates how such scholarship enhances the teaching and learning process. The contributors are key researchers in teaching and learning across the faculties of the University of Sydney. The book is designed to showcase research on teaching and learning within the University and to demonstrate how this research is translated into changes in teaching practice.

The collected works illustrate research to develop a better understanding of students' conceptions and experiences in relation to specific curricula challenges, as well as describing a range of innovative strategies to increase students' preparedness to undertake study in their chosen field. Some of the chapters in this volume demonstrate the ways in which research and inquiry into aspects of teaching and student learning is being integrated in an iterative way into curriculum design and development.

The work presented here has been subjected to international peer review. Uniquely, the book demonstrates a wide spread of practice in the scholarship of teaching and learning from within one single institution. We hope that it will demonstrate how teaching scholarship is being used to enhance students' learning and that it will make an important contribution to intellectual discussions and debates about the scholarship of teaching and learning worldwide.

Don Nutbeam
Provost and Deputy Vice-Chancellor

University of Sydney

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About the book

At the time of commissioning this book, Judyth Sachs was Pro Vice Chancellor (Learning and Teaching) at Sydney. By the time of its publication she had taken up the position of Deputy Vice Chancellor, Provost at Macquarie University. The idea for the book was to further intellectual discussion and debate about the scholarship of teaching and learning by showcasing research and scholarship on teaching and learning practice in the University of Sydney and demonstrating how such work had contributed to the improvement of teaching and student learning practice.

We wanted to produce a scholarly book that would demonstrate quality research on teaching at the University of Sydney. To this end, each chapter was blind refereed by two academics from a panel of internationally recognised scholars. We wish to express our appreciation to the following people who acted as referees and provided high quality feedback:

Dr. Gerlese Åkerlind, Australian National University, Australia
Professor Moya Andrews, Indiana University, USA
Dr. Stephen Bostock, Keele University, United Kingdom
Ms. Alison Bunker, Edith Cowan University, Australia
Ms. Denise Chalmers, Carrick Institute for Learning and Teaching in Higher Education, Australia
Associate Professor Julia Christensen Hughes, University of Guelph, Canada
Professor Sue Clegg, Leeds Metropolitan University, United Kingdom
Dr. Glynis Cousin, Higher Education Academy, United Kingdom
Professor Patricia Cranton, Pennsylvania State University, USA
Dr. Phyllis Crème, University College London, United Kingdom
Professor Suki Ekaratne, University of Colombo, Sri Lanka
Professor Graham Gibbs, University of Oxford, United Kingdom
Dr. Allan Goody, University of Western Australia, Australia
Dr. Barbara Grant, University of Auckland, New Zealand

Professor Mick Healey, University of Gloucestershire, United Kingdom
Dr. Margaret Kiley, Australian National University, Australia
Professor Anette Kolmos, Aalborg University, Denmark
Professor Patricia Lawler, Widener University, USA
Dr Philippa Levy, Sheffield University, United Kingdom
Professor Ranald Macdonald, Sheffield Hallam University, United Kingdom
Dr Catherine Manathunga, University of Queensland, Australia
Professor Kristine Mason O'Connor, University of Gloucestershire, United Kingdom
Professor Lynn McAlpine, McGill University, Canada
Professor David McConnell, Lancaster University, United Kingdom
Dr. Jo McKenzie, University of Technology Sydney, Australia
Professor Joy Mighty, Queen's University, Canada
Emeritus Professor Harry Murray, University of Western Ontario, Canada
Dr. Martin Oliver, University of London, United Kingdom
Ms. Margot Pearson, Australian National University, Australia
Professor Albert Pilot, Utrecht University, The Netherlands
Dr. Dan Pratt, University of British Columbia, Canada
Dr. Jane Robertson, University of Canterbury, New Zealand
Dr. Chris Rust, Oxford Brookes University, United Kingdom
Professor Lorraine Stefani, University of Auckland, New Zealand
Dr. Kathryn Sutherland, Victoria University of Wellington, New Zealand
Professor Carmen Vizcarro, University of Castille-La Mancha, Spain
Dr Jennifer Weir, Murdoch University, Australia
Professor Johannes Wildt, University of Dortmund, Germany
Dr Margaret Wilson, University of Alberta, Canada
Professor Gina Wisker, University of Brighton, United Kingdom

Referees were asked to provide feedback and to rate the chapters according to whether:

- the issues/questions/ problems that led to the investigation were clear
- the courses/subjects/departments which were the contexts for the research were clearly specified
- the relevant research literature was discussed and analysed
- it was clear what methodological and/or theoretical approaches informed the work
- the way the researchers went about the investigation was clear
- whether the results of the investigation were well explained
- the chapter discussed how the research findings were used in improving teaching and learning
- the chapter made a contribution to knowledge in the field of higher education teaching and learning

We would also like to acknowledge the support and help of colleagues in the Institute for Teaching and Learning; in particular, Professor Michael Jackson (Acting Director from 2005-6) and the current Director, Professor Keith Trigwell. We are grateful to Professor Don Nutbeam for agreeing to provide the preface and to Alana Clarke for efficient administration of the submissions and refereeing process. Thanks also to Susan Murray-Smith and Joshua Fry at Sydney University Press.

Contributors

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Simon Barrie is Associate Director of the Institute for Teaching and Learning. His research explores the nature of the student learning experience in universities as well as the academic development processes associated with efforts to improve this. In particular, his recent research has focused on the development of graduate attributes and the quality assurance of university teaching and learning. He leads the University of Sydney's Institutional Projects on Generic Graduate Attributes and Evaluation and Quality Assurance and teaches on the Institute's graduate programmes.

Angela Brew is Associate Professor in the Institute for Teaching and Learning. She teaches on the Institute's graduate programs and leads the University of Sydney strategic projects on Research-Enhanced Learning and Teaching and Research Higher Degree Supervision Development. She is internationally renowned as a researcher and speaker. Her research on the nature of research and human knowing and its relationship to teaching has been published widely. Her most recent book is *Research and Teaching: beyond the divide* published by PalgraveMacmillan in 2006. She is co-editor of the *International Journal for Academic Development*.

Sandra Britton is Senior Lecturer and the Director of First Year Studies in the School of Mathematics and Statistics, within the Faculty of Science. Her teaching roles encompass lecturing mathematics units of study at first, second and third year levels. She was awarded a University of Sydney Excellence in Teaching Award in 1994. Her research interest is in the teaching and learning of mathematics at tertiary level. She was instrumental in forming the Sydney

University Tertiary Mathematics Education Group (SUTMEG). A conference organised by SUTMEG in 1996 led to the inauguration of the Delta conferences, now one of the most important series of international conferences on the teaching and learning of mathematics at tertiary level.

Rafael A. Calvo is Senior Lecturer, Director of the Web Engineering Group and Director for Teaching and Learning, at the University of Sydney's School of Electrical and Information Engineering. He holds a PhD in Artificial Intelligence applied to automatic document classification and has taught at several Universities, high schools and professional training institutions. He has worked at Carnegie Mellon University (USA) and Universidad Nacional de Rosario (Argentina), and as an internet consultant for projects in Australia, Brazil, USA, and Argentina. Rafael is author of a book and over 50 other publications in the field and the theme editor for the *Journal of Digital Information*. He is a member of IEEE and ACM.

Paul Canfield is Professor in Veterinary Pathology and Clinical Pathology and Director of Diagnostic Services in the Faculty of Veterinary Science. Paul teaches in professional practice, veterinary conservation biology, principles of disease and veterinary clinical pathology. In 2001 he received a Faculty Pfizer Teaching Award for excellence and innovation. Paul's research interests include host-pathogen-environment interactions in wildlife and domestic animal disease. He has over 170 publications and has successfully supervised over 15 postgraduate students. He was awarded a Doctor of Veterinary Science for his thesis of published works, entitled *Investigations into the health and disease of Australian wildlife, with particular reference to the koala*, in 2003.

Nicholas L. Carroll is working toward his PhD in the School of Electrical and Information Engineering. Nicholas has a BE/BCom from the University of Sydney. His research focuses on the development of an e-portfolio system called Dotfolio. He is also a member of the core development team for an open source Web application framework called OpenACS.

Henriikka Clarkeburn lectures in professional ethics in Government and International Relations, International Business, and Civil Engineering. Her research interests include ethical decision-making in professional contexts, development of academic honesty and the pedagogy of ethics teaching in tertiary education. She has published in various international journals on ethics teaching, academic honesty and health care ethics.

Tanya Covic is a researcher in the field of teaching and learning in higher education. She also teaches psychology to postgraduate students in the Faculty of Health Sciences.

Kristie Daniel-DiGregorio is an honorary research fellow at Yooroang Garang: School of Indigenous Health Studies. She currently works as Instructor in Human Development and Academic Strategies at El Camino College in Torrance, California. Her teaching, program development and research focus on

approaches to fostering student success at university. From 1996-2000, she was Research Fellow at Yooroang Garang: School of Indigenous Health Studies and she continues to work with her colleagues on the Student Experiences Study, an ongoing research project centred on the factors that affect the academic success of Indigenous health sciences students.

Helen Drury is Senior Lecturer in the Learning Centre. She has worked in the area of academic literacy and learning for more than 20 years in Australia, the UK and Indonesia. She has developed and taught generic programs in academic literacy and worked collaboratively across disciplines to integrate academic literacy into subject area curricula. Her most recent teaching innovations have been the development and evaluation of discipline specific online programs for supporting students in writing their scientific reports. She has published and presented widely in the areas of scientific and technical writing, genre analysis and online learning of academic literacy.

Ann Elias is Senior Lecturer at Sydney College of the Arts. She teaches the history of contemporary art to undergraduates, and supervises PhD candidates. She is Chair of the SCA Board. Her research is primarily in the discipline of art history, with specialisation in still life painting, and aesthetics and war. A recent publication discusses the language of the flower in war, and she is writing a book on Hans Heysen and the philosophy of still life. A second field of research is the practice and theory of teaching and learning in the visual arts.

Robert Ellis is Associate Professor and Director of eLearning. As such, he is responsible for coordinating the eLearning activities supporting over 46,000 students and 3,000 academic and general staff in 16 faculties using eLearning to extend, enhance and elaborate the student experience of learning. This role includes policy writing, strategic planning, management, and benchmarking activities with international universities in the United Kingdom and Australia. To support this role, Dr Ellis is the current recipient of two large Australian Research Council Grants investigating blended learning in higher education with Professor Peter Goodyear of the University of Sydney and Professor Michael Prosser of the University of Hong Kong.

Sally Farrington is Senior Lecturer, Yooroang Garang: School of Indigenous Studies, Faculty of Health Sciences is co-ordinator of student support for Indigenous students within the faculty. Through her research in Indigenous student experience, her teaching within the academic support and transition programs and the management of the personal, administrative and financial support for students she strives to improve educational outcomes for Indigenous students at the faculty. Sally's achievements in Indigenous student support were recently recognised with a University Award for Excellence in Teaching.

Mark Freeman is Associate Professor and inaugural Director of the Office of Learning and Teaching in Economics and Business at the University of Sydney. Mark has received multiple awards for excellence in teaching including the

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Tania Gerzina is Senior Lecturer in the Faculty of Dentistry and is Associate Dean, Educational Development and the Sub Dean (Clinical Affairs-Sydney Dental Hospital). She teaches in the area of clinical dentistry. Her PhD was in the areas of biocompatibility and bioavailability of components of dental materials. She has completed a clinical fellowship with the Royal Australasian College of Dental Surgery (FRACDS) and an education degree with the Institute for Teaching and Learning. She recently returned from a Special Studies Leave (sabbatical) at the University of Toronto working in both the Faculties of Dentistry and Medicine as a Visiting Professor. Her current research interests are in educational research, evaluation and accreditation of clinical teaching in Dentistry and student learning quality assessment.

Jerry Goldfried is Senior Research Consultant with an independent social research agency specialising in social, market and communications research for the government sector. Prior to entering the commercial world Jerry taught in areas such as research methods/statistics and social psychology while undertaking a PhD in the School of Psychology. Jerry currently holds a Bachelors Degree, with 1st Class Honours and was awarded the University Psychology Medal (University of Western Sydney, 1999). His research interests concern campaign evaluation, the impact of research on government decision makers and policy design, and religious orientation and tolerance.

Peter Goodyear is Professor of Education in the Faculty of Education and Social Work. He is co-director of the Centre for Research on Computer-Supported Learning and Cognition (CoCo). He teaches postgraduate courses on learning technology and the learning sciences and supervises graduate research in these areas. His research interests include: learning with new technology, particularly in higher education and in the workplace; the nature of pedagogical knowledge, especially in relation to teaching with new technology and/or in higher education; methods and tools for the design of complex learning environments; continuing professional development and the collaborative construction of 'working knowledge'. He is editor of the journal Instructional Science.

Nerida Jarkey is Senior Lecturer in the School of Languages and Cultures, within the Faculty of Arts. She teaches Japanese reading, grammar and linguistics. Her discipline-based research is in the field of Asian area linguistics. In her role as Director of First Year Teaching & Learning in Arts, Nerida conducts research on the first year in higher education, and coordinates the Arts Network Mentoring Program, Tutors' Development Program and 'Not Drowning, Wav-

ing' Program for students at risk. She has been the recipient of two University of Sydney Vice-Chancellor's Awards: for Learning and Teaching and for Support of the Student Experience.

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Michelle Lincoln is Associate Professor and Head of Discipline of Speech Pathology in the Faculty of Health Sciences. She is a researcher and teacher in the allied health field of speech pathology. Her role as Director of Clinical Education has resulted in a close and productive interface between student education and workplaces. In 2006 Michelle was awarded an Australian National Teaching Citation for an Outstanding Contribution to Student Learning by the Carrick Institute for Learning and Teaching in Higher Education.

Jennifer Lingard is Senior Lecturer, Discipline of Biomedical Science, Faculty of Medicine. Following 13 years research in renal and pancreatic physiology, including an NH&MRC post-doctoral position, she began multidisciplinary curriculum development and teaching of foundation biosciences for a range of health-related professional courses in the Health Sciences Faculty. Facilitating learning of underpinning sciences for students with strong end-professional focus is challenging. It now stimulates her research both in biochemistry and into students' perspectives of foundation studies and what motivates them to engage deeply therein. She has served as Head of School, Associate Dean and on the University Research Committee.

Hilary Lloyd is Senior Lecturer in the School of Medical Sciences, Pharmacology. Hilary is Chair of the Teaching and Learning Committee in Pharmacology and an active member of the Science Faculty Teaching and Learning Committee. She is a Foundation Tutor for the University of Sydney Medical Programme (1997) and is now involved in tutor training for this programme. In the last five years, Hilary and her colleagues have been awarded four teaching grants including a Teaching Improvement Fund (TIF) grant entitled 'Managing group work and assessment'. In her own discipline area of neuropharmacology she has 19 publications and currently supervises three PhD students, one Honours and two Pharmacy (Advanced) students.

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Kim McShane is Lecturer in the Institute for Teaching and Learning. Her work in the ITL is oriented towards exploring and eliciting the values, perceptions and approaches of academics who teach. Kim co-teaches and co-ordinates two of the units of study in the ITL's Graduate Certificate program for university teachers: 'The Scholarship of University Teaching and Learning' and Research-enhanced Teaching and Learning. Her research interests are focused on contributing critical perspectives to discussions of academic professionalism in higher education research, policy and practice in blended learning and teaching.

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Peter New was a Senior Lecturer in microbiology in the School of Molecular and Microbial Biosciences within the Faculty of Science, with long-term involvement in teaching improvement and curriculum development, including periods as Chair of the Teaching and Learning Committees of his School and Faculty. Having recently retired, he has left the undergraduate teaching world of lectures, tutorials and practicals to pursue his other research interests in agricultural micro-

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Charlotte Taylor is Senior Lecturer in the School of Biological Sciences within the Faculty of Science. She is also the Director of Learning and Teaching for the Faculty of Science. As deputy director in First Year Biology, she had 15 years experience in course design, staff training, assessment and online learning for large classes of 1000-1500 students. She received a Vice Chancellor's Excellence in Teaching Award, and completed a Master in Higher Education degree. She is Chair of the Research in Biology Education and Training group (RIBET), and has published collaborative papers in learning through writing, teaching large classes, giving, and use of, feedback and online discussions. Her research on threshold concepts in biology encompasses investigations into teachers' and graduates' conceptions of troublesome knowledge.

Rosanne Taylor is Associate Professor in the Faculty of Veterinary Science. She teaches veterinary physiology and animal biotechnology. Her research on inherited neurological disease in animals investigates new strategies for therapy

and has gained an AVCS Clunies Ross Research Award. She led change in teaching practices as Associate Dean and Chair of Learning and Teaching and helped develop the Faculty's scholarly, professional approach to improving student learning. She received the Faculty's Pfizer Teaching and Grace Mary Mitchell Awards, Vice Chancellor's Award for Outstanding Teaching, and was a national finalist in the Australian University Teaching Awards.

Lesley Treleaven is Senior Lecturer in the Office of Learning and Teaching within the Faculty of Economics and Business. She has taught business subjects at undergraduate and postgraduate levels employing approaches that enable students to learn deeply, actively and collaboratively. Applications of postmodern approaches to knowledge and change in organisations shape her research interests. She has published in *AJET, Studies in Continuing Education* and *Journal of Organisational Change Management*, and received several teaching innovation grants and excellence awards, including a Carrick funded 2 year collaborative action research project, Embedding Development of Intercultural Competence in Business Education, with three other universities.

Richard Walker teaches educational psychology at undergraduate and postgraduate levels in the Faculty of Education and Social Work. He is currently the Postgraduate Course Work Coordinator in the Faculty. Richard was awarded the inaugural Teaching Excellence award in the Faculty in 1994 and was subsequently awarded a University of Sydney Teaching Excellence award in 1998. He has published a number of journal articles and book chapters on various aspects of learning and motivation, with a particular focus on sociocultural approaches. His most recent area of research interest is in the area of social approaches to motivation. He has a chapter on this topic in the forthcoming International Encyclopedia of Education (3rd Ed).

Fiona White is Senior Lecturer in the School of Psychology. She is the School's Teaching Quality Officer and e-learning manager. She is also an active member of the Science Faculty's Learning and Teaching Committee. Fiona and her colleagues have been awarded several teaching grants including a Teaching Improvement Fund (TIF) grant; two Teaching Development Grants and one Teaching Improvement and Equipment Scheme (TIES) grant to Improve e-learning in undergraduate Psychology. Fiona's main research interest concerns racial prejudice reduction and she has 28 publications including a textbook titled *Developmental Psychology from Infancy to Adulthood*. Fiona currently supervises three PhD students and three honours students.

Helen Wozniak is Senior Lecturer in the Centre for Innovation in Professional Health Education & Research, Faculty of Medicine. She has a keen interest in innovative learning and teaching strategies for health professionals and holds a masters degree in health science education. Her innovations in clinical education, teaching and elearning were recognised with the award of the Faculty of Health Sciences J.O. Miller Award for Teaching Excellence in 2003 and Univer-

sity of Sydney Vice-Chancellor's Award for Outstanding Teaching in 2004. She is currently responsible for clinical skills development for medical students and post graduate teaching in medical education and continues to research eLearning, workplace learning and clinical education.

Chapter 1
Approaches to the scholarship of teaching and learning

Angela Brew

Institute for Teaching and Learning

This book is designed to show what happens when a university takes seriously the idea of the scholarship of teaching and learning and sets out to promote, develop and reward it. The aim of the book is to advance intellectual discussion and debate about teaching and learning improvement by showcasing research and scholarship on teaching and learning practice that has been carried out within the University of Sydney. A key concern is to demonstrate how such work has contributed to the improvement of teaching and student learning through transforming the ways in which teaching and curricula are understood.

In preparing this volume, we have been concerned to demonstrate what happens when one institution takes the development of the scholarship of teaching and learning seriously. The book aims to provide evidence of the effectiveness of research on teaching and learning for the transformation of university teaching and learning within one university and to demonstrate its impact by making the outcomes of some of this work publicly available. Contributors are key researchers in teaching and learning across the University of Sydney. Invitations were sent to academics who had hitherto carried out substantial internationally published research on aspects of their teaching asking if they would like to contribute a chapter either individually or in collaboration with colleagues. Contributors were asked to indicate the issues, questions or problems that led them to investigate the issue being discussed and to locate that within a relevant research literature and theory. They were asked to describe the investigation and summarise the results. Finally they were asked to indicate how they had used the research findings in improving teaching and learning.

THE SCHOLARSHIP OF TEACHING AND LEARNING

The idea of the scholarship of teaching and learning arose in the work of Ernest Boyer and colleagues at the Carnegie Foundation for the Advancement of Uni-

versity Teaching with the publication in 1990 of the seminal work *'Scholarship Reconsidered'*. This book appeared at a time when there was considerable concern about how academic work was rewarded, and a desire to bring the concept of scholarship up to date and make it more relevant to the modern university and to developments in the professions. Boyer's intention was to bring research, scholarship and teaching together through a redefinition of four forms of scholarship: the scholarships of discovery, application (later referred to as the scholarship of engagement (Boyer 1996)), the scholarships of integration and of teaching. For Boyer, the scholarship of teaching was characterised by knowledge of the subject being taught, carefully planned and continuously evaluated teaching related to the subject matter, encouragement of active, life-long learning which develops students as critical, creative thinkers, and the recognition that teachers are also learners. Hutchings and Shulman (1999) subsequently suggested that before ideas of the scholarship of teaching were developed, teaching did not automatically renew itself. It was possible to teach for many years without any development of that teaching. However, what is now known as the scholarship of teaching and learning demands a kind of 'going meta' (Hutchings & Shulman 1999 p. 13) where academics frame questions that they systematically investigate in relation to their teaching and their students' learning.

Initial formulations of the scholarship of teaching were helpful in suggesting a language with which to frame ongoing improvements in teaching and learning. By emphasising the scholarly nature of the teaching and learning process, it provided a framework for higher education teachers committed to improving teaching and students' learning to think about their teaching as a scholarly process. Since the publication of *Scholarship Reconsidered* a number of scholars have explored the possibilities contained in the idea so that there are now many examples of practice in the literature, and a number of theoretical models which extend ideas of what it may encompass. Most scholars now agree that the scholarship of teaching and learning includes ongoing 'learning about teaching and the demonstration of teaching knowledge' (Kreber & Cranton 2000, p. 477-8). Indeed, there is now general agreement that the purpose of the scholarship of teaching is to infuse teaching with scholarly qualities in order to enhance learning (Hutchings, Babb & Bjork, 2002; Hutchings & Shulman, 1999; Kreber, 2002; Trigwell & Shale, 2004). These scholarly qualities emphasise systematic evaluation and critical reflection on teaching and student learning supported by peer review.

Different models of the scholarship of teaching and learning have developed in different contexts and different countries. Some have focused on the development of teaching portfolios for promotion, recognition or reward. Others have focused on the course portfolio as a way of integrating curricula in a specific discipline across a national system. Other models emphasise the development of critical reflective practice, while others have focused on the development of ped-

agogical research. Trigwell, Martin, Benjamin & Prosser (2000, p. 156) say the aim of scholarly teaching is to 'make transparent how we have made learning possible.' In order that this can happen, they argue, 'teachers must be informed of the theoretical perspectives and literature of teaching and learning in their discipline, and be able to collect and present rigorous evidence of effectiveness.' It is this view of the scholarship of teaching and learning that lies at the heart of the work presented in this book.

In order to frame the book, this chapter discusses the institutional strategies that have been implemented to encourage and support the scholarship of teaching and learning at the University of Sydney. The chapter then looks more generally at the relationship between the scholarship of teaching and learning and improvements in students' learning experiences. It concludes with a brief overview of the organisation of the book.

THE DEVELOPMENT OF THE SCHOLARSHIP OF TEACHING AND LEARNING AT THE UNIVERSITY OF SYDNEY

The University of Sydney is a large research-intensive institution with approximately 31,000 undergraduate and 14,000 postgraduate students. As the oldest university in Australia, the University aims to be a leader both in disciplinary research and scholarship and in teaching and learning. The university has taken a systematic and scholarly approach to the improvement of teaching and learning since the year 2000. This includes a range of approaches to the management and evaluation of teaching and student learning driven by an emphasis on understanding and improving students' learning experiences. As far as the development of the scholarship of teaching and learning is concerned four initiatives are particularly relevant: a teaching quality improvement performance-based funding system, strategic university-wide projects, for example, on research-led teaching and the scholarship of teaching and graduate attributes, the availability of training in carrying out research on university teaching and learning at graduate certificate level and the possibility of being promoted or gaining an award on the basis of outstanding teaching.

These initiatives indicate a commitment to achieving and rewarding quality teaching in a research intensive environment. At a time when the Australian federal government is about to introduce research assessment through its Research Quality Framework (RQF), these initiatives can be viewed as an important counterpoint to a preoccupation with disciplinary research.

Performance-based funding for teaching

A major part of the University of Sydney performance-based funding system for teaching is a 'Teaching Dividend' comprising the allocation of six per cent of operating grant money to faculties in proportion to their relative teaching quality as measured by a series of teaching performance indicators (Ramsden 2001):

- Student Progress Rate (SPR)
- First to Second Year Retention
- SCEQ Good Teaching
- SCEQ Generic Skills
- SCEQ Overall Satisfaction
- CEQ Good Teaching
- CEQ Generic Skills
- CEQ Overall Satisfaction
- Full-Time Employment
- Full-Time Further Study

The SCEQ (Student Course Experience Questionnaire) and the CEQ (Course Experience Questionnaire) include series of questions designed to measure students' experiences of a range of aspects of the teaching and learning environment. The CEQ is used nationally to measure students overall course experiences, so the CEQ scores used in each discipline are benchmarked with the average score for the same discipline in other universities in Australia in the Group of Eight (research-intensive) universities. The teaching quality funding system also provides resources to enable faculties to address areas for improvement bid for on a competitive basis. The university's improvement agenda has also included rewarding departments for a defined and weighted set of scholarly accomplishments in relation to teaching and learning via what is known as the Scholarship Index.

The purpose of the Scholarship Index is to provide financial rewards to departments whose staff members contribute to teaching quality through the scholarship of university teaching and learning. These are measured on a defined and weighted set of criteria. The Scholarship Index is sourced from 0.5% of operating grant money and a contribution of 0.5% of the previous year's international student fee income. Claims are made annually and evidence for each claim is required. The criteria and their weightings are presented in Table 1.1.

Table 1.1 The University of Sydney Scholarship Index Criteria

Criterion	**Points**
Qualification in university teaching	10

Criterion	Points
National or state teaching award	10
National teaching award (finalist)	5
Vice-Chancellor's Award winner (includes Outstanding Teaching, Research Higher Degree Supervision and Support of the Student Experience awards)	5
College or Faculty award winner (includes Outstanding Teaching, Research Higher Degree Supervision and Support of the Student Experience awards)	2
Publication on university teaching - book	10
Publication on university teaching - refereed chapter	2
Publication on university teaching - refereed article	2
Publication on university teaching - non-refereed chapter, article or published conference chapter	1
Presented conference chapter or poster on university teaching	1

The overall levels of achievement of faculties in the Scholarship Index are presented in Figure 1.1 This shows the variation in the extent to which faculties have actively engaged with it. Some faculties have taken it extremely seriously demonstrated by substantial achievements.

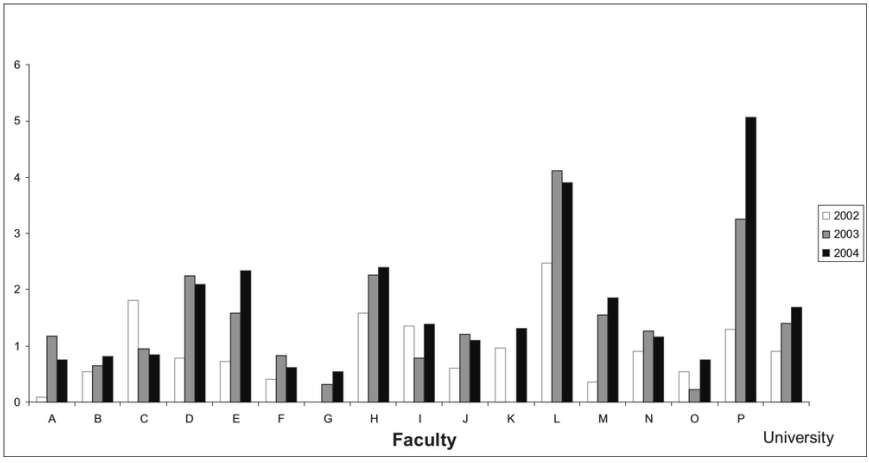

Figure 1.1 Scholarship Index points per FTE academic staff member by faculty.

The variation shown in Figure 1.1 indicates two major trends. First, it would appear that across faculties over the three years there have been substantial gains in points allocated. This indicates increasing levels of scholarly work being undertaken across the university as a whole. Second, the results show considerable differences between faculties in the levels of scholarly work undertaken with some faculties showing quite marked gains over the three years.

Strategic projects

The development of the scholarship of teaching and learning has been part of a university-wide project that was established in 2000 to increasingly employ undergraduate teaching and learning strategies which enhance the links between research and teaching and utilise scholarly inquiry as an organising principle in departmental organisation, and curriculum development; and to encourage and reward the scholarship of teaching and learning.

A large forum has been held every two years since 2000, each attended by approximately 200 academics and featuring many presentations of research on teaching by University of Sydney staff as well as internationally renowned keynote speakers. These events have been important in raising awareness and sharing good practice. A number of similar events have subsequently been held within faculties. In 2005, the University hosted the Annual International Higher Education Research and Development Society of Australasia (HERDSA) conference with 460 delegates. 120 University of Sydney staff presented at this event. Further strategies to encourage the scholarship of teaching and learning have included the establishment of a strategic working group with representatives from each faculty nominated by deans. The working group has established a set of performance indicators for research-led teaching and the scholarship of teaching and carried out an audit. It has established clear guidelines for dealing with ethical procedures when carrying out research on teaching and has been responsible for drafting policy and for a number of initiatives designed to share good practice. Other project strategies have included: the development of a web site with resources to encourage and support academics in developing the scholarship of teaching and learning, revision of the criteria for the Vice-Chancellor's award schemes for outstanding teaching to strengthen the emphasis on demonstrating scholarship in teaching, and carrying out investigative work regarding best practice in research-led teaching in research-intensive institutions with which the University of Sydney has benchmarking relationships.

In 2001 the University of Sydney's Academic Board, its main academic decision-making body, initiated a series of reviews in which questions were asked in each faculty about the development of research-led teaching and the scholarship of teaching. Each faculty was required to address the recommendations that were made. In addition, a Graduate Certificate in Higher Education unit of study

focused on the *Scholarship of University Teaching and Learning* was established to teach academics the skills of scholarly inquiry related to teaching and learning (see Chapter 20). To date, over 250 academics have completed the graduate certificate.

Faculties have, in turn, adopted a series of strategies to develop the scholarship of teaching and learning. These vary from faculty to faculty but include: making changes to faculty policies; seminars and discussions of research on teaching and learning; research on teaching and learning websites to encourage development; research on teaching competitive grant schemes; making the University's graduate certificate in higher education compulsory for all new staff; using scholarship index money to fund teaching awards; rewarding achievements in scholarship of teaching in teaching awards; attendance at higher education teaching and learning or research on teaching conferences. Evidence suggests that faculties that have put in place explicit strategies to increase performance on the Scholarship Index have indeed been successful. The extent to which these achievements have resulted in enhanced student learning experiences is examined below.

As a result of all of these initiatives, in the light of discussions at other universities in the UK and Australia, and taking account of the international research literature, the Research-Enhanced Learning and Teaching Working Group drafted a policy which has now been accepted by Academic Board. The policy includes the following:

> '4. Definition:
>
> In the University of Sydney, research-enhanced teaching covers three key areas of activity.
>
> *4.1 Research-enhanced teaching:* Teaching is informed by staff research. This includes the integration of disciplinary research findings into courses and curricula at all levels such that students are both an audience for research and engaged in research activity.
>
> *4.2 Research-based learning:* Opportunities are provided for students at all levels to experience and conduct research, learn about research throughout their courses, develop the skills of research and inquiry and contribute to the University's research effort.
>
> *4.3 Scholarship of learning and teaching:* Staff and students engage in scholarship and/or research in relation to understanding learning and teaching. Evidence-based approaches are used to establish the effects and effectiveness of student learning, teaching effectiveness and academic practice.' (University of Sydney 2007)

Coexistent with these developments has been a related project to specify the attributes that the university considers its graduates develop. As a consequence

of this project a set of generic attributes of graduate of the University of Sydney which embody the university's scholarly values as a research intensive university has been developed. Resources to support staff in ensuring students develop the graduate attributes, a strategic working group to support the project and the ongoing dissemination and implementation of university graduate attributes policy within faculties as well as a benchmarking process has been developed. The graduate attributes strategic project has fed into curriculum reviews in many faculties. It underscores the university's commitment to scholarly inquiry and evidence-based practice in relation both to student learning and academic work.

DOES ENGAGING IN THE SCHOLARSHIP OF TEACHING RESULT IN BETTER TEACHING?

In preparing this book we have been mindful of the need to link research on teaching and learning to improvements in students' learning. In 2000 Healey reported that there was very little research evidence that engaging in the scholarship of teaching and learning enhanced learning (Healey 2000). There were many anecdotal examples of teachers improving aspects of their practice as a consequence of engaging in inquiries into their students' learning. There was anecdotal evidence at the University of Sydney that teachers initiated into the practice of scholarship of teaching and learning were becoming leaders in teaching developments in their faculties. A number of these individuals are represented in this volume. There is some research evidence that engaging in training in university teaching leads to increased student satisfaction and an increase in the use of student-focused approaches to teaching (Gibbs & Coffey, 2004; Lueddeke, 2003). However, an Australian study of tertiary teaching award programs (Dearn, Fraser & Ryan, 2002) found that such courses were most likely to be focused on the development of teaching skills or the development of a specific teaching practice, for example, flexible and online teaching, assessment of student learning, postgraduate supervision and internationalisation, not on developing scholarly approaches to teaching.

There is evidence that when university teachers say they reflect on their teaching they do so at an instrumental or technical level focused on improving actions in the classroom, rather than in understanding the reasons why particular methods are chosen, why students respond as they do, or reflecting in ways that question their basic teaching assumptions (Kreber, 2004, McAlpine & Weston, 2002; Trigwell et al., 2000). In Chapter 20 we shall see that a key contribution of engaging in the scholarship of teaching and learning is its capacity to provide a means whereby teachers are enabled to develop a reflexive critique of their teaching enabling them to questions the values and assumptions that drive them to teach the ways they do.

However, given the efforts that have been made to develop the scholarship of teaching at the University of Sydney, it is pertinent to ask what its impact is on the experiences of students. In order to address this issue, my colleague Paul Ginns and I investigated whether faculty differences in performance on the Scholarship Index were associated with faculty differences in changes in undergraduate responses on the Student Course Experience Questionnaire (SCEQ) scales. SCEQ data has been collected from undergraduates since 1999, while Faculties have lodged Scholarship Index claims each year since 2002 (data for 2005 was lodged in the middle of 2006 and audited early in 2007). Our analysis therefore aimed to investigate the possible link between these two institutional initiatives by investigating the association between a faculty's three year performance (2002-2004) on the Scholarship Index, and the *change* in the faculty's SCEQ score between 2001 and 2005.

We calculated 2 results for each faculty. The first was the sum across 2002 to 2004 of the Scholarship Index performances for each faculty, weighted according to the number of full-time equivalent teaching staff in that faculty. The second was the change in SCEQ scores between the 2001 survey of undergraduates, and the 2005 survey. We investigated the association between these 2 variables using regression analysis, specifying the Scholarship Index sum variable as the independent variable, and the change in SCEQ scores as the dependent variable (Brew & Ginns, 2006). What we found was that this relationship was statistically significant for three of the SCEQ scales – Good Teaching (p=.036), Appropriate Assessment (p=.021), and Generic Skills (p=.020) suggesting that performance on the Scholarship Index is related to students' perceptions of their assessment, how and whether their generic skills have been developed and their perceptions of the quality of the teaching (Brew & Ginns, 2006). In particular, we found that differences in faculty performances over three years (2003-2004) on the Scholarship Index were reliably associated with changes in student perceptions between 2001 and 2005.

These results provide support for the introduction of the Scholarship Index as a means for improving student learning experiences. They provide tangible support for Hutchings and Shulman's (1999) suggestion that the scholarship of teaching and learning is how the profession of teaching advances. However, it is pertinent to ask why developing the scholarship of teaching has the effects that are seen here on measures of students' experiences. Developing the scholarship of teaching ultimately has an effect on the ways in which students' experience their courses. Curriculum development within such a context is no longer based on ad hoc assumptions or reactions to teaching methods experienced as a student. Instead, decision-making comes to be based on evidence of what is effective as demonstrated in the scholarly research literature and as evidenced in the specific context. As can be seen in this volume, engaging in the scholarship of teaching and learning means that teachers become capable of articulating their theories of

teaching and of understanding the epistemological framework that drives their investigations. They become aware of the role that educational research and theory plays in their discipline. In short, they develop a reflexive critique of practice (see Chapter 20). There is also evidence to suggest that the scholarship of teaching and learning, by engaging teachers in the process of inquiring into their teaching, leads teachers to articulate a pedagogical framework or philosophy of teaching (see for example Brew & Peseta, 2004; 2001) in which specific approaches to teaching are viewed as instances of a broader theoretical approach.

Further research is needed to examine more systematically what faculties that are performing well are doing. We also need more information about the contributions that the different criteria on the Scholarship Index make in explaining performance differences. For example, highly successful faculties may be marked by the emphasis they place on encouraging staff to obtain teaching qualifications or write textbooks which are weighted highly on the scale. Another avenue of institutional research might be to continue to refine the composition of the Scholarship Index to increase its capacity to effect change. Examining the variation between faculties in how Scholarship Index funds are dispersed and the purposes to which these funds are put is also a subject for future research.

ORGANISATION OF THE BOOK

The chapters in this book represent a wide spectrum of disciplinary areas of the University of Sydney and address a considerable variety of questions in regard to teaching and learning using a considerable range of methodologies and theoretical approaches. There are five broad areas around which we have chosen to organise the book. We begin in Part 1 by presenting research which has been carried out in order to understand better the experiences and understandings of students. The focus of attention in these chapters is on addressing challenges presented within particular curricula: for example, concepts that students typically find difficult in a course as in the chapter by Erica Sainsbury and Richard Walker, the challenge of learning within service courses as in the chapter by Laura Minasian-Batmanian and Jennifer Lingard, the challenge of students' attitudes to material presented as in the chapters by Ann Alias and Kathryn Marsh. Each of these chapters in their different ways focuses on inducting students into ways of knowing and thinking in specific disciplines. This theme is taken up in the chapter by Peter Goodyear and Robert Ellis whose specific focus is on understanding the ways in which online collaborative learning activities are and are not used to develop understanding of the way knowledge operates in their particular disciplinary area.

Part II presents work which has focused on developing a greater understanding of student assessment. Fiona White, Hilary Lloyd and Jerry Goldfried

examine students' attitudes towards collaborative group work and group assessment, while Ian Sefton and Manjula Sharma compare the findings of a phenomenographic study of students' conceptions with students' examination scores. This raises some interesting questions about the relationship between examination marks and students' understanding

A number of studies that have been carried out in a wide range of contexts have sought to understand and respond to students' preparedness for university study. These are the focus of Part III. The contexts for which students require preparation are varied. So in Chapter 9 Patricia Lyon discusses research which led to medical students being better prepared for learning in the operating theatre, while Susan Page, Sally Farrington and Kristie Daniel DiGregorio in Chapter 10 discuss work which has focused on Indigenous students' preparedness for university study. Writing and numeracy are integral to university study, and in the chapters by Charlotte Taylor and Helen Drury and by Sandra Britton and colleagues, students' writing and mathematical skills are the focus. In Chapter 13, Nerida Jarkey discusses a program of research and development designed to prepare first year Arts students for university study. This chapter focuses on an iterative process of research informing practice and vice versa. As such it forms a bridge to Part IV which contains a number of further chapters where the authors have engaged in ongoing cycles of research and curriculum change. Mark Freeman, Henriikka Clarkeburn and Lesley Treleaven discuss the ways that research on academic honesty has been successively integrated into strategies at the faculty level. They show how a more sophisticated understanding of the problems of plagiarism and cheating resulted from this. The chapters by Helen Wozniak and colleagues and Rafael Calvo and colleagues each focus on interactive processes of research and development in relation to eLearning but from very different perspectives; one on understanding how learners engage in online discussions, the other, understanding how to develop software that will engage students in deep approaches to learning. Anna Rubbo provides an insight into a global research and educational intervention in the teaching of architects, while the chapters by Barbara Adamson and colleagues and by Tania Gerzina recount a range of research on teaching projects that have been carried out over a long period of time, leading to successive changes in teaching and learning in the Faculties of Health Sciences and Dentistry respectively.

Finally, in Part V we reflect in different ways on the challenges and the successes of engaging in the scholarship of teaching and learning. In Chapter 20, Tai Peseta and academic development colleagues from the Institute for Teaching and Learning reflect on the challenges for disciplinary academics in engaging in the scholarship of teaching and learning and on some of the dilemmas associated with performing a role as change agents in an institution where the scholarship of teaching and learning is strongly encouraged. Rosanne Taylor then looks from a faculty perspective to highlight and celebrate the achievements of a faculty

that has fully embraced not only the scholarship of teaching and learning, but the scholarship of academic practice more broadly. Finally, in conclusion, Judyth Sachs offers some reflections and implications for teaching and learning in the future.

CONCLUSION

Within Australia, as this book is in production, the introduction of a Research Quality Framework which measures impact and quality of disciplinary research is on the near horizon. Such a framework threatens to supplant efforts to improve teaching through the scholarship of teaching and learning. Through the initiatives discussed in this book, we believe that the university has made substantial progress in developing understanding of the nature of the scholarship of teaching at different levels of the University and that scholarly work in relation to teaching has demonstrably been used to enhance practice. The strategic initiatives discussed in this chapter have provided a context for scholarly work in relation to teaching and learning, but the research and developments detailed in this book could not have been achieved without the hard work and determination of individuals and groups of academics who with dedication and commitment to students' learning have shown creativity and courage in advancing research on teaching and learning in the university.

More generally, as seen in Figure 1.1, the scholarship of teaching and learning is being energetically pursued across the university and its effects are clear and widespread. Progress has been made in moving thinking away from a teacher focused view to focus more on the student experiences. There is still much to learn about what it is that a research-intensive university can offer students that is unavailable in other higher education contexts. There is a long way to go in transforming a university, but it is already evident that the initiatives such as are detailed in this book are taking us beyond perfunctory notions of quality assurance towards sustained quality enhancement.

The process of transforming the teaching and learning processes and practices within a large and diverse institution is a long term project. It is an ongoing process that cannot ever be complete. We hope this book will provide inspiration to other institutions thinking about utilising the scholarship of teaching and learning to effect curriculum transformation and that it will encourage academics in other universities who are thinking about researching their teaching to take up the challenges it offers.

ACKNOWLEDGEMENTS

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PART I

RESEARCHING STUDENTS' UNDERSTANDINGS AND EXPERIENCES

Chapter 2

Same words, different meanings: Learning to talk the scientific language of pharmacy

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Pharmacists are health care professionals whose expertise lies in the provision of medicines and information, with the aim of optimising medicine use in the overall care of patients. A strong foundation in both pharmaceutical and social sciences underpins the pharmacist's role, and within the pharmacy curriculum at the University of Sydney relevant skills and attributes are embedded in this disciplinary knowledge. In relation to the pharmaceutical sciences, observations over a number of years (Sainsbury & Walker, 2004) suggested that many students experienced difficulties in applying communication, problem-solving and critical thinking skills to pharmacy issues, whereas those skills were clearly evident in other contexts such as chemistry. In particular, first year students struggled with 'acids and bases', both conceptually and in solving common problems. The primary confusion appeared to stem from a failure to recognise that the conventions of pharmacy differed from those familiar from chemistry, and a consequent attempt to use concepts and problem-solving approaches which had been applied successfully in chemistry but were inappropriate for the new context. Specifically, students focused on the physical characteristics of solutions of acids and bases, whereas the emphasis in pharmacy is on the structures which make a drug an acid or a base. While there are some situations in which concepts are directly transferable from chemistry to pharmacy, this is by no means universal, and students exhibited difficulties in discriminating between contexts.

In order to investigate possible reasons for these observations, we framed the problem as one of conceptual change, and drew on sociocultural approaches to learning to conduct research into both the processes and outcomes of conceptual change learning in a collaborative environment designed to facilitate the socialisation of students into their future profession of pharmacy. Using data collected during classroom interactions and individual interviews, we evaluated the extent to which students developed and used concepts which reflected the conventions of pharmacy.

THEORETICAL BACKGROUND

Sociocultural theories and conceptual change

Sociocultural theories, which are derived from the writings of Vygotsky, are based on the assumptions that learning and development are intrinsically social in nature and that individual processes originate in social practices (John-Steiner & Mahn, 1996; Rogoff, 1998). The fundamental tenet is that, as an individual participates in social practices, those practices become part of that individual's repertoire through a process of appropriation. From this perspective, communication through language plays a fundamental role in learning, and individual learning is seen to be shaped by the specific social, cultural and historical contexts in which it takes place (Wertsch, 1991). The professional curricula of the contemporary university are therefore well suited to interpretation from a sociocultural perspective, through focusing on the ways in which the cultural practices (Miller & Goodnow, 1995) of a profession are learned by novices. For these novices, learning different cultural practices often involves conceptual change. Traditional conceptual change theories (Posner, Strike, Hewson & Gertzog, 1982) focus on replacement of incorrect concepts with correct alternatives, however a sociocultural approach is more concerned with the development of discrimination between different contexts and the ability to choose the concept which is situationally relevant (Driver, Asoko, Leach, Mortimer & Scott, 1994). Sociocultural theories also suggest that the idea of 'concept' can be broadened to include social and cultural practices (Säljö, 1999) and highlight the importance of participating in collaborative activity as a means of promoting change (Kelly & Green, 1998).

Collaborative interaction in an educational setting can facilitate enculturation into professional practice, particularly if authentic language and resources are used by participants engaging with realistic situations and issues. Learning occurs as individuals work collaboratively, often with the assistance of more capable guides, so that all are able to develop beyond their current capabilities, thus creating what Vygotsky (1978) termed zones of proximal development. Collaboration is regarded as something more than simply working together, in that it involves the development of intersubjectivity (Rogoff, 1998). In this chapter we describe how first year pharmacy students experienced conceptual change in relation to 'acids and bases' by learning to differentiate between language use and problem-solving approaches appropriate to chemistry and those appropriate to pharmacy, through engaging in groupwork within a weekly workshop during one semester. Through collaborative participation in specific learning activities, students learned ways of participating more successfully in the cultural practices of the pharmacy profession.

Communities, cultural practices and zones of proximal

development (ZPDs)

The profession of pharmacy is an example of a community of practice (Wenger, 2000), which is a group engaged in particular cultural practices that come over time to be regarded as the property of the group and to constitute part of the personal identity of a community member (Miller & Goodnow, 1995). A community develops its own historical traditions and sociocultural identity, together with shared beliefs, patterns of language, and ways of carrying out its constituent practices (Säljö, 1999). Becoming part of the community entails learning to participate in ways which are recognised as characteristic of the community, and in particular learning its ways of communicating (Lemke, 1990). Depending on the nature of the community, different modes of communication may be appropriate, however the ability to communicate meaningfully through language is central to most human activities. Some aspects of the language used by one community may be shared with others, but often the meanings vary between communities. Pharmacy, for example, uses terms such as 'acid', 'drug' and 'poison' to communicate very precise meanings which are different from the meanings non-pharmacists would normally recognise. Communication through language is, however, rarely a matter simply of knowing definitions and using an appropriate vocabulary; rather it is a social process in which a group of participants create and sustain relationships through the making and sharing of meaning.

Socialisation into a professional community is a gradual process, and commonly involves a mixture of classroom learning and an apprenticeship of some type. Within the classroom, a type of community is created (Brown, 1997; Walker, 2003), with its own characteristic means of communication and cultural practices, but these are often idiosyncratic. A classroom cannot therefore mirror a professional community, but can be a safe environment for inexperienced peers to engage in relevant professional practices. The assistance of professional practitioners, often as tutors, allows students to evaluate their learning and appropriate more of the characteristics of the professional community. These conditions promote the formation of ZPDs, which are environments within which individuals collaborate on activities which they cannot successfully complete alone (Newman, Griffin & Cole, 1989). ZPDs are characterised by collaborative activity where each individual takes some form of responsibility for personal and group learning (Brown, 1997). Learning professional cultural practices is enhanced when ZPDs arise: final year pharmacy students at the University of Sydney, for example, learn clinical decision-making in the context of supplying prescription medicines though problem-based learning under the guidance of practicing pharmacists. In the early years of the degree, ZPDs are created as students learn appropriate patterns of language use through talking to each other. The latter is critical because students already have their own ways of talking about pharmacy topics – such as 'acids and bases' – which are different from those of pharmacy. In first year, one critical aim is to assist students to learn ways of talking which

are characteristic of pharmacy, rather than chemistry.

Conceptual change through changing language practices

Learning a new way of talking about what appears to be a familiar topic involves conceptual change. When novices encounter a situation in which familiar words convey quite different meanings, they often experience conceptual confusion because they do not recognise that any difference exists. We believe that this is at the heart of the difficulties experienced by pharmacy students with 'acids and bases'. In chemistry, these words are associated with physical features such as pH, corrosiveness, taste and feel, whereas in pharmacy the meanings revolve around molecular structure and behaviour in various environments: these differences in conceptual meaning determine the interpretation of problems and approaches to solving them. As suggested earlier, a sociocultural approach to conceptual change is concerned with discrimination of concepts and practices between contexts; this discrimination extends to the use of language (Säljö, 1999), and conceptual change can include enculturation into the language used within a particular community. Participation in the community itself, or in a well-structured learning environment, is critical for the development of fluency and confidence in this new language use through provision of opportunities to participate in discussion with both peers and professional practitioners. In the research reported in this chapter, we structured the workshop activities such that discussion was encouraged among the peer groups both in the absence and presence of the tutor, who was a practicing pharmacist.

Conceptual change and thinking together

The provision of learning environments designed to encourage discussion is important but not sufficient to promote conceptual change, since change is critically dependent on the nature of the interactions within the environment. As suggested earlier, collaboration involves more than simply working with others; it requires a sharing by the participants of the meaning and goals of a joint activity, and a willingness to engage with the group and the activity which results in intersubjectivity (Rogoff, 1998). Intersubjectivity is characterised by the ability of groups to work within a common frame of reference and to share their thinking (Tudge & Rogoff, 1989). Evidence for shared thinking in the current research was sought in the social interactions within the groups, primarily the language patterns, but also group dynamics. We were particularly interested in the relationship between group interactions, the development of intersubjectivity, and evidence for conceptual change.

RESEARCH CONTEXT AND METHODOLOGY

The present research aimed to examine aspects of the process of enculturation into the pharmacy community through observing small collaborative groups of learners. In this chapter we focus on the patterns of conceptual change observed within two small work groups of first year pharmacy students learning about 'acids and bases'. Students self-selected into these groups within a large workshop class which met weekly for two hours over one semester. No specific instruction was given to students about working in groups since it was of research interest to observe the patterns of collaboration which students would choose to adopt.

The context was Introductory Pharmaceutical Science, a compulsory component of the four-year Bachelor of Pharmacy at the University of Sydney with an enrolment of over 200, and consisting of lectures and workshops, all taught face-to-face. Within the workshops, groups of four to six students carried out assigned tasks including discussion of concepts, reflective exercises, solution of problems, and joint construction of explanations.

Change was explored through observing the language patterns used by members of the two groups, both in workshop sessions and in interviews. Three workshop sessions were scheduled to be videotaped for each group (although one group requested not to be recorded on the third occasion) and each member took part in three interviews: immediately prior to commencement of the topic 'acids and bases'; immediately after the topic; and five months later, at the start of the following academic year. Examples of the questions are included in the appendix. Insights into the processes of change were gained through specific questions in the interviews and analysis of the social functioning of the groups during workshop sessions.

As the research progressed, considerable differences were observed between the two groups. In one case, the members began using language patterns appropriate to pharmacy and became more skilled in applying relevant critical thinking and problem-solving approaches; these changes persisted for at least five months. We describe this group as the persistent-change group (PC). In the other case, although short-term learning was apparent, conceptual change in the form of different ways of talking was not maintained beyond the end of the teaching semester. We describe this group as the transient-change group (TC).

The persistent-change group (PC). In the persistent-change group, all six members were female and aged between 17 and 19 years. Four of the six were not native English speakers, and indicated that they spoke either Cantonese or Vietnamese at home. All were fluent in spoken English. The group consisted of a nucleus of three friends, who had worked together during the previous semester and three additional students who were acquaintances but not friends.

The transient-change group (TC). The transient-change group consisted of three females and two males, all aged between 17 and 19 years. One male indicated that he spoke Cantonese at home, however he was fluent in English. All other members were native English speakers. Members described themselves as close friends, and had arranged their timetables to enable them to work together in this workshop. All were residents of residential colleges on campus, and studied and socialised together.

EXPLORING CHANGE

Evidence of learning and conceptual change

Evidence of conceptual change learning was sought in comparisons between the three interviews held with each student, and in particular the extent to which any changes persisted beyond the end of the year. Initial interviews before commencement of the topic established that students shared a chemistry perspective of the topic; the second interviews, held immediately after the topic finished, indicated that all students had learned to articulate key concepts and solve problems in ways consistent with pharmacy conventions. During the third interviews, held after the university long vacation, students engaged in discussions similar to those of the second interview, and were asked to solve problems like those encountered during the previous semester. They were encouraged to articulate their thinking while solving the problems. The third interviews were regarded as providing evidence of the persistence of any conceptual change, in contrast to the second interviews which were indicative of short-term learning. The results discussed in this chapter were obtained from the third interviews.

Persistent–change group. Members of the PC were generally confident in their answers to questions about the characteristics of an acid, identification of acidic and basic functional groups, the association of pKa rather than pH[1] with acidic drugs, and the meaning and function of pKa; all of these dimensions reflected relevant pharmacy conventions. Their explanations tended to be concise and came to the point without needing excessive prompting. Their language was generally consistent with pharmacy usage, and was reflective of group discussions during

1 pH and pKa are two parameters associated with acids and bases. pH refers to the concentration of hydrogen ions in a solution containing acids and/or bases, whereas pKa is a reflection of the equilibrium constant for the dissociation of the acid or base in water. In chemistry, the focus is more on pH; in pharmacy the focus is on pKa as a characteristic of acids and bases.

workshop sessions. Not surprisingly, they were unable to articulate all of the material learned in the previous semester, but they tended to have forgotten specific points, rather than confused concepts. The interviews tended to be short, as extensive probing was not required to stimulate articulation of their understanding.

Excerpts from the interviews serve to illustrate a number of critical findings.

Excerpt PC1

Veronica: Um, a drug is acidic because it has an acidic functional group on it…Acidic drugs have acidic functional groups on them but there's other parts to the drug as well. Whereas acids are just acids itself.

One of the key differences between chemistry and pharmacy is definitional. Students are familiar from chemistry with physical properties of acids such as pH, feel and corrosiveness, whereas pharmacy conventionally focuses on molecular structure. Veronica clearly and concisely articulates the pharmacy convention using language appropriate to the context and indicates that she is able to discriminate between prior learning and her new conceptual understanding.

Excerpt PC2

Isabelle: That is an acidic group.

Interviewer: Yes.

Isabelle: And I can't see anything else so I would call that an acidic drug.

Isabelle also demonstrates an appreciation of the importance of molecular structure, and confidently identifies the sole functional group correctly, then uses this identification to classify the molecule correctly, using appropriate language.

Excerpt PC3

Interviewer: Do you think of acids as having a pH?

Kellie: No, they have a pKa. I think pH is for solutions that contain acids and bases.

One of the key issues identified in previous observations of conceptual difficulties is the association of acids and bases with pH. pH is often associated in chemistry with acids and bases, although it is considered in pharmacy as the property of a solution of an acid or a base. When acids are identified on the basis of molecular structure as they are in pharmacy, the significant parameter is pKa rather than pH. The acknowledgement by students of the importance of pKa

rather than pH in the context of pharmacy is key evidence for conceptual change learning.

Excerpt PC4

Denise: Ka is the acid dissociation constant. Which is like the products over the reactants. And then pKa is minus log of the Ka.

Interviewer: What do we use pKas for? What do they tell us?

Denise: The extent of dissociation.

Denise also clearly demonstrates pharmacy conventions and definitions. Although pKa is also important in chemistry, students generally give it less importance than pH, thus familiarity with the meaning of pKa is important as evidence for learning.

Transient-change group. The students in the TC were considerably less confident than those in the PC. Their responses were typically a mixture of pharmacy and non-pharmacy conventions, and on many occasions appeared to reflect a combination of pre- and post-instruction responses. In contrast to the PC, several TC students relied on memorisation of the material, and stated explicitly that they needed to write the answers down rather than articulate them verbally. Interviews tended to be longer, as substantially more prompting and probing was necessary, and the interviewer frequently resorted to leading questions in an effort to encourage verbal responses. Several of the students were capable of solving the problems presented to them, with assistance, but their solutions tended to be idiosyncratic rather than according to pharmacy conventions.

Excerpt TC1

Larry: Well, as you said, drugs tend to be not as acidic, they're more… You don't, yeah… There is a difference between, like most acidic drugs don't tend to be as strong as normal acids. Like your Hydrogen Chloride or whatever is a much stronger acid, whereas your acidic drugs are not as strong.

Interviewer: What's the difference? What kind of characteristics, apart from strength, might be different between say, hydrochloric acid and a drug which is an acidic drug?

Larry: They contain weaker acidic groups. Like carboxylic acid.

Interviewer: What do you mean by strength, then? What does a strong acid do that a weak acid doesn't?

Larry: A strong acid dissociates completely, or it's meant to. Most acidic drugs don't dissociate completely.

Larry was clearly lower in confidence as evidenced by his use of incomplete sentences and long pauses. His replies demonstrate conceptual confusion, involving a mixture of chemistry and pharmacy concepts, with little apparent discrimination between contexts. His responses focus primarily on strength rather than molecular structure, despite probing for alternative concepts. In addition, strength is explained using chemistry conventions rather than pharmacy: in pharmacy strong acids are defined in terms of low pKa rather than complete dissociation.

Excerpt TC2

Lucy: pH and Ka but I just can't remember the relationship between it. That's terrible it's only been, it hasn't been very long.

Interviewer: OK. Does it have anything, do you associate pKa with strength of acids and bases?

Lucy: Yeah, but I can't remember which one it is, whether it's high or low.

Interviewer: So pKa has something to do with strength but you would need to re-memorise which one went with which.

Lucy: Yes.

Lucy was characteristic of her group in that she tended to rely on recalling aspects which she had studied for the exam, rather than demonstrating evidence of conceptual understanding. In this case her memory fails her. Another member, Janine, also indicated that memory was important in her learning and commented that memorisation was one of her preferred study methods. Janine was, however, able to remember considerably more than Lucy.

Excerpt TC3

Interviewer: What makes something an acid?

Geoffrey: Donates a proton.

Interviewer: Anything else that you think of as being characteristic?

Geoffrey: Well, you mean physical characteristics? Taste and stuff, for example? Yeah, I suppose.

Interviewer: You suppose?

Geoffrey: Yeah, I've just stuck with those since Year 8 chemistry. Tastes sour, all that sort of stuff.

Geoffrey's explanation is based on pre-instruction concepts, and uses chemistry conventions. The role of secondary school chemistry is evident in shaping his conceptual understanding, and his ideas had apparently not developed from a consideration of physical characteristics (chemistry) to the alternative of molecu-

lar structures (pharmacy).

Excerpt TC4

Larry: That is a thingy group, amine, did you call it?
Interviewer: So what does that make lignocaine?
Larry: That makes it a acidic drug.
Interviewer: Nope.
Larry: It's a basic drug?
Interviewer: Amines are basic.
Larry: Does phenols make it acidic?
Interviewer: Phenols are acidic, yes.
Larry: Ah, see, there you go. Assume the OH group. OH groups are basic, normally.

Larry's response demonstrates conceptual confusion in the identification of functional groups, suggesting the persistence of chemistry conventions. Phenols are weakly acidic molecules with an OH group directly attached to a benzene ring, but Larry retains a concept of OH as basic, confusing it with the concept of hydroxide ions (OH-). His terminology is also imprecise, again suggesting a lack of conceptual clarity.

As these short excerpts suggest, the two groups differed significantly in the persistence of conceptual change. Five months after learning the material, PC members remained able to articulate pharmacy language clearly, concisely and confidently and were able to discriminate between chemistry and pharmacy concepts. On the other hand, TC members showed evidence of regression to prior conceptual understanding and a blending of ideas with little acknowledgement of the differences between the two contexts. TC members were less confident in using pharmacy language, and tended to rely on memory rather than a long-term change in understanding. Explanations for the observed differences in conceptual change persistence were sought in an evaluation of the social functioning of the two groups during workshops. Results from interviews and brief observations from the workshop sessions are presented in the following section. It is clear that the two groups operated in substantially different ways.

Social functioning

Persistent-change group. All members of the PC commented favourably on the experience of working within this group during the semester. Each felt comfortable within the group, and indicated that other members were supportive, cooperative and helpful. They felt the group was cohesive, and that all contributions were valued. Expressing ignorance or difficulty in understanding was

encouraged, both as an opportunity for another member to offer an explanation (and enhance their own learning in the process), and as a rationale for requesting assistance from a tutor. There was little evidence of competition between students, rather a strong sense of collaboration whereby success involved learning for all members. Friendships were created and strengthened, and all students indicated that they would be happy to work with all other members of the group again. The following excerpts serve as illustrations.

> Denise: Oh I think, like we all worked really well. Because yeah they were really nice people and they were easy to work with. Yeah they were all really cooperative.
>
> Kellie: I think we worked well together. 'Cause we all shared ideas and tried to work through the problems together… It felt like, we were all there to help each other. And help each other learn. So it was no problem if you didn't understand something. You would just speak up and then someone would try to explain it. And then it helps them as well. They learn from it as well.
>
> Isabelle: They're friends now, they're my friends now and I just, they're easy to talk to and you don't feel, like even though I felt less intelligent I still didn't feel bad when they told me, hinted answers or whatever, so they were good to get along with and understand things.

Observation of this group during workshops supported these self-reports, and revealed that the group used a number of collaborative strategies to facilitate their learning, including a focus on participation, sharing of leadership within the group, mutual respect for other members' contributions, and listening and responding constructively. Group processes were characterised by inquiry, involvement of the whole group in solving a problem, and willingness to try out pharmacy language. These strategies, characteristics and processes provided evidence for the development of high levels of intersubjectivity, and the creation of ZPDs which allowed members to achieve beyond their individual capabilities.

Transient-change group. The TC began as a group of close friends, but as the semester progressed, tensions became apparent. One member was perceived as operating primarily for herself, and behaving in a manner which discouraged the other members. This student was perceived as particularly conscientious in her study habits, which distinguished her from the remaining members. Group work was seen as having the potential to hold back such students, who were often faster at solving problems. This observation suggested that at least some members of the group regarded completion of the tasks – rather than learning – as the primary purpose of their participation. Friendships were strained rather than strengthened as a more competitive atmosphere prevailed.

Geoffrey: Sometimes it's better if you work by yourself though, like sometimes it can be, it might slow you down a bit which is I think what Janine sees the group work as. Like sometimes she might see it as slowing her down a bit because she knows what she's doing and she sees it more as, rather than helping us I think she sees it more as an interruption to her work.

Geoffrey: We're pretty much a group of friends except um not so much with Janine lately though. I think I'm speaking on behalf on everyone because when she goes into study mode she can be very, um, she comes across as, my opinion is that she comes across as being very, very arrogant sometimes.

Larry: And we had Janine there, who's not exactly helpful, when she, when the rest of us are trying to do it at her pace. She works at a much quicker pace. She does so much more study than we do, so she knows, she comes in there, she knows what to do, she does it, and when you try to get help from Janine, or, you know, you try to do anything with Janine, she just somehow just makes you feel almost stupid …. It's hard to work with her in a group, because if you're not up to her level, then she doesn't appreciate the fact that you're trying to learn it.

Lucy: Geoffrey or Larry were usually the best at helping me cause, I don't know, I'm closer to them I think personally than the other two, Janine and Emma, so and I think that's just it really. I get along better with those two so that helps me understand.

Observation of this group also supported their individual reflections. Members rarely worked in more than pairs, and several students clearly preferred to work individually and at their own pace. Assistance tended to be sought from a tutor rather than another group member, and questions usually originated from one or two students, rather than from a whole group consensus (which was common in the PC). As a result, discussion of the material was limited, and extended exchanges in the context of problem-solving were far less frequent than in the PC. The discussion which did take place tended to be of a peer-teaching nature, with one student giving the answer to a problem, or stating an approach to follow, rather than a more collaborative exploration by all members. Consequently, the extent to which members of this group practised pharmacy language was significantly less than that for the PC. Intersubjectivity levels were low for most of the workshop sessions, as students did not share their thinking to a great extent, and ZPDs were rarely evident.

DISCUSSION AND CONCLUSIONS

The evidence from the investigation presented in this chapter is consistent with

the argument that conceptual change learning is promoted by collaborative activity which results in intersubjectivity, and the development of ZPDs. In particular, the extent and nature of group discussion was central to the persistence of learning beyond the immediate teaching period. The PC engaged in social interactions which supported discussion and exploration of difficulties in understanding, and were able to develop shared thinking by expressing their ideas in a supportive atmosphere. Their shared discussion, or social knowledge, was then able to be appropriated into the individual's conceptual understanding, which persisted for a substantial period after formal classes. On the other hand, the TC engaged in more individualistic and competitive behaviours which did not promote intersubjectivity or the creation of ZPDs. Members of the TC did not engage in extended discussion and thus experienced reduced opportunities for appropriating social knowledge. A consequence their individual conceptual understanding did not develop to the same degree as the PC. In particular, members of the TC exhibited confusion between contexts which was not evidence in the PC, and a significantly lower ability to communicate appropriately in the context of pharmacy.

Our findings are consistent with those of Barron (2003) who identified patterns of collaboration which differentiated groups which were more successful in solving problems from groups which were less so. She found that successful groups were far more likely to engage with a problem, and to demonstrate sensitivity towards each other, awareness of each other's progress and a willingness both to contribute and to listen. Within the less successful groups, competitive interactions and individual attempts at problem-solving hindered joint activities and the likelihood of achieving a solution. These patterns were evident in the two groups in our research, and similar relationships were observed between collaboration/competition and success, where success was regarded as persistence of conceptual change learning. Palincsar, Anderson and David (1993) identified four social patterns of activity which were associated with successful collaboration: contributing to the group, giving reasons for suggestions, making efforts to understand, and building on other students' ideas. Our results were also consistent with these observations in that productive patterns were strongly evident in the interactions of the PC but only minimally in the TC. It is interesting to note that members of the TC actually outperformed members of the PC by approximately ten percentage points in the end-of-unit examination, suggesting that the TC was not academically inferior. We have represented the relationships between social functioning and learning processes and outcomes in Figure 2.1.

Barron (2003) further identified personal relationship or friendship as a critical aspect of group learning. Her review of the literature suggested that interactions between friends were more productive than interactions between individuals who were not friends. Our results suggest that the impact of friendship on collaborative learning is more complex. Members of the PC strengthened their friendships throughout the course of the workshops, whereas the relationships

within the TC deteriorated. Many interrelated factors were responsible for these contrasting outcomes, and the area is one in which further research would be illuminating.

It is clearly difficult to extrapolate research findings from two small groups within a much larger cohort to the wider population, but continuing analysis of the data presented briefly in this chapter is currently illuminating more details about patterns of activity and interaction which appear to promote learning, and patterns which appear to be less productive. Exploration of these patterns should provide guidance to teachers and students about how to enhance learning through collaboration. Nevertheless, there are a number of implications which can be drawn to this point, including the importance of collaboration in groupwork and of providing opportunities for students to discuss their understanding and approaches to problem-solving. Learning activities are ideally structured so that ZPDs can form; this suggests that the activities should be slightly more difficult than students' current capabilities but not so difficult that they cannot engage with the activity at all. This research did not explore the impact of how groups are created, however it is likely that issues which arise for self-selected groups may differ from issues associated with allocated groups and this avenue is worth pursuing in this context. Finally, although a minor aspect of the current research, the finding that persistent conceptual change learning was not obviously related to examination performance poses challenges for all academics seeking to ensure that learning is appropriately encouraged, acknowledged and recognised. The final examination in Introductory Pharmaceutical Science was a written paper designed primarily to assess skills in problem-solving, both numerical and word-based, thus provided little opportunity for students to demonstrate spoken language patterns. Assessing the latter is problematic, particularly for large cohorts, and while a number of approaches have been suggested (for example Magnusson, Templin & Boyle, 1997; Sainsbury & Walker, in press), considerable challenges still exist in designing assessments which are both authentic and practicable.

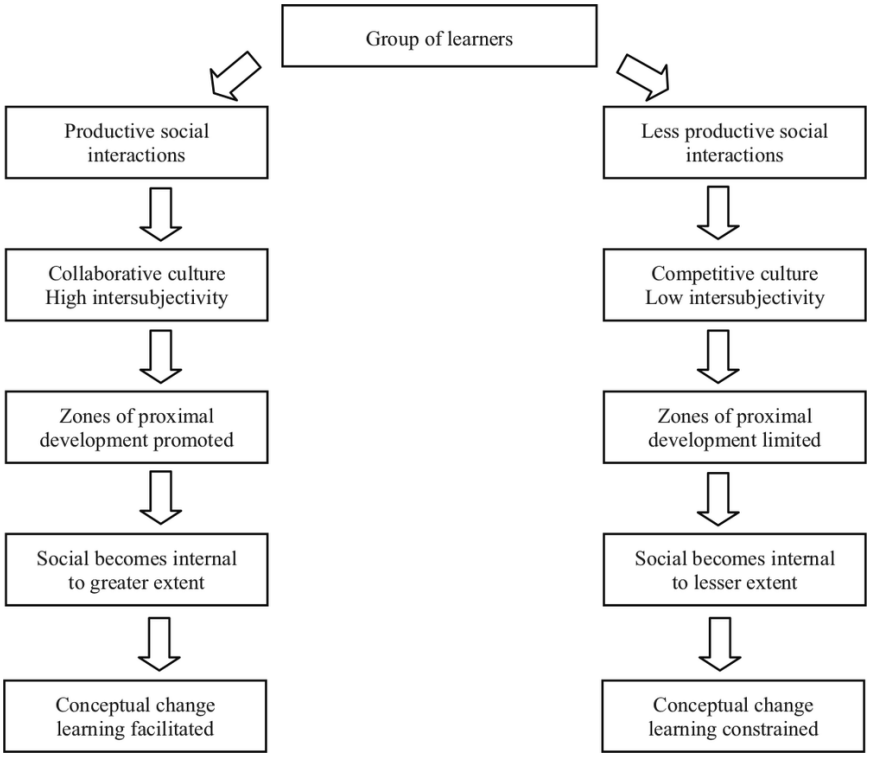

Figure 2.1. Group culture and conceptual change

CHANGES IN PRACTICE

The findings from this research have been implemented in a number of ways. Firstly, although some specific indications were given to study participants about the differences between chemistry and pharmacy terminology, it was clear that more explicit assistance would be beneficial, and this has been implemented in subsequent teaching. Secondly, the findings have been discussed with students and the purposes behind working in collaborative groups have been more clearly outlined. Thirdly, more attention has been focused on assisting students to learn how to work productively in groups. This assistance is incorporated into a unit of study earlier in first year which is designed to facilitate both socialisation into the profession of pharmacy and transition to tertiary study. Fourthly, the collaborative workshop approach has been adopted by a number of colleagues responsible for a number of other units of study, as a means of facilitating learning more broadly within the Faculty.

APPENDIX: EXAMPLES OF INTERVIEW QUESTIONS

Each interview was semi-structured and was responsive to the student's comments, however each covered three primary questions, namely:

- What makes something an acid or a base? What are the characteristics of an acid or base?
- What is meant by the strength of an acid or base?
- Does acid always mean the same thing to you?

The depth or breadth of discussion of each question was unique to each interview. Students were also asked to engage in a number of problem-solving activities, while verbalising their thinking and reasoning. These activities included:

- Given these structures, can you identify the functional groups and tell me if the molecule is an acid or base or something else?
- Can you tell me pH values where these drugs would be completely ionised and completely unionised?

Depending on the student's response, items of more complexity were also added on occasion.

Chapter 3
Learning and teaching of basic sciences in the health related professions in the 21st Century

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Previous research in pure sciences reported a link between students' approaches to study and their perceptions of both the learning environment (Trigwell & Prosser, 1991) and their conceptions of learning (Van Rossum & Schenk, 1984). As far as perceptions of the learning environment are concerned, it was found that aspects such as the nature of the objectives and self-directed learning capabilities of students are associated with deep approaches to learning, whereas assessment emphasising rote learning and heavy workloads favours students resorting to surface approaches (Entwistle & Ramsden, 1983; Kember, 1996). Conceptions of learning on the other hand, refers to the way students view learning (Van Rossum & Schenk, 1984; Prosser & Trigwell, 1999). These authors found that those who see learning as a method of achieving greater meaning or understanding were more likely to follow deep approaches to learning, as compared to those whose view of the purpose of learning is more limited. This latter group were suggested to be more likely to follow surface approaches to learning. More specifically, research into the learning of physics (Prosser, Walker & Millar, 1996) and mathematics (Crawford, Gordon, Nicholas & Prosser, 1998), established a greater likelihood of obtaining a higher quality learning outcome when students pursue a deep approach to learning. As these findings were obtained with students studying familiar, non-compulsory subjects, in non professional degrees (e.g., science), the question arose whether these same relationships could be extended to applied science students studying unfamiliar, compulsory subjects, in professional degrees.

The Faculty of Health Sciences at the University of Sydney provides courses in over ten different allied health professions (e.g., communication sciences and disorders, medical radiation sciences), all of which involve the study of some basic science. The Discipline of Biomedical Science caters for all the biomedical foundation teaching in the faculty, a role commonly known as service teaching. The required standard of entry (University Admissions Index (UAI)), varies widely among the courses, and in general, there are no topic pre-requisites for entry into any of the courses. Students studying basic sciences therefore exhibit

different backgrounds in prior topic knowledge and have different professional goals and thus interest profiles. There is even a wide range of understanding of what their chosen profession really involves, resulting in many students showing ambivalence about engaging with apparently 'irrelevant' material in a compulsory subject. In the past, highly tailored subjects were offered to students in different professional degree programmes. This minimised, but did not eliminate, the effect of many of these issues. For example, topic background knowledge was more uniform within a single professional group. Decreases in funding have led to commonality of basic science instruction in large multidisciplinary classes. In addition, students are pursuing unfamiliar topics (e.g., biochemistry), that are compulsory parts of a professional degree, where the emphasis is on practice rather than foundation studies. The challenge therefore has been not only to pitch content at an appropriate level, but also to put it in a context that has meaning for the students. Hence, it seemed crucial to obtain information about the views of incoming students, so that the learning environment of the different student groups at the Faculty of Health Sciences could be enhanced. For this purpose an analysis of students' pre-semester conceptions of biochemistry and approaches to study was undertaken (Minasian-Batmanian, Lingatd & Prosser, 2005).

Students' experiences of learning and the relation between these experiences and learning outcomes have been reported both from qualitative (e.g., phenomenographic) and quantitative (e.g., factor and cluster analysis) perspectives (Marton, Hounsell & Entwistle, 1997; Prosser & Trigwell, 1999; Ramsden, 2003). Phenomenography involves investigating the variation in students' experiences of a particular phenomenon and describing these experiences in terms of structurally related categories of description which are not pre-determined, but are constituted in relationship to the data (Marton et al., 1997). Historically this technique used in-depth interviews with a small number of individuals thought to represent the variation in the selected population. An alternative approach has been reported to make use of short open ended written statements from a large number of individuals (Prosser, 2002). The latter qualitative phenomenographic approach was particularly applicable to our large student group and was therefore chosen to analyse students' views and experiences in the present study. It enabled students to describe their views in their own words, rather than choosing a best alternative from a prepared list, thereby allowing a greater spectrum of experience to be expressed and captured.

Initially it was intended to survey the students solely at the beginning of their first year university course. However, the results proved to be so surprisingly unexpected (Minasian-Batmanian, Lingard & Prosser, 2005), that it was decided to repeat the survey using the same methodology after the topic material was delivered and they had completed their semester of learning. This post-semester study was recently finalised and reported (Minasian-Batmanian, Lingard & Prosser, 2006). This chapter compares these pre- and post-semester results. It describes

how students' perceptions changed after a semester of studying biochemistry and the changes made to teaching to improve conceptions and approaches to study.

METHOD

First year students (203 pre-semester and 151 end-semester, of 250) at the University's Faculty of Health Sciences completed surveys on their experiences of learning biochemistry. The cohort comprised 150 Physiotherapy and 100 exercise and sports science students studying biochemistry in a multidisciplinary class. The mean age of 19.1 ± 2.5 SD years (n=149) and range of 17-36 reflects the fact that 24% were not immediate school-leavers. The University entry score (UAI) was high (94.5 ± 3.7; n=125; Range 83.9 - 99.9) and two-thirds were female. Only half of the students had studied chemistry to year 12 and 20% had not even studied it to year 10. A similar distribution was evident in the study of biology. Fifteen percent of students had completed both chemistry and biology to year 12; 11% had studied neither of these beyond year 10.

In addition to some demographic data, both surveys consisted of a half-page open written response to the questions shown below in Table 3.1. The wording of the questions was such that they could easily be understood and students could provide answers in their own words.

Table 3.1. Survey design

	Open-ended questions
Approaches to learning	Pre-semester 1) What do you think you need to do to learn biochemistry? End-semeste 2) How did you approach the study of biochemistry in Semester 1? What sort of things did you do and why did you do them?
Conceptions of subject	Pre-semester 1) What do you think biochemistry is about? End-semester 2) Having now completed Semester 1, what do you think bio-

Open-ended questions
chemistry is about?

A phenomenographic methodology originally described by Marton and Saljo (1976) and further refined by Marton et al. (1997) was used to sort student responses into broad categories of description for each question. A detailed description of this process as applied to our study has already been published (Minasian-Batmanian et al., 2006).

The analyses were carried out in the framework of deep or surface approaches to learning and fragmented and cohesive conceptions. They resulted in a similar set of categories for both pre-semester and end-semester surveys. However, the questions in the end-semester survey elicited a few responses of a totally different nature that remained 'unclassified'.

RESULTS

How did students approach the learning of biochemistry?

An analysis of the students' responses to the survey questions in Table 3.1, revealed a set of 4 qualitatively different, but logically related categories (A to D) describing their approaches to learning biochemistry, upon entry to university. On the other hand, it can be seen that two of these categories (A and C) were obtained for students reporting their first semester experience. Table 3.2 presents descriptions of these categories and the associated representative quotes from the student surveys. Some end-semester survey responses (~6%) could not be categorised into the groups described above, or any other group.

Table 3.2. Categories of responses (pre- and end-semester) for students' approaches to learning biochemistry

Category	Pre-semester representative quotes	End-semester representative quotes
A. Learning by meeting class requirements with the intention to reproduce - process driven	'Listen to lecturers, take notes, summarise, be studious'	'Studied to pass'
	'Read textbook, attend all lectures, pracs. Keep up to speed (organisation)'	'Read through lecture notes, learnt it'
		'I went over lecture

Category	Pre-semester representative quotes	End-semester representative quotes
		notes to review and study for the exam'
		'I left everything to last minute, then crammed'
B. Learning by studying chemistry and/ or biology with the intention to reproduce chemistry and biology - content driven	'Have a basic chemistry knowledge (e.g., element, moles, reactions etc) and have a basic knowledge of biology'	None in this category
	'Know about some types of proteins in the body, some hydrocarbon compounds, lipids and the role of water in the body'	
	'I need to have background knowledge on chemistry and biology. Therefore I am going to have to do some study in biology'	
C. Learning by relating chemistry and/or biology to the body with the intention to understand how biology and chemistry relate to body function	'Have an understanding of biology and how chemistry plays a vital role within it'	'Attend all lectures. Drew on previous knowledge in HSC chemistry and biology. In general, revised and asked questions until I understood'
	'Study the relationship between chemistry and biology, through how chemistry principles work in the human body'	
		'Read textbook for greater understanding, did practice exams to see what needed review

Category	Pre-semester representative quotes	End-semester representative quotes
D. Learning by conceptualising the body in terms of chemical and biological processes with the intention to understand the whole body in biological and chemical terms	'Understand both the basics of the biological structures and functions and the basic chemical principles, and then understand how it comes together as whole body functions'	None in this category

The categories were analysed in terms of the students' intentions for their studies and their strategies for achieving their intentions. The relationships between these two factors (intentions and strategies) have been explained in detail in a previous publication (Minasian-Batmanian et al., 2006).

The approaches identified by these categories are inclusive and form a logical hierarchy, progressing from an intention to reproduce knowledge (Categories A and B) to an intention to seek relationships between items of new information and to apply it to understanding a greater whole (Categories C and D). The approach to reproduction (surface approach) is reflected in comments emphasising learning content and following processes such as printing notes and attending lectures. In contrast, those who expressed an intention to understand (deeper approach) were focusing on how chemistry and biology related to the body.

Many students who sought understanding also intended to use some surface techniques, so these latter approaches were included in their overall strategy. However, students whose approach was categorised as A reported using process only. This overall situation was the same in both pre- and end-semester surveys. The difference, however, lay in the fact that in the end-semester survey, no responses were found in either categories B or D. The absence of any responses in category D may simply reflect the very small numbers involved (2 in the pre- and 0 in the end-semester survey). However, the absence of responses in category B indicates that students have narrowed their focus, such that a pre-semester intention to focus on content had been abandoned and the sole focus of the surface strategy was on process.

What were the students' conceptions of biochemistry?

In the pre-semester survey, the students were asked what they thought biochemistry was about. Then at the end of the semester, they were asked to reflect on what they now thought it was about (Table 3.1). An analysis of the students' responses revealed a set of four categories of students' conceptions of biochemistry, which were the same for the pre- and end-semester surveys. Table 3.3 summarises a brief description of these categories and representative quotes.

Categories A and B represent simple or fragmented ideas with chemistry and

biology not integrated with the overall functioning of the body, whereas categories C and D represent higher-level cohesive conceptions of biochemistry with chemistry and biology being the basis for complex function. (See Minasian-Batmanian et al. (2006) for the logical relationship among these categories.)

As for the categories of approaches to learning, these categories of conception are also logically inclusive, with the responses of students who viewed the topic as a coherent whole also recognising the component parts. A student who sees a larger picture and conceives the body as a functioning whole that is reliant on chemistry and/or biology is apparently much more able to relate small items of information than a student who only conceives that biochemistry is simply chemistry and/or biology related to the body.

Table 3.3. Categories of the responses (pre- and end-semester) for students' conceptions of biochemistry

Category	**Pre-semester representative quotes**	**End-semester representative quotes**
A. Biochemistry is the study of chemistry or biology only	'Chemical processes within the body'	'The study of organic and inorganic compounds'
	'Chemistry based on living things'	'Chemistry involved with the body'
	'The chemical reactions that occur in the body'	'Chemistry reactions in the body'
B. Biochemistry is the study of chemistry and biology	'Biology and Chemistry combined into one subject'	'Biology and chemistry'
	'Biology mixed with chemistry'	'Chemistry and biology combined'
		'Processes in the body, both biological and chemical'

Category	Pre-semester representative quotes	End-semester representative quotes
C. Biochemistry is the study of biology and/or chemistry related to the body	'The chemical reactions which take place within all living things to maintain homeostasis and keep them alive'	'How reactions in the body take place, why, and the consequences of each to provide what we need to survive'
	'A combination of biology and chemistry that explains the structure and function of living organisms'	'Understanding at the microscopic level how our body works so that we may have a more complete understanding of the entire human anatomy'
D. Biochemistry is the study of body structure and function and how they relate to chemistry and/or biology	'About what makes us tick – what enables us to move our limbs and bodies. Our digestive, reproductive, respiratory and homeostatic mechanisms are run by chemical reactions'	'Study of the chemical basis of life. Pretty well explains how the body operates on a molecular level to arrive at something greater.'

Distribution of responses and the link between approach and conception

The distribution of responses across categories for both pre- and end-semester approaches and conceptions is presented in Table 3.4.

Table 3.4. Distribution of pre- and end-semester approaches and conceptions

Approach/Conceptions	Pre-semester % (n)	End-semester % (n)
Approach	54.1 (98)	82.6 (100)
Surface		
A. Process driven	32.6 (59)	0 (0)

Approach/Conceptions	**Pre-semester % (n)**	**End-semester % (n)**
B. Content driven		
Deep		
C. Understanding how chemistry and/or biology relate to the body	12.2 (22)	17.4 (21)
D. The body: its foundation in chemical and biological processes	1.1 (2)	0 (0)
Missing data (no response)	(22)	(30)
Total	(203)	(151)
Conception		
Fragmented		
A. Chemistry or biology	51.5 (86)	45.7 (48)
B. Chemistry and biology	31.7 (53)	25.7 (27)
Cohesive		
C. Biology and/or chemistry related to the body	13.8 (23)	27.6 (29)

Approach/Conceptions	Pre-semester % (n)	End-semester % (n)
D. Body structure and function: its dependence on chemistry and/or biology	3.0 (5)	1.0 (1)
Missing Data (no response)	(36)	(46)
Total	(203)	(151)

Table 3.4 indicates that the percentage of students who at the end of semester reported using surface learning approaches did not change from their earlier pre-semester expressed intentions (82.6% v. 86.7%). However, the breakdown of the surface category has changed markedly, with no responses whatsoever being obtained in category B at the end of semester.

There is a decrease in the number of students who reported a 'fragmented' conception of the topic (prior 83.2% cf. post 71.4%). A correspondingly larger group of the students (post 28.6% cf. prior 16.8%) focused on the topics as being constituent parts related to a greater whole (in this case the function of the body).

With student conceptions of biochemistry and their approach to learning defined independently by the above categorisations, it was then possible to explore any potential relationship between the two. Table 3.5 shows an analysis of the relationship between topic conceptions and learning approaches in both the pre- and end-semester surveys.

Table 3.5. Relationship between approaches to learning biochemistry and conceptions of biochemistry as determined at pre- and end-semester times

Approac	Conception column %			
	Fragmented		Cohesive	
	Pre-semester (A+B)	End-semester (A+B)	Presemester (C+D)	End-semester (C+D)
Surface				
• Pre (A+B)	91%		63%	

• End (A+B)*	88%	66%
Deep		
• Pre (C+D)	9%	37%
• End (C+D)*	12%	34%

Chi-square = 14.5, p < 0.001, for pre-semester results.
Chi-square = 10.4, p = 0.014 (exact significance), for end-semester results.
** There were no responses in categories B or D in the end-semester survey.*

In both pre- and end-semester cases there is a statistically significant relationship between approaches and conceptions. (Chi-square = 14.5, $p<0.001$; Chi-square = 10.4, $p = 0.014$, respectively). Moreover, the relationship shows that in both pre- and end-semester surveys, students with fragmented conceptions, compared to those with a cohesive conception, are much more likely to adopt surface rather than deep approaches to study (91% cf. 9%; 88% cf. 12%, respectively). On the other hand, students with a more comprehensive understanding of what biochemistry is about approached their learning with more meaningful, deep learning practices (63% cf. 37% (pre); 66% cf. 34% (end), respectively). These latter data also indicate that among those who exhibited cohesive conceptions, twice as many still chose to use surface approaches to learning.

Most of the students who responded to the end-semester survey had also completed the pre-semester survey and thus represent a sub-group of the pre-semester responses. A small group (7% of group), were new respondees. Any possible biasing influence has been assessed by undertaking statistical analyses with and without this group. The significance of this relationship was unaffected.

No relationship was observed between either student conceptions or approaches and any of the demographic variables (age, sex, time since leaving school, level of prior study in chemistry or biology or parental tertiary study).

DISCUSSION

The teaching and learning of compulsory basic science in professionally oriented undergraduate degree programmes present many challenges for both staff and students. These challenges include in particular the different levels of background knowledge in the topic and the students' lack of appreciation of its importance in the profession. In choosing how the content is presented, staff have to balance the risk of 'losing' the students with less topic background against 'boring' those

with greater prior knowledge.

Earlier research in the study of basic sciences had reported a linkage between students' prior conceptions and how they approached their learning, e.g., physics (Prosser et al., 1996, Stewart et al., 2001), or mathematics (Crawford et al., 1998). However, in these cases the students were choosing to study these topics as part of their interest stream in a non-professional degree (e.g., science). Our research sought to examine student conceptions of, and approaches to learning, in a health sciences service subject (biochemistry), where the topic is both compulsory and studied early in the students' degree programme, before they have any experience of the dimensions of professional practice.

Before study of the topic, most students (83%) were found to have only a fragmented conception of the topic to be studied and its potential place in their overall professional studies. A similar percentage (87%) expressed an intention to use surface approaches to learning. However, it was surprising and alarming to find that of those with cohesive conceptions, where a deep approach to learning might have been predicted, roughly twice as many intended to use surface approaches as well (Minasian-Batmanian et al., 2005). This impelled us to re-examine their views at the end of the semester.

The comparison of their expressed views at the beginning and end of their studies reveals an increase in the percentage of students with a cohesive conception of the topic (17% to 29%), without any concomitant change in the reported use of deeper approaches to learning. Thus, despite a third of the students having achieved cohesive conceptions by the end of the semester, this did not translate into their deeper approaches to learning.

Hence, the ability of more students to view topics as being constituent parts of a greater whole (in this case the function of the body) did not result in their altering their approaches to learning from 'surface' approaches. The surface approaches adopted were characterised by answering objectives, reading the recommended textbook and rereading lecture notes, with the apparent intention just to reproduce.

Even though a semester of study increased the proportion of students with cohesive conceptions, about 70% still had a fragmented view of the topic. There are many potential explanations for the low number of students exhibiting deep approaches to learning. Examples would be time constraints driven by overall workload (including employment), prior exam success using only surface strategies at school and difficulty in seeing where the basic knowledge fits or has relevance to their profession. Some students may have intended to achieve a deeper understanding but did not know how to go about it, i.e., they might have thought that 'going through objectives' was indeed a deep approach to learning. In relation to assessment, it is widely acknowledged that the nature of assessment drives the type of learning. It is not known how the students perceive the assessment in biochemistry, but it contained 20% of questions requiring a higher level

of understanding. Obviously, there is a need to explore the students' perception of assessment; something that has recently been addressed.

Our findings broadly re-enforce the importance of the relationship between topic conceptions and approaches to learning (Prosser et al., 1996; Donald, 1997) and extend this link to a situation where learning occurs in both a foundation subject (i.e., non-major) and a subject which is part of a professional degree (e.g., physiotherapy) (Minasian-Batmanian et al., 2005 & 2006). However, the higher percentage of student learners with cohesive conceptions who indicated that they used surface approaches may prove to be a characteristic of foundation subjects in professional degrees. It is therefore necessary to better understand its basis, and find innovative solutions. Some insight into the students' thinking was obtained from the 'unclassified' responses mentioned earlier. An example of the potential effect of prior topic knowledge is the following student's response, 'I had studied chemistry and biology before, so I didn't spend much time on it at the end of the semester. I just did the sample questions before the actual exam'. This student was apparently making a strategic decision to apply time to other areas. This concept of strategic learning may reduce attempts to achieve deeper learning as a student concentrates more on another topic. Although cultural differences in learning approaches have been reported with Chinese students in Hong Kong having an approach that required a third categorisation more in line with 'strategic' learning (Marton, Watkins & Tang, 1997), this is unlikely to have had a big impact as most students in the present study were locally educated.

Curriculum review and experience over several years had led to certain changes that were already incorporated into the subject undertaken by the students surveyed for this research e.g. worksheets (with later release of detailed answers), review sessions, practice questions, online discussion forum etc. Clearly these aspects have assisted the students gaining a cohesive conception of the material, because the proportion had nearly doubled (from 17% to 29%). However, it is still only about one-third of students and new strategies must be investigated and implemented to increase this figure further.

Research findings implemented into teaching and learning

This biochemistry unit of study was designed to encourage deeper learning by incorporating at least 20% distinction level questions. In order to inform students of what it is they are expected to do to achieve deeper approaches, grade descriptors were recently developed and applied to practice questions. This has enabled students to gain experience in what constitutes higher level conceptions, including the ability to inter-relate information and apply it to a larger whole. Thus the students have seen examples of how and why they need to pursue deeper learning. Their views on the level of difficulty have been collected for comparison with those of staff and also with the students' marks. It is hoped that this strategy will

better prepare students to learn and study more effectively. In fact, many of the students who participated in this exercise remarked that the process helped them understand what relating information is about. A further approach to encourage more students to embrace deeper learning was achieved by increasing the degree of student participation in class by asking them to role play situations, like protein synthesis, which has been introduced in lectures to emphasise the overall process. It would be an interesting future investigation to find out if this personal involvement with the material translates into better understanding and retention and therefore academic performance.

Academics teaching this subject have varied their teaching method to include only minimal necessary factual information so that the students are not overwhelmed by content which in turn would lead them to adopt a surface approach to learning. Examples of how material applies to professional scenarios are now regularly incorporated into the teaching, to highlight the overall implications of the conceptual and theoretical course material.

The problem of some students having no prior chemistry background has been addressed by introducing a quiz covering basic chemical concepts. If the students are able to successfully complete this formative assessment, they are not required to attend the initial segment of the subject. This initiative has been well received by the students and has resulted in a dual benefit. Firstly, the anxiety felt by the students with no background was lessened, as the threat of being left behind or embarrassed to participate was removed. Secondly, it prevented students with a better background losing interest in the subject.

Given the predominantly large group learning situation, students' individual needs were taken into account, by introducing review tutorials. These tutorials were set up to resolve any problems still persisting following the release of model answers to worksheets. In this way, individual barriers to deep learning could be removed. These tutorials were also useful in identifying specific skills (such as mathematical) that were lacking in students.

Further studies are intended to find out if student academic performance may be linked to a) their conceptions of and approaches to learning and b) improvements in teaching and learning. The present research suggests that many students may need to be taught exactly what constitutes deep learning and to value it not only for their immediate learning but as a lifelong learning tool. It may also be that there are students who do understand the nature of deep learning and do value it, but are still making strategic decisions about their learning approach for reasons that may be beyond our control. This could be especially important for students from different backgrounds undertaking studies in multidisciplinary classes in their initial year at university.

A crucial practical point to stress is the importance of having sufficient authority to ensure broad application of any change in order to ensure resultant modification of student behaviour.

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Chapter 4
Moral conflict, cultural pluralism and contemporary visual arts education

Ann Elias
Sydney College of the Arts

Between 2004 and 2006, four visual arts students at the University of Sydney claimed to be offended and disturbed by contemporary art[2]. Three indicated that a conflict with religious beliefs was the cause of distress, and two commented that they felt ostracised by peers and teachers for practising religion. One student objected to the performances of French artist Orlan on the grounds she interferes with the 'natural' body through reconstructive surgery. The student requested warnings with slides and the right not to view. The request presents a dilemma for teachers who believe in the ethics of the right to freedom of expression over censorship, and calls into question a fundamental assumption of education in the field of visual arts: that trainee artists are eager to engage with the dissonance of contemporary art. On the contrary, it appears that some would prefer to be shielded from a full representation of it.

The discussion that follows is based on the written views of four students. While the research sample is too small to bring empirical rigor to the study, the comments are presented as indications of the presence of a problem on campus, and one that has much wider community significance. Moral conflict in the learning environment affects every equity group at university, but the resurgence of religion in contemporary society and the growing diversity of university populations, suggest that religious-based conflict in education will increase. Further, this is one of the first inquiries into the subject of moral conflict among visual arts students at tertiary level in Australia. The body of literature on overseas cases also appears small. By comparison, there is a large body of research addressing moral conflict among medical students, the aim of which is to educate medical practitioners of high moral character in order to raise the standard of ethics within the profession (Feudtner, Christakis & Christakis, 1994, pp. 670-679). By contrast,

2 Their comments were originally published in a conference paper titled 'Contemporary Visual Arts Education, the Moral Minority, and Freedom of Expression' for the 2005 Annual Conference of the *Australasian Council for University Art and Design Schools*, Edith Cowan University, http://www.acuads.com.au/

the motivation for this inquiry is not to raise the moral character of professional artists but rather to scrutinise a paradox in contemporary art education and use research to establish how others negotiate both practical and theoretical solutions to moral conflict in the broader field of learning and teaching.

The case of four students at Sydney College of the Arts cautions us to be attentive to the social makeup of the student body, hone skills at discussion as a way of teaching, review the contemporaneity of course content, and question the cultural assumptions that underpin curricula.

THE LEARNING CONTEXT

Sydney College of the Arts is a faculty of visual arts at the University of Sydney. Its mission is to 'educate and train those who will practice as makers or interpreters of contemporary art, craft and design' (Sydney College of the Arts, 2005). Students undertake an integrated program of studio practice and art theory. The art school was founded in 1975 following 1960s idealism when art's social role was to offer 'insight into what it means to be free in emotional response, and free in the choice of ideas' (Taylor, 1960, p. 60). When Sydney College of the Arts amalgamated with the University of Sydney in 1990, it joined an institution founded on the principle of academic freedom, a philosophy that further validates the significance of its own professional ethics of freedom of expression.

Students are encouraged to engage with social and cultural issues relevant to the contemporary world, and challenge their own assumptions about the nature of art. A culture of dissonance is encouraged. In 2004, when this study began, first-year students were shown a representation of contemporary international art including works that have been embroiled in public controversy and censorship: S&M photographs from the X Portfolio (1978) by Robert Mapplethorpe; surgery photographs of Orlan's operations (from 1990); sculptures of anatomically perverse children titled Tragic Anatomies (1996) by Jake, and Dinos Chapman; a bust of frozen human blood titled Self (1991) by Marc Quinn; and a photograph of a crucifix immersed in urine titled Piss Christ (1989) by Andres Serrano. Each has provoked the response: 'But is it Art?'

THE RESEARCH PROBLEM AND METHODOLOGY

In 2004, when eighty first-year visual arts students returned routine university course evaluation questionnaires for their art theory unit, two students complained of feeling emotionally and physically disturbed by slides shown in lectures. Neither student identified the art works, but their comments were unprecedented in sixteen years of evaluation of art theory, and set in train an inquiry into

the incidence of moral conflict in contemporary visual arts education.

The experiences of colleagues in other visual arts faculties in Australia and the United States were sought. As the research progressed it became increasingly important to identify works of art that cause disturbance for students, therefore in 2006 the faculty's Learning and Teaching Committee supported the design of a second, anonymous and voluntary questionnaire on the subject of moral conflict. The questionnaire was designed by art theory staff, and made available to students in their final year of undergraduate study. Two students from a cohort of one hundred and thirty responded negatively. The information was then assessed in relation to literature on diversity and equity, as well as censorship and moral rights as they affect visual arts.

This study is therefore based on written responses collected over two years. Staff ascertain, on the basis of different handwriting and syntax that they are written by four different people.

STUDENT COMMENTS: 2004 FORMAL STUDENT EVALUATION QUESTIONNAIRES

Student A remarked that 'often the works on slide were disturbing & offending' and, when asked about overall satisfaction with the quality of the unit of study, responded negatively: 'because the works that were chosen by the lecturers were sometimes too shocking & very offending especially the religious & racial issues'. Student A judged the unit as unsatisfactory because 'the type of work that were shown is just too contemporary, and they aren't the type of work that I go for nor interested in'. The unit of study was criticised three times for focusing on works that were either 'too contemporary', or simply 'contemporary' (anonymous response, student evaluation questionnaire, first semester, 2004).

During the same evaluation process Student B acknowledged that the course material 'does make me see art in different perspectives, but, it simply makes me feel disturbed most of the time'. Student B ticked the box 'disagree' when asked to confirm satisfaction with the course, because 'what affects me more is the feeling left inside me after these lectures. The artworks are mostly disturbing, hence most of the time I'm left feeling depressed, and filled with anxiety, some-times anger. This really affects me this past 3 months' (anonymous response, student evaluation questionnaire, first semester, 2004).

STUDENT COMMENTS: 2006 INFORMAL FACULTY QUESTIONNAIRES

Students C and D criticised the intolerance of peers and teachers to religious faith,

and they criticised lecturers for choosing to show psychologically 'disturbing' slides (anonymous response, Moral Conflict and Visual Arts Education questionnaire, June, 2006).

Student C not only felt 'uninspired' by peers, but did not 'enjoy coming to uni as much, and it is a contributing factor that has made me change my goals'. Student C identified as 'mature age', and felt that viewing works of contemporary art should be optional, arguing that 'I totally agree with freedom of expression, but there should also be freedom of choice to view these things' (anonymous response, Moral Conflict and Visual Arts Education questionnaire, 2006):

> Lecturers could state the nature of the artwork & have a raise of hands if this will offend anyone, & give warnings to those (if any) when the details of the artwork are shown/discussed, so they have an opportunity to leave for 5 mins or however long the lecturer recommends. Sometimes things that I know I cannot change, annoy me so much id rather not know they exist (anonymous response, Moral Conflict and Visual Arts Education questionnaire, 2006).

Student C identified, as 'disturbing', the work of French artist Orlan – who changes her body through plastic surgery – and disapproved of any artist involved 'with altering the body permanently'. When asked if there is sufficient opportunity, and encouragement on campus to discuss moral conflict, Student C responded that this was best done 'with friends & family outside of uni' rather than with peers who did not share similar views (anonymous response, Moral Conflict and Visual Arts Education questionnaire, 2006).

In 2006, Student D, who identified as 'religious', and 'Catholic', was aware that conflict was 'often the intention of the artist' but was concerned about negativity to religious beliefs on campus, and being labelled 'religious' by other students and staff. When asked if there was sufficient opportunity to air views about moral conflict on campus, Student D, whose artistic work addresses the Catholic Church, claimed that this had impacted on ambitions to become an artist 'as I sometimes feel as though I can't freely express my ideas. They will be criticised merely because people have a problem with the Catholic church not because of the actual work'. The student described a 'split between the religious & non-religious students', and criticised staff for 'their own personal slagging' to 'highlight flaws in the church' (anonymous response, Moral Conflict and Visual Arts Education questionnaire, 2006).

The 2006 questionnaire did not specifically ask students about religious moral conflict. However, both respondents focused on religion. Therefore, before reflecting on comments cited above, a brief orientation will be given to current perceptions and discussions of the growth in religion and moral conservatism, on a global scale, and in learning and teaching environments.

A SOCIAL CONTEXT

Recent Australian media coverage suggests that the liberal pedagogical ethos of universities is no longer in step with the changing demographic of student bodies (Blue, 2005, p. 9). The Evangelical Union has a growing presence on the University of Sydney's campuses, a situation that is described as 'a reality that defies the public stereotype of uni as a zone of youthful rebellion, free love, and political activism' (Blue, 2005, p. 9). The wider context for this is the resurgence of religion as one of the most significant social changes in the contemporary world. Roman Catholicism is 'now a vastly complex religious community of one billion adherents, more than 17 per cent of the world's population' (Weigel, 1999, p. 20), and it has been noted that 'for the last three or four decades there has been a steady global upsurge in conservative Protestant Christianity parallel to the upsurge in conservative Islam' (Martin, 1999, p. 37).

ANALYSIS OF STUDENT COMMENTS

The comments cited above indicate that the four students in question are not integrated within the wider community of the faculty: they stay silent; they use anonymous questionnaires to express opinions; they prefer to air their ideas outside university among family and friends; they propose leaving the lecture theatre to avoid looking at works of art that disturb them. But their responses also suggest they feel personally divided. Two practice separation from the wider Sydney College of the Arts community but at the same time are politicised in their views about inclusiveness. Iris Young has studied similar feelings of discord among minority groups. In *Education in the Context of Structural Injustice* she argues that marginalised groups will claim freedom of speech, and assert 'difference as cultural expression', but will also display a desire to separate rather than participate in wider communities (Young, 2006, p. 101). This is perceived as an obstacle to education by George Petelin, who is a Senior Lecturer in Art Theory at Queensland College of Art in Australia. He characterises the obstacle as

> …the desire on the part of students to preserve identification with peer groups away from their place of learning. Education always alienates people from the beliefs they previously shared with friends and relatives and thus has the potential to socially distance them. The stress of this needs to be acknowledged and accommodated within pedagogy. (G. Petelin, personal communication, August 4, 2006)

The social complexity of today's universities is the subject of on-going research by Canadian psychologists. One team has looked specifically at moral

behaviour in undergraduates to understand the relationships between religion, identity and moral reasoning (Maclean, Walker & Matsuba, 2004). They cite the earlier work of Marcia et al., whose research into the psychosocial development of individuals, argues that religion is 'a significant component of identity formation' (Marcia et al as cited in Maclean, Walker & Matsuba, 2004, p. 429). This is supported by comments from Students C and D who stress the importance of religious practice and religious moralism to their personal identities and artistic development. Student D is aware that contemporary artists often intend to create moral conflict for the viewer, but accuses Sydney College of the Arts of being hypocritical: religious conviction is 'a form of expression not encouraged. Which is a form of censorship in itself' (anonymous response, Moral Conflict and Visual Arts Education questionnaire, 2006). The comment draws attention to the complexities of the concepts of academic freedom and freedom of expression, when these are relative to teachers, students, the institution, the discipline and the profession.

> Academic freedom in the classroom is an exceedingly complex, and ill-defined topic. The freedom of the individual professor must be balanced against not only the academic freedom of the corporate body of the faculty to design, and implement curricular requirements, but also against the academic freedom of students (Post, 2006, p. 79).

Consider the competing claims on academic freedom and artistic freedom created by Student C's suggestion for staff to provide warnings with slides. The student is offended by the work of performance artist Orlan and in the name of academic freedom, wants the right to censor the work by having it figuratively or literally blocked from view. The lecturer also claims academic freedom and feels it is right to show slides of Orlan's work, without providing warnings, because while the graphic imagery of her operations is repulsive, its grotesquery is integral to its critique of the cultural longing for beauty. This is why Orlan says to her audience, 'Sorry for having to make you suffer' (as cited in Zimmermann, 2002, p. 38). However, can the lecturer expect students to suspend their views and beliefs and assume a disinterested or detached stance towards the work?

THE DISINTERESTED VIEWER AND STUDENTS WHO CLAIMS A RIGHT NOT TO VIEW

Feminism has sustained one of the most influential critiques of the concept of the disinterested observer, who is supposed to be neutral in order to be unreservedly receptive to art. Pen Dalton argues that contemporary art education places an ideological emphasis on the disinterested observer and freedom of expression be-

cause the philosophy of art schools is still based in dated modernist principles (Dalton, 1995, p. 45). Feminists argue that the Western idea of a neutral viewer is 'white, male and middle-class' (Deepwell, 1995, p. 8). These arguments are relevant to many social groups, including students with religious beliefs, and claim the impossibility of disinterestedness for minorities and those who are disadvantaged or discriminated against.

However, feminist author Peggy Zeglin Brand argues that while an interested stance is important, it is also important with feminist art such as Orlan's, to experience it disinterestedly (Brand, 1998, p. 5). For the person who prefers not to view Orlan's work, Brand presents a model encouraging them to embrace the conflicting experiences of the work so there is 'a deliberate shift toward viewing bloody facial features as combinations of reds and purples, darks and lights, and a shift to reflection on the concept of women and of art exploited by the performance series' (Brand, 1998, p. 8-9). This may be easier said than done.

Why not just warn students, or allow them to look away? The argument returns to censorship. Feminist critique has also been energetic, but fractured, on the subject of censorship. Anna Douglas argues for regulation, believing that the arts community must confront the question of appropriate and inappropriate subject-matter as a way of addressing social inequalities. She questions 'the moral absolutist terms of the 'freedom of speech' criteria' that claim censorship is bad and free expression is good, and argues for a more circumspect view of the role of censorship so that art is not elitist, but properly connected with its social context (Douglas, 1995, pp. 102-109).

CENSORSHIP AND COMPARATIVE CASE-STUDIES FROM AUSTRALIA AND THE UNITED STATES

In the late 1980's, in the U.S, art and censorship became 'a litmus test of beliefs about sexuality, public decency, obscenity, and the limits of tolerance' (Devereaux, 1993, p. 208). Today, at the University of North Iowa, Associate Professor of Art, Timothy B. Dooley, directs students to Cynthia Freeland's book *But is it Art?*, and in particular the chapter 'Blood, and Beauty' in which the author questions the motivation for the stress on blood in contemporary art. By reading this text students become aware that there is an extended discourse around the strategy of 'shock'.

> In the end, I subscribe to the 'fair warning' policy, wherein I inform students from the beginning that we will be looking at contemporary art, and contemporary artists are more than willing to 'boldly go' as the saying says. I tell them that if they are not comfortable with dealing with the full scope

> of humanity, then they can drop the course, and choose another instructor (T. Dooley, personal communication, April 13, 2006).

Students at the University of North Iowa comment that they are, 'shocked by the absence of what they would deem the 'beautiful' in much contemporary art' (T. Dooley, personal communication, April 13, 2006), but no-one has requested censorship of lecture material.

In Australia, George Petelin of Queensland College of Art observes that 'aesthetic conservatism seems to accompany moral fundamentalism', and cites the example of a student who 'complained in a course titled *International Avant-garde* that he did not know why we had to learn about so many artists who deal with "perversion" and "politics"' (G.Petelin, personal communication, June 13, 2006). Petelin's strategy was to ask the student to propose his preferred selection of artists. When the names 'Rembrandt' and 'Arthur Boyd' were offered, Petelin prepared a lecture for students in which he demonstrated that even the canon of art is not without shock, and that the aesthetics of traditional art, including religious art, is not something necessarily apolitical, pleasing to the senses, or without perversion. The manner in which Petelin negotiated the complaint, by integrating the student's sense of moral conflict into the study of art history, provides an excellent model for others. Petelin was presented with a challenge to his ownership of teaching and met it by encouraging the student to influence curriculum.

Petelin's strategy also reinforces the pedagogically-sound logic of demonstrating how historical art, and contemporary art, share a great deal in common and that students who bring narrow assumptions about both to their study must expect to have these challenged by deeper knowledge of their discipline.

> If we censor out what is actually happening in the world we may as well close our universities. By all means treat people's beliefs, about what should be, politely, but let's not walk about with blinkers on about what is (G.Petelin, personal communication, June 13, 2006).

CHANGES TO LEARNING AND TEACHING PRACTICES AT SYDNEY COLLEGE OF THE ARTS

Petelin and Dooley seem confident in the appropriateness of their curricula. However in the course of this research, art theory staff at Sydney College of the Arts questioned the contemporaneity of theirs. The curriculum is clearly underpinned by ideological emphasis on the autonomy of art, the neutral observer, the wholly receptive student and freedom of expression, but these concepts are not presented to students as objects for scrutiny.

Following the example of George Petelin who teaches students that the history of art is inseparable from the subject of morality, the curriculum now includes a focus on freedom of expression, and censorship. At the conclusion of this research, in October 2006, art theory staff asked a large group of first-year students if they had experienced moral conflict with examples of contemporary art, and were overwhelmed by the affirmative response. Many were disturbed by a recorded performance by Chinese artist Zhu Yu, titled Eating People (2000). The artist is filmed eating a human foetus as a protest against moral judgment. While the majority of students were morally outraged by the work, one argued for the right of the artist to freedom of expression. The discussion soon became confrontational. Staff encouraged students to reflect on the role that their personal beliefs played in determining their responses, a method that John Swift and John Steers advocate for secondary teaching because it improves respect for difference, plurality, and independence of mind, which in turn shape learners with 'interpersonal tolerance' (Swift & Steers, 1999, p. 7).

However, through research, we have learnt that there are other strategies for discussion that recommend the expression of emotions rather than suppression. In *Discussion as a Way of Teaching*, Stephen Brookfield and Stephen Preskill address the appropriateness of strong emotions such as anger and argue that:

> [teachers wrongly]…think that classrooms are an inappropriate place for expressing anger or grief. But if we want people to express themselves honestly, and openly, tolerating, and even respecting expressions of strong feeling may be an important part of talking across differences (Brookfield & Preskill, 2005, p. 136).

Brookfield and Preskill advise against expecting discussion to resolve differences among people of divergent cultural and ethnic groups, and claim 'that confrontation of difference is instructive to showing how certain voices have been silenced' (Brookfield & Preskill, 2005, p. 26). Their theories share ideas in common with the work of Jack Arbuthnot and David Faust who advocate a course of action to create 'disequilibration' for students. They argue that cognitive development in individuals can be stimulated by the creation of conflicts in thinking. In *Teaching Moral Reasoning: Theory and Practice*, Arbuthnot and Faust stress that disequilibration is not about creating stress for students. It is about allowing students to be curious, and stretch their tolerance as well as challenge their views on the world (Arbuthnot & Faust, 1981, p. 141).

In the course of this research we have learnt to communicate differently with the student body at Sydney College of the Arts by seeking a deeper understanding of their welfare over and above academic performance. The research confirms the importance of an ethics of teaching, attained through discussions that are sensitive to the social and intellectual anxieties of students, and a curriculum that is

transparent to the key philosophical underpinnings of the discipline and profession: one that embraces the full spectrum of contemporary art. Secondary school pedagogy has set a benchmark by establishing an ethics of learning and teaching for visual arts based on a partnership between education and what is being practiced in the profession, so that contemporary art is never taught as something problematic (Burgess & Addison, 2004, pp. 15-39). The case at Sydney College of the Arts also confirms the importance of an ethics of learning, attained through participation in discussions, so that students will graduate with the university's key generic graduate attribute: 'an informed respect for the principles, methods, standards, values, and boundaries of their discipline, and the capacity to question these' (Institute for Teaching and Learning, 2004).

CONCLUSION

Contemporary art can be confronting on grounds of race, religion, and sex. The controversies of contemporary art are of interest to every discipline in the humanities, which is why, in 2006, British philosopher, Matthew Kieran, posed the question: 'Imagine that you have just seen or read a work you find deeply troubling. Why?' (Kieran, 2006, p. 129).

This chapter on the subject of moral conflict and contemporary visual arts education is based on the written comments of four visual arts students. While small in number their comments amplify an unfamiliar voice within the student population of Sydney College of the Arts, one that asserts religious moralism as grounds for evaluation of course content, and for criticism of campus life. The study shows there is no homogenous body of learners at Sydney College of the Arts who collectively place the ethics of freedom of artistic expression above other 'faiths'. In 1975, when Sydney College of the Arts was founded, it would have seemed implausible that future members of the student population would claim a right to disengagement with contemporary art on moral grounds. In 2006, in a global context where religion is a major source of conflict, it seems implausible that there is so little literature on moral conflict and visual arts pedagogy at tertiary level.

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Chapter 5

Here, alive and accessible: The role of an inquiry-based fieldwork project in changing student attitudes to cultural diversity in music education

Kathryn Marsh
Conservatorium of Music

The international concern with teachers' approaches to cultural diversity in the delivery of music programs has been well documented in recent years (Biernoff & Blom, 2000; Campbell, 2004; Campbell, Drummond, Dunbar-Hall, Howard, Schippers & Wiggins, 2005; Dunbar-Hall, 1997, 2000; Hookey, 1994; Klinger, 1994; Lundquist, 2002; Lundquist & Szego, 1998; Reimer, 2002; Schippers, 1996; Solis, 2004; Standley, 2000; Teicher, 1997; Walker, 1996). Such challenges for music educators are particularly evident in a culturally diverse nation such as Australia, where the population is drawn from more than one hundred ethnic groups, including Anglo-Australians, immigrants and their descendants, and Indigenous Australians (Aborigines and Torres Strait Islanders). This chapter discusses issues associated with teaching multicultural music education to music teacher education students in Sydney and outlines the results of a research project that investigated changes in student attitudes to the teaching of multicultural music in schools as a result of an inquiry-based approach to the delivery of subject content. In particular, the effectiveness of an inquiry-based fieldwork project in changing pre-service teacher education students' attitudes is examined.

During the last decades of the twentieth century, there have been major changes in government and educational policies relating to cultural and linguistic diversity in Australia, with concepts of assimilation being superseded by ideologies of multiculturalism, cultural pluralism and the need for equal educational opportunity and self-determination for members of Australia's immigrant and Indigenous peoples (Allan & Hill, 1995; Jamrozik, Boland & Urquhart, 1995). In the state of New South Wales (NSW) such ideological shifts have been reflected in policies that have been developed to meet the needs of its multiethnic population.

In NSW, educational policies stipulate that multicultural and Aboriginal perspectives should be included in all curriculum areas and that all students should be informed by these perspectives. Music education curriculum documents at primary, junior secondary and senior secondary levels delineate the need for all school students to study music from a range of cultures in order to explore varied

forms of cultural expression and the pluralistic values, beliefs and identities that exist both within and beyond cultures represented within Australia. Enhancement of feelings of self worth in individual students and cultural maintenance within school communities are also goals of this approach.

However, despite the acknowledgement of cultural diversity in current NSW music curriculum documents, guidelines in these curricula regarding the inclusion of a multicultural perspective in music programs have been limited. Consequently, in NSW, there has been little emphasis on the principles of multicultural education policies in the implementation of music programs within schools. In music programs, involvement of members of ethnic or Indigenous communities as owners of musical and cultural knowledge and co-participants in the teaching and learning process has also been limited, mainly occurring in schools which have a high population of immigrant or Indigenous students (Dunbar-Hall, 1997). In incorporating a 'multicultural perspective' in their music programs, teachers have frequently used inappropriate examples of music out of context, examples derived from publications which bear very little relationship to the manifestations of music within the Australian community, in direct contravention of the multicultural education policy focus on the Australian multicultural experience.

Given that both human and published resources are available, it seems that insufficient resources or musicological understanding do not account entirely for teachers' lack of confidence to implement multicultural music programs. Rather, it would appear that this lack of confidence reflects the fact that, in their pre-service training, many teachers have not acquired an understanding of the necessity of such programs (Lundquist, 2002). In attributing this to the 'Eurocentric approach in which they were trained' Teicher (1997, p. 416) also indicates that teachers perceive that the inclusion of multicultural materials is too difficult to manage within an already 'full' curriculum.

Another problem appears to be the inability of many teachers to view music or behaviour related to a particular culture from an 'insider's' perspective, relevant to their own lives and those of their students. In some ways, published music education materials relating to world musics have contributed to the distancing of the teacher and cultural 'other' by emphasising the differences between musical cultures and by placing music firmly in a geographical context which is removed from the lives of teachers. Some more recent publications have endeavoured to overcome this difficulty by foregrounding the role of music in the lives of real people who have bicultural experiences as members of a multicultural society (Campbell, McCullough-Brabson & Tucker, 1994).

To encourage pre-service students to take a more active and personal approach to understanding and teaching the music of an unfamiliar culture represented within a pluralist Australian society, I have explored the potential of fieldwork research. The ethnomusicological model discussed by Titon (1997, pp. 91-92), in which there is 'an emphasis on understanding… the lived experience

of people making music' seemed particularly appropriate. In this approach, fieldwork is 'defined as "knowing people making music", an experiential, dialogic, participatory way of knowing and "being in the world"' (Cooley, 1997, p. 15). The importance of interpersonal fieldwork relationships in developing musical understandings is further explained by Titon (1997, p. 94): 'When I see that I and others are making the music that I hear, I want to know these others… If you were an object I might come to know you as other objects. But you are a person making music and I come to know you as a person… We seek to know each other through lived experience'.

This chapter discusses the efficacy of an inquiry-based fieldwork project in creating forms of 'lived experience' of music making in which students could engage with 'knowing people making music' as a way of effecting attitudinal change in relation to the teaching of musics representative of the Australian multiethnic population. The project operates through a form of cultural immersion that takes place within the relatively invisible context of music making of diverse ethnic groups in a large Australian city and entry into the immersion process is the responsibility of individual students. Investigation of the outcomes of this project has been made on an ongoing basis since its inception.

THE PROJECT CONTEXT

The inquiry-based fieldwork project has been undertaken on an annual basis by students majoring in music education at the Sydney Conservatorium of Music, University of Sydney, in the years from 1998 to the present. The project constitutes a key component of *Multicultural Studies in Music Education*, a core fourth year subject of the Bachelor of Music (Music Education) program. Students within this program have had many years of formal music training but the majority of these students indicate that training has been almost entirely within the Western music tradition, despite a considerable level of diversity in their personal cultural backgrounds. The few instances of music education relating to world music which students have experienced in a school context, either in their own previous schooling or during teaching practicum sessions, are reported as being reliant on information derived from books, decontextualised, and therefore relatively meaningless. There has been a similar lack of exposure to music from outside the western tradition in their previous university training and, with few exceptions, previous assignments have exclusively involved library and internet research. However, since 1999, students' experiences of music beyond the western tradition have been expanded by participation in an additional core subject involving the learning of Balinese or Javanese gamelan. This subject is undertaken during the same semester as *Multicultural Studies in Music Education* to encourage the transfer of understandings gained through both of these subjects.

The project involves students in the recording and transcription of a number of musical items, including a song, performed by a non-Anglo-Australian member of the community. From its inception, students have contacted and recorded a wide variety of performers, ranging from professional musicians to community-based amateur groups, relatives and friends performing at backyard gatherings. By interviewing their informant/s and through further research, students have developed not only an understanding of musical characteristics but also background information on the recorded music in relation to cultural and performance context, individual and social meanings. These understandings have then been used to formulate a school music program, aspects of which are used to enliven student presentations on their projects to other participants in the university class. Students are also asked to reflect on the process of their learning in their written assignments.

INVESTIGATING THE PROJECT

As a form of reflexive practice, I have investigated the outcomes of this project utilising qualitative research methods. These include observation of student presentations, document analysis of students' written reflections in assignments and semi-structured interviews with students. This investigation was initially formulated and conducted in 1998 as a formal project with seed funding from a faculty research grant. The research project was designed as a multi-case study (Burns, 2000), with individual students constituting each case. A purposive sample of 10 students (approximately one third of the cohort) was selected on the basis of thoughtful remarks relating to changed understandings or attitudes, which were described in students' presentations or written reflections. Following the completion of the subject, these students were interviewed in order to further explore these reflections and the implications that the project had for students' attitudes towards incorporating such forms of learning in their future music programs. Semi-structured interviews enabled students to attain a level of discursiveness in their responses, so that issues could be probed in a way that was most meaningful to each student (Hammersley & Atkinson, 1995; Cohen, Manion & Morrison, 2000). Interviews with individual students were audio recorded, then transcribed and coded using grounded theory principles (Strauss & Corbin, 1998).

The initial 1998 cohort of students was predominantly Anglo-Australian in ethnicity. Because notions of multicultural education were almost entirely new to the majority of these students, the outcomes of this project were variable. Generally, however, there was a shift in disposition of many of the students towards the implementation of a more pluralistic approach to music programs, particularly those directly involving members of local ethnic communities. Over a number of years the sociocultural backgrounds of student cohorts varied considerably, with

concomitant variation in the outcomes of the fieldwork project. Without funding, I continued to investigate the attitudes of a more limited number of students, particularly those with non Anglo-Australian ethnicities, using the same research strategies employed in 1998. In recent years (2003 and 2006), email and telephone correspondence with former students has also been included in the data for analysis. Outcomes of this analysis can best be discussed by examining changes in understanding and attitudes of several groups of students whose differing patterns of change are outlined in the following sections.

ANGLO-AUSTRALIAN STUDENTS' BROADENED PERCEPTIONS

For some Anglo-Australian students, the fieldwork project created an awareness of the previous narrowness of their musical and social experience: 'It makes you realise how you live your life in this very narrow corridor' (Interview, Susan[3], 1998). For many of these students, the potential benefits of utilising the skills of community-based performers were evident for the first time in their years of training, the existence of these musical subcultures within Sydney having been beyond the scope of the students' previous social and educational experience. One of the major benefits of the project was perceived to be

> just actually mixing with a part of society I had never had anything to do with before, because … when I was growing up, 'ethnic' music was their own thing and I never really saw a lot of it in concerts or public performances or anything. It was always behind the doors. (Interview, Belinda, 1998)

Students outlined their previous feelings of personal distance from music of cultural 'others':

> I sort of distanced - the first time I taught it on prac last year. I sort of just said, oh, this is music from other cultures. But when I did [the field project with a Papua New Guinean fusion band] I actually realised how much it does relate to us. (Interview, Jane, 1998)

This was contrasted with the personal association created by their interac-

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[N]ow I was behind the doors in this group practising their music… opening my eyes up and making me think, yeah, there are all these different sorts of music and they're here and they're alive and they're accessible and I can use them. (Interview, Belinda, 1998).

tions with musicians within the community. Belinda, a clarinet player who had discovered that the father of one of her clarinet students was an accomplished Turkish musician who ran a private Turkish and Arabic music school expressed this eloquently:

> [N]ow I was behind the doors in this group practising their music… opening my eyes up and making me think, yeah, there are all these different sorts of music and they're here and they're alive and they're accessible and I can use them. (Interview, Belinda, 1998).

The change in knowledge and attitudes developed through contact with a lived music experience in cultural context was so intense that it was described by one student as akin to 'a hit on the head' (Interview, Paul). Students had a high level of personal engagement in the experience, leading to a greater understanding of music and culture:

> When you're there, you feel like you are from the culture and you're really experiencing it … I could write about what the culture was like when I was there but someone else wouldn't have the same feeling as when I was there. Listening to these Croatian voices, like, ringing in the room was just an incredible sound. (Interview, Jacqui, 1998)
>
> You're going out, really - I guess you'd say living the culture … Because I was there and was experiencing it, it was a personal experience. It was first hand and I was researching first hand what actually goes on and I think that was a lot more fascinating. (Interview, Belinda, 1998)

For a number of students, the immersion in the lives of informants also led to a much greater understanding of the personal, economic and political issues facing people within the Australian community, from recent immigrants to those of mixed descent. Perhaps most poignant were developing understandings about the lives of refugees, for whom music was a link to lost homelands and a means of maintaining identity and social cohesion amidst the sense of dispossession, economic hardship and loss.

The fieldwork project, for many students, promoted a greater commitment to a more pluralist approach to music programming in their future teaching:

> … everyone is always talking about Australia is such a multicultural nation or whatever, and imagine not including that in your teaching… you've got to… And this is a pretty new perspective for me. (Interview, Annabel 1998)

Students also saw the necessity of continuing to utilise the field approach in order to increase their own knowledge and to create opportunities for school stu-

dents that were similar to their own:

> I think the teacher really has to have a thorough understanding and a really great appreciation for that culture and be motivated to make the kids feel the same way. I don't think it's worth doing if you're going to get into it half-heartedly, so I would say if you're going to teach any music of another culture you would need some way to experience it first before you taught it. (Interview, Jacqui 1998)
>
> I think there is an assumption that the teacher knows everything, that the music teacher will know all there is to teach, but I certainly don't and I think that it would be a great resource to use those people within the school community to come in and teach about those things or even if I learn from them and can use them as a resource within the classroom. And also the students… [can teach] each other, if they've got different cultures. (Interview, Felicity 1998)
>
> I found that it's the one way I could really, I guess, live the topic… So I would definitely, definitely use that with a school group for my own purpose for finding out information for me and also having the kids maybe try something like that… I think that's such a great way for them to find out for themselves. (Interview, Belinda 1998)

For the latter student, the experience of going 'behind the doors' was an incentive to continue to engage with that culture:

> [T]here is that sort of connection that makes me keep thinking that, yeah, I would like to be involved in that: be a part of somebody's culture that I've never had an experience with and they are willing to have me as part of their culture. (Interview, Belinda 1998)

Her engagement with the musical culture that had been the focus of her initial fieldwork project was continued by travelling to Turkey, her correspondence from Turkey indicating that her knowledge of the music (even in limited form) had acted as an entry point for cultural interchange in that country.

In recent years other Anglo Australian students have demonstrated their ongoing commitment to the principles established during the project, either by successfully incorporating performers in residence from local communities into their school practicum programs or by supporting inclusion of community-based ensembles after gaining permanent teaching positions in schools. One student attested to the continuing value of her experiences within the course:

> I thought I'd email and let you know that I've just survived my first week as the music teacher at W Girls HS… it's overwhelming. The school as you

> might know… is 97% NESB with over 60% Arabic… Out of the 250 new names, perhaps 15 are Anglo … But I'm getting there - have a lot of help as you can imagine. Glad I did Multicultural studies? … you bet! The music department has no ensembles established though it does have a large Pacific Islander population in the school that organise their own singing and dancing. The staff are incredibly supportive and positive. I'm liking it very much. (Email, Kay 2003)

The enduring nature of the attitudinal change has been most evident in the proactive work of another graduate of the course. In the few years in which she has been in the teaching profession, she has developed multiple programs that create an interface between community-based musicians and students not only in her own school but on a regional level, providing opportunities for developing the understandings of other teachers as well as students. (Telephone communication, Calista, 2006).

BICULTURAL STUDENTS' REDISCOVERY OF CULTURE

In 1999, Chinese Australians formed a significant proportion of the students undertaking the course. The majority of these students, having been born in Australia, had a bicultural home life but many aspects of their parents' culture had been subsumed as they grew older, as a way of reducing the 'difference' between themselves and their peers. Most of these students did not speak their parents' first language and had studied music entirely within the western tradition, though they had been exposed to various forms of Chinese music at home.

For these students, the fieldwork project, often conducted with their parents or ethnic Chinese friends or relatives, opened a different set of doors towards a rediscovery of their partially obscured cultural heritage. The reflections of one such student, Hsu Li, expressed some of the changes in knowledge and attitudes brought about by the fieldwork experience with her mother, an ethnic Chinese woman born in the Philippines who had migrated to Australia as an adult:

> I am the first to admit that I do not know enough about my own cultural heritage. I knew enough beforehand to say that I was of a strange cultural mix (my mother's influences combined with my father's childhood in Shanghai, Hong Kong and later years travelling the world). This fieldwork collection immersed me into my mother's adolescent culture and allowed me to see what things shaped her in her youth. It also gave me an opportunity to find out about Taiwan and China in a broader historical context. (Extract, Hsu Li's assignment, 1999)

Hsu Li discussed the way in which she had come to appreciate music that had previously seemed 'a hilarious blend of trashy western harmonies and mushy Chinese singing', through researching the Taiwanese popular music and Cantopop which her mother enjoyed. In so doing, she discovered the value of such personal links in creating access to knowledge:

> I never dreamed of obtaining materials for teaching from such a source as my own mother. I can now say that is rather a confining view. The verbal and personal reactions and experiences of a person of the culture are just as valid as academic and formal reactions. (Extract, Hsu Li's assignment, 1999)

The experience also resulted in a greater understanding of her own personal and cultural identity:

> This … has personally allowed me to place my own family's history into the broader framework of social and political events. I have a greater understanding of why my Taiwanese relatives decided to live there, and why my family has so much cultural diversity which has been passed on to my brother and myself. Stories that I have been told about Uncles, Aunts, my grandparents fit into a larger picture of the countries' histories and I feel richer for knowing these contexts… (Extract, Hsu Li's assignment, 1999)

EMPOWERMENT OF CULTURE BEARERS

Bicultural students in previous years had shared knowledge of their cultures anecdotally (for example, by helping with pronunciation and translation of songs in their first languages). However it was not until 2000 that a number of bicultural students drew attention to their own active participation in music from their parents' birth cultures. For these students, the fieldwork project provided a forum in which to display an expertise that was not always evident in other academic areas, due in part to difficulties with English as a Second Language.

A Vietnamese Australian student, Thuy, had learnt the piano from an early age because there was no-one available at that time to teach her a Vietnamese instrument. In 1997 she had begun to study the Vietnamese 16 string zither, Dàn Tranh, at a Vietnamese community music school, although she had stopped learning the instrument in 1999 because of pressures of university study. Although there was strong bicultural maintenance at home, Thuy saw her whole schooling process as assimilationist, in direct contrast to the tenets of the multicultural education policies previously discussed:

> … from the education system you're just supposed to assimilate and learn what the other people are learning. (Interview, Thuy, 2000)

She had not had any previous opportunities in a school or university context either to display or explore her Vietnamese cultural identity or to research Vietnamese music. By contrast, she saw the fieldwork project as a vehicle through which she could highlight 'her music'. Thuy's success in sharing her musical and cultural expertise was evident in the enthusiastic response to her presentation by her classmates. As she demonstrated performance characteristics and encouraged other students to discover playing techniques for themselves, the students were clearly engrossed in the learning process. Her confidence in answering questions from peers was supported by the research into 'her music' which she had undertaken with the assistance of her zither teacher.

She commented that the project had given her the opportunity to explore the background to 'her music' and culture in more detail. It had also provided her with the incentive to start learning the Dàn Tranh again:

> … when I got the chance to do multicultural music I… start[ed] playing, start[ed] learning again… When I was researching I learnt more about the music and the reason why we're actually playing the music. Before that [the teacher] used to tell us stories about the music but I never took it into consideration. I never thought it was that important… but when I did the research… that got me thinking… I thought that every piece of music… plays a special part in Vietnamese musical culture. (Interview, Thuy, 2000)

It was also clear that the form of the project had empowered Thuy to succeed in an academic field where her difficulties with written English had often prevented her from doing well. In this case the doors had not only been opened to intercultural exchange but also to alternative ways of establishing and acknowledging different kinds of expertise in what was a largely monocultural institution. It was interesting to note that her increased confidence was reflected later in the year in a greatly improved performance in her teaching practicum, conducted with aplomb in a school with a highly diverse population.

Thuy was able to generalise from her own experience as a culture bearer and to consider the implications for school students who were also culture bearers. In discussing her previous teaching practicum in a school with a large Vietnamese Australian student population, she clearly saw, in retrospect, the opportunities for empowerment of students which could be provided by inclusion of a music program utilising music of their own culture:

> It would have been good because then those students themselves could have told me a bit about their music and what they know about the music

> and maybe I could get them to understand about the music that their parents listen to… I think they would have enjoyed it a bit more. Some children have English problems and they speak Vietnamese more fluently and maybe that would have helped them to actually enjoy music classes a bit more - something that they're familiar with and that they can teach others instead of teaching something
>
> that they don't quite understand…they're happy to share their views [because they understand this]. (Interview, Thuy, 2000)

More recently, a greater proportion of the students undertaking the course have been empowered to draw on their own cultural backgrounds, musical skills and expertise for their projects. Greek Australian students have demonstrated songs and dances learnt in community schools, community events and Orthodox church gatherings which form part of their lives. Malay, Indonesian, Korean, Ukrainian and Maori students have acted as informants for other students' projects, confidently recording and performing songs learnt as children or (in the case of the Ukrainian student) through a lengthy training process as a professional performer.

CONCLUSION

For the students engaged in inquiry-based fieldwork projects these modes of learning have provided avenues to 'understanding … the lived experience of people making music' (Titon, 1997, pp. 91-92) which completely changed their approach to the teaching of music from one of monoculturalism to pluralism. These experiences are transformational, particularly in regard to removing the boundaries between 'insider' and 'outsider' knowledge and power, in a manner described by Rice (1997, p. 106) where the researcher and researched are 'potentially interchangeable' and 'capable of change through time, during the dialogues that typify the fieldwork experience'.

Students have been able to open pathways through cultural barriers which were previously seen as impenetrable and to explore the cultural and musical identities of both themselves and others, in so doing, discovering that diverse groups 'do not merely co-exist but interact' (Reyes Schramm, 1982). Through making personal connections with members of hitherto unknown or unexplored musical cultures, students have been able to broaden possibilities for future musical exchange and growth of musical knowledge and to directly establish the importance of enabling culture-bearers to take a collaborative role in implementing music education in schools.

From my own point of view, this study has emphasised the centrality of interpersonal contact between members of different cultures to the development of

intercultural understanding. It has also led me to recognise the importance of endorsement of individual students' cultural backgrounds as a means of personal empowerment leading to academic achievement within an institutional setting. In responding to the results of this study, I have endeavoured to provide a broader range of opportunities for students to participate in a dialogue with culture-bearers both within and beyond the confines of the university classroom. Students with language backgrounds other than English are given flexible forms of assessment that enable them to demonstrate their musical and cultural knowledge in forms of teaching and learning interchange that emphasise their strengths. Musicians who have been recorded and interviewed by students have also been invited to perform and share their knowledge within the classroom. It is anticipated that future implementation of the course will involve school teachers, their students and performers who have been participating in successful performer in residence programs. In this way a cycle of engagement with real world experience has been established as a model to be emulated following graduation.

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Chapter 6
The development of epistemic fluency: Learning to think for a living

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THINKING FOR A LIVING

Most of the jobs taken up by university graduates involve knowledge-work: adding value to a product or service through the application of knowledge. This is true in the private sector but also in the professions and areas of public service, where there is a strengthening expectation that policies and practice will be informed by sound evidence. Tom Davenport characterises such work as 'thinking for a living' (Davenport, 2005). One might expect academia to be comfortable with the notion of knowledge work, but it would be fair to say that little of the literature on teaching and learning in higher education is underpinned by a confident or illuminating analysis of what this entails. It is a major problem when higher education is unable to provide an adequate theorisation of some of the key qualities demanded of its graduates (Barrie, 2006).

This chapter emerges from the following combination of concerns. First, we are interested in getting a firmer understanding of some of the key characteristics of knowledge work. Knowing how tasks are carried out by experienced knowledge workers is a prerequisite for helping students learn how to carry out such tasks. Secondly, we have been investigating 'learning through discussion', in higher education settings, with students who are involved in both face-to-face and online discussions. Discussion is taken-for-granted, valued and threatened in higher education. It is threatened by worsening staff:student ratios and by the reduction in the time students are willing or able to give to participation in on-campus activities. It is valued in images of the ideal forms of interaction and relationship in academia (Ashwin, 2005; Palfreyman, 2001). It is surprisingly under-researched and one does not often hear a clear articulation of its role when discussion-based activities are being slotted into a course plan. Part of our research focuses on how students make sense of learning through discussion; what they believe it is good for, how they approach discussion tasks, etc. Thirdly, we are interested in educational design. As researchers, and in our daily work, we want a richer understanding of how to design, or help our colleagues design,

engaging productive learning tasks, supported by appropriate tools and learning resources. These three sets of concerns combine to connect educational design, learning through discussion and apprenticeship in knowledge work.

The diverse disciplinary contexts in which we have been working include the social and health sciences and engineering. A unifying feature is that, in each of these contexts, we have been collaborating with teachers who are trying to find good ways of combining online and face-to-face discussion activity within the courses they teach. We have found that the apparently new challenges involved in finding appropriate uses for computer technology shed light on broader and more enduring questions about learning activity and curriculum goals. It turns out that the different affordances of face-to-face and online discussion have implications for the connections between discussion and collaboration in knowledge-building. Neither is intrinsically superior to the other; they can have complementary strengths. We pay particular attention to the way that online discussion creates a shared and persisting record of ideas and to the implications this has for the collaborative improvement of ideas.

Our chapter proceeds as follows. We start with an overview of the areas of academic practice that have been involved in our recent research, but make some bold claims about the general applicability of what we have to say. Then we survey some of the literature on which we have been drawing, offering a conceptualising of apprenticeship in knowledge work and a summary of some recent research on learning through discussion in higher education. In particular, we focus on evidence of conceptions of discussion that are compatible with our sense of what apprenticeship in knowledge work ought to entail. We find few signs of such conceptions. This segues into our own research. We summarise the methods and outcomes of some of our recent and ongoing empirical studies of learning through (face-to-face and online) discussion. Finally, we draw out some implications for practice.

The overall aim of our chapter is to demonstrate the need for a more firmly grounded account of the place of discussion in learning to 'think for a living'. In our view, collaboration in knowledge-building, as a curriculum goal and as a pedagogical strategy, needs teachers and students to be clear about the intention behind, and the form to be taken by, students' collaborative engagement in knowledge work. The ability to distinguish between different intentions and forms depends upon a more sophisticated set of ideas about knowledge work than we are finding in our interview data.

AREAS OF ACADEMIC PRACTICE INVOLVED IN OUR RESEARCH

Our recent research has gathered data from a number of academic areas, includ-

ing education, social work, sociology, political science, engineering, pharmacy and law. Studies have included both postgraduate and undergraduate students. A small subset of the data has come from courses in which we've been involved as teachers or advisers. For the most part, it represents experience from courses in which we have had no direct stake, run at Sydney and at other universities, including universities in the UK. Typically, the research has been done in close partnership with the teachers who direct the courses concerned. Part of the motivation has been to work with these teachers in order to come to a better understanding of their students' experiences, with a view to distilling specific ideas for improving their courses, as well as more general implications for better educational designs. All of the data comes from courses in which students spend some of their time engaged in online collaborative activity, ranging in kind from loosely structured discussion to tightly scripted group projects. None of it comes from courses in which teachers were experimenting with online activity for the first time, or courses where students' evaluations made it clear that there were serious problems with the course. Most of our work has involved relatively small samples – never more than 200 in our questionnaire studies, and 20-60 in each of our interview studies. Nevertheless, we think the implications are worth serious consideration by anyone who is interested in the education of knowledge workers or the role of learning through discussion.

APPRENTICESHIP IN KNOWLEDGE WORK, LEARNING THROUGH DISCUSSION AND EDUCATIONAL DESIGN

Apprenticeship in knowledge work

> 'In a complex, multicultural society such as ours, truth takes many forms. Different contexts and different subcultures support different ways of constructing knowledge, and different ways of understanding what it means to 'know' something' (Morrison & Collins, 1996, p. 108).

We have been drawing on the writings of a number of scholars whose work makes connections between educational practice and cognitive science in order to develop a conception of 'apprenticeship in knowledge work' that is both rich and precise. David Perkins, Stellan Ohlsson and Allan Collins have provided some useful ideas about the special qualities of knowledge work, rendered in terms of epistemic tasks (Perkins & Blythe, 1994; Ohlsson, 1995; Collins & Ferguson, 1993; Morrison & Collins, 1996). More recently, Carl Bereiter has drawn on Popper's 'Three Worlds' ontology as a way of distinguishing between learning and knowledge-building (Bereiter, 2002; Bereiter & Scardamalia, 2003). We find

these writers helpful, because they take us *beyond* the mere acknowledgement that knowledge is socially constructed and that knowledge-claims are contestable, needing to be understood relative to the norms, values and practices of a culture (Barnett & Griffin, 1997; Berger & Luckmann, 1967; Latour & Woolgar, 1986). The fact that knowledge is relative does not make it simple or arbitrary.

Allan Collins provides some vocabulary for talking about key elements of knowledge work: *epistemic forms* and *epistemic games*. Epistemic forms are 'target structures that guide inquiry' (Morrison & Collins, 1996, p. 109). Epistemic games are 'sets of moves, constraints, and strategies that guide the construction of knowledge *around a particular epistemic form*' (*loc. cit*., our emphasis). Taxonomic hierarchies, stage models, systems dynamic models and even simple lists can be examples of epistemic forms. Just as one cannot become a batsman merely by watching cricket, so one has to *play* epistemic games – ideally with people who are better at the game than you are.

Collins was thinking primarily of science education, in which epistemic forms and games mainly serve purposes of explanation and prediction. We believe the constructs are also useful in other areas of work. For example, in many areas of professional practice or corporate work, one can identify epistemic forms that are a combination of action-oriented knowledge (e.g., a plan, strategy, procedure or set of recommendations) plus a warrant or rationale (the evidence and argument justifying the action). Drawing on some of the courses we have studied in recent years, we could add examples such as a Use Case in software engineering, an ordered list of symptoms of schizophrenia, in psychology, or a legal opinion in law. The broader point is that the constructs of 'epistemic forms' and 'epistemic games' are useful tools for carrying out a cognitive anthropology of an epistemic culture. If we think of ways of formulating shared professional knowledge claims in an area like school teaching, for example, we can turn up epistemic forms such as a curriculum plan, or a grouping strategy, and its accompanying rationale. We can interpret the activities involved in producing such epistemic forms by focusing on those aspects which can be understood as moves in the corresponding epistemic game.

Epistemic fluency can then be defined as the ability to recognise and participate in a variety of epistemic games 'to identify and use different ways of knowing, to understand their different forms of expression and evaluation, and to take the perspective of others who are operating within a different epistemic framework' (Morrison & Collins, 1996, p. 109). We argue that students benefit from induction into more than one epistemic community (knowledge-building community), such that they can engage in what Lave and Wenger (1991) call 'legitimate peripheral participation' in the work of each community and can also come to recognise that different communities have different knowledge-building practices. Such communities may be academic or vocational in their primary orientation, and ideally students should have experience of communities in which

both the creation and the application of knowledge have value and are well-understood.

An important element of this socio-cultural view of learning is that *participation* in authentic knowledge-creation activities, coupled with a growing sense of oneself as a legitimate and valued member of a knowledge-building community, are essential to the development of an effective knowledge-worker. Action and identity are key.

At this point, we need to introduce a distinction between 'weak' and 'strong' interpretations of knowledge-building. Both are of value, but only the strong version amounts to authentic participation in knowledge work. The 'weak' version sees participation in collaborative knowledge-building as (just) a means to the end of personal conceptual development. To distinguish this from knowledge-building in a 'strong' sense, we need to follow Carl Bereiter in drawing on Karl Popper's 'Three Worlds'. World 1 is the objective world of physically existing things external to me (you, others, rain, rocks and sheep). World 2 is my subjective/inner world (mental states, beliefs, feelings). World 3 is the objective world of 'conceptual artifacts': ideas, theories, etc. The weak version of knowledge building is concerned solely with effects in World 2. The strong version is primarily concerned with activity and effects in World 3, though there may be beneficial side-effects in World 2. Bereiter (2002, pp. 64-68) talks about knowledge-building as collaboration in the improvement of conceptual artifacts. Collins, through the notion of 'epistemic forms', shows how we might identify *kinds* of conceptual artifacts that turn out to be important in a particular epistemic community – knowledge structures that are key to the distinctive ways of thinking and acting in that community (cf. McCune & Hounsell, 2005). Legitimate peripheral participation in World 3 knowledge building is how one learns to be a knowledge worker. Students can be given opportunities to participate in a number of different ways, for example through various kinds of research or inquiry task (Brew, 2006). However, collaboration in knowledge-building must always give a central place to discussion, so we now turn to this important but surprisingly neglected area.

Learning through discussion

There has been remarkably little research on learning through discussion in higher education, despite the central place it has had in many disciplines. A notable exception is the recent work of Helen Askell-Williams and Michael Lawson, which reports on students' beliefs about learning though discussion using data from school as well as university students. They show that students hold a wide range of beliefs about the educational purposes of discussion but that these can be reduced to five categories: information acquisition, remembering, comparison, motivation and knowledge construction (Askell-Williams & Law-

son, 2005). At first glance, the knowledge construction category looks as if it would come close to what we have in mind for apprenticeship in knowledge work, but on further examination it turns out that all of the purposes subsumed by this heading are to do with personal conceptual development. Discussions 'open my eyes to new points of view', 'help me to clarify my own opinions', 'help me expand my thinking', 'help me formulate my own thoughts' (pp. 99-101). One sub-category of purpose is labeled 'discussions facilitate the co-construction of knowledge' (p. 101) but this is used to describe situations in which two people help each other come to understand something. This is valuable, but it's firmly in World 2 rather than World 3.

Paul Ashwin's phenomenographic study of Oxford University students' conceptions of the 'Oxford Tutorial' also gives us some insight into what students see as the purposes of learning through discussion, albeit in a rarefied context. Ashwin's analysis results in four qualitatively different conceptions of the tutorial, distinguished by different conceptions of the roles of the participants and of the nature of knowledge (Ashwin, 2005). Tutorials are seen as (i) 'the tutor explaining to the student what the student does not understand', (ii) 'the tutor showing the student how to see the subject in the way the tutor does', (iii) 'the tutor bringing things into relation to each other to help the student develop a new perspective in the wider context of the discipline' and (iv) 'the tutor and the student exchanging different points of view on the topic and both coming to a new understanding' (op. cit., p. 635). Of these, only (iv) comes close to Bereiter's notion of collaboratively improving conceptual artifacts, and the implied purpose is still personal understanding (World 2) rather than the creation of new knowledge (World 3).

Students' beliefs about how they can benefit from participation in discussions are important because they are a strong influence on what students actually do when we set them a task. Other areas of belief and intention are also important: notably, students' personal epistemologies, conceptions of learning and approaches to study (Biggs, 2003; Hofer, 2000; Marton & Säljo, 1997; Perry, 1970; Prosser & Trigwell, 1999). If a student believes that there is only one right answer to a question, and that the teacher's job is to know and share the truth, then they are unlikely to see much value in debating different perspectives on the question with their fellow students. Conversely, if a student sees all knowledge claims as contestable and values the debate that flows from sharing personal interpretations of events, then they are more likely to engage in discussion with peers, even in cases where that discussion has no clear end in sight. Neither of these conceptions has the epistemological sophistication needed to create a space for collaborative knowledge-building in our strong (World 3) sense.

Educational design, discussion and collaborative knowledge-building

The kinds of face-to-face discussion that we find embedded in traditional university educational practice vary in format but are remarkably consistent in outcome. By this we mean that there are several recognisable ways of organising roles and the process of face-to-face discussion (e.g., a buzz group, a seminar led by a student on the topic of a journal article, an Oxbridge tutorial) but that the outcome is usually the same. What is left, at the end of such a discussion, is a set of cognitive and emotional traces, subtly different for each participant, and vulnerable to change and loss with the passage of time. There may be sets of private notes, or marks on butcher's paper, but it is not common educational practice to conclude a discussion with the production of a shared artifact.

Online discussion is different. Online discussion is the production of shared artifacts – normally texts. While the sound waves generated in a face-to-face meeting disappear into the ether, online discussion proceeds through producing and reflecting on *persistent* discourse. The personal and educational corollaries of this quality of public persistence have been explored in a rich seam of research on online networked learning (e.g., Adrianson, 2001; Hardy, Hodgson & McConnell, 1994; Kaye, 1992; McConnell, 2000). But the point we want to make here is that persistent, shareable online texts *afford* collaborative knowledge-building or knowledge-construction (Kovalainen & Kumpulainen, 2005; Pontecorvo, 1987; Scardamalia & Bereiter, 1991; Weinberger & Fischer, 2006).

We can now distinguish between educational designs for discussion-based activity that are primarily oriented towards bringing about change in World 2 (conceptual change in individuals) and those that are primarily oriented towards change in World 3 (improvement of conceptual artifacts). Conceptual artifacts, such as theoretical ideas in science, have an existence independent of any single inscription in a material artifact (such as a text) and independent of the cognition of any individual. However, they also *require* representation in material and cognitive forms for collaborative knowledge work to be possible. There is a special connection with online collaboration here. Face-to-face discussion can be used as a way of bringing about change in World 2 and it can be used to co-ordinate the construction of new or revised material representations of conceptual artifacts. Online discussion can also do this but, as we have seen, online discussion proceeds *through the construction of texts* (which we might class as digital artifacts renderable in a variety of material forms) and these texts can be representations of conceptual artifacts. This explains why a number of educational technology research and development teams around the world have developed computer systems that help an epistemic community collaborate in the improvement of conceptual artifacts, essentially by using a shared database of textual or multimedia notes. Examples would be Bereiter & Scardamalia's work in Canada on CSILE (Computer Supported Intentional Learning Environments) and Knowledge Fo-

rum (e.g., Scardamalia, Bereiter & Lamon, 1994) and, in Europe, work associated with the JITOL ('Just-in-Time Open Learning') and SHARP ('Shareable Representations of Practice') projects (Goodyear, 1995; Goodyear & Steeples, 1998).

OUR OWN RESEARCH

To what extent are students in higher education consciously involved in a *strong* version of collaborative knowledge building? We suspect that this is pretty rare, other than in cases that are so leading-edge that the teachers involved document what they are doing in the literature of innovative teaching and learning. Individual knowledge-building, in the strong sense, is not uncommon. It is the stuff of student research projects. Moreover, students in some discipline areas – notably the laboratory sciences – carry out their projects as part of a team and may have a sense of legitimate peripheral involvement in a larger knowledge-building community. But if apprenticeship in knowledge work – learning to think for a living – is to be available to most, if not all, university students then we have to find ways of engaging them in collaborative knowledge-building outside the lab-based subjects. And if we are serious about epistemic fluency, then students need to be legitimate participants in a wider variety of epistemic games. Perhaps this is happening, but without much publicity.

Over the last eight years we have accumulated a number of datasets through our interview and survey-based research into teachers' and students' conceptions of collaborative and discussion-based online and face-to-face learning activity. The datasets include full transcripts of in-depth interviews with 90 university students and 19 lecturers, as well as responses to open-ended questionnaires and rating scale instruments completed by over 400 students. The data have been gathered from courses at universities in the UK and Australia and in each case the course involved significant use of online discussion activity.

We have analysed this material using a broadly phenomenographic approach and have reported on relationships between conceptions of learning, approaches to study and engagement in online and face-to-face discussion (see Goodyear, Asensio, Jones, Hodgson & Steeples, 2003; Goodyear, Jones, Asensio, Hodgson & Steeples, 2005; Ellis, Goodyear, Prosser & O'Hara, 2006; Ellis, Goodyear, O'Hara, & Prosser, 2007).

For this chapter, we have worked through some of the interview transcripts afresh, looking for excerpts that reflect a consciousness of participation in knowledge-building in the strong sense. Our aim was to get an approximate sense of the frequency/rarity of such excerpts and to characterise the thinking about knowledge-building embedded in them.

We focused on two sets of transcripts and used concordance analysis to identify key words and phrases in context. The first set of transcripts came from

interviews with 19 university teachers, each of whom had at least two years experience of using online discussions in their teaching. Each of these teachers had a local or national reputation for educational innovation and had taken up online teaching for pedagogical reasons, rather than because they felt a need to keep up with technological developments. The second set of transcripts came from in-depth interviews with 30 undergraduate students involved in courses that included a combination of face-to-face and online discussion.

Interviews with university teachers

This corpus of hour-long interview transcripts amounted to just over 150,000 words. The interviews were very loosely structured and invited the teachers to speak about the elements of course design and course experience that mattered most to them. The interviews were conducted several years after the publication of Allan Collins's ideas about epistemic forms, games and fluency. Nevertheless, we probably should not be surprised that the words 'epistemic', 'epistemology' and 'fluency' are entirely absent from the interview transcripts. There are no mentions of the names 'Collins' or 'Bereiter'; no mention of 'knowledge work' or 'apprenticeship'.

We began the hunt for mentions of collaborative knowledge-building by searching the text for the word 'knowledge'. There were 34 occurrences. None referred explicitly to 'knowledge-building' and just two referred explicitly to 'knowledge construction'. Both of these came from the same transcript (Teacher Q). The first mention was in a passage about how to assess students' online contributions. Teacher Q wanted to go beyond rewarding the *quantity* of student input:

> …we needed a more positive way of looking at what they'd contributed in terms of the knowledge constructional process not just what comes out at the end.. (Teacher Q)

It isn't clear from the rest of Teacher Q's transcript whether this 'knowledge constructional process' was something they saw as World 2 (the weak sense) or World 3 (the strong sense of knowledge-building).

In a later passage, they mentioned knowledge construction again.

> I'd like to develop more this idea that the way that knowledge is being talked about, used, collected, managed, constructed, transmitted, whatever um in a future which is dominated by quantity rather than quality you know that's a fundamental issue, I mean we talk a lot about knowledge extraction and collaborative knowledge construction and all the rest of it and in the end we still have experts deciding whether or not somebody has you know

> done it right basically and I don't think that is a sustainable model to be honest um somehow in our teaching… (Teacher Q).

Again, it's unclear whether Teacher Q is thinking of collaborative knowledge construction in the strong or weak sense. What is clear is that, for Teacher Q, collaborative knowledge construction is just something that is being *talked* about. It doesn't feature as they would wish in the course they teach.

Perhaps university teachers have other ways of talking about knowledge-building activities in their courses. Checking through all the other 32 occurrences of the word 'knowledge', we found it being used in a variety of ways, referring to the teacher's knowledge of their students, teacher's pedagogical knowledge, and – most frequently – knowledge as that which was to be taught and learned. Five occurrences came close on our theme of knowledge-building and apprenticeship in knowledge work. Two of these were from the interview with Teacher Q again, so we deal with these first.

> I would give credit to somebody who may be who's academic writing was not of the top drawer in the conventional sense but if they had used the medium in a way which either is an original way or a way that sort of created new opportunities for communication or new opportunities or new ideas about what sort of knowledge is being constructed in this process in a sense so somebody for example who opted to design a piece of multimedia could get a distinction for an assignment in which they produced a very good design and also a rationale for that design could get a distinction mark, but somebody who wrote a very good critique of another design um could also get a distinction mark (Teacher Q)

Teacher Q is referring to knowledge construction in World 2 *and* World 3. She is talking about what the student is learning through engagement in one kind of activity rather than another, but also about the inscription of conceptual artifacts in material (digital) form. That said, Teacher Q's focus is on (superficial) presentational rather than (deeper) epistemic forms.

The final excerpt is the closing passage from Teacher Q's interview.

> …we've got people here who are interested in knowledge management issues who are asking questions like 'what is in that, what is in the August data that we've got, all this discussion, three years of professional discussion amongst educational technologist about various about structured discussions about various issues, what's the knowledge that's in there, how do we find it, how do we define it and how do we get it out and what form do we have to put it into to make it accessible by anybody else'. That's a really important question I think or set of questions and if we don't do

> something about that we are kind of losing half of our opportunity to create new things about what we are doing rather than just making money out of it, not that I've got anything against making money of course' (Teacher Q)

This extract shows a belief that there's exploitable knowledge locked up in the transcripts of student discussions (the students in this case being professional educational technologists), but these thoughts aren't accompanied by any utterances that would lead one to believe that Teacher Q sees the strong version of collaborative knowledge-building as being *pedagogically*, rather than economically, desirable.

Two passages from interviews with other teachers also reveal some thinking about knowledge-building.

> 'the idea was that the group discussion is more interactive that they contribute that it's their page because you know when you listen to the small group discussions in the class they're fascinating. People are coming out with really interesting things, they are making excellent points and these are the sorts of things you want recorded up so that the group members have another source to draw on, OK they've got the books, they've got their work experience, they've got whatever and they've also got all their colleagues harvest knowledge, this is the idea' (Teacher D)

Teacher D is talking about their intention to capture some of the richness of face-to-face discussions in small groups when they redesign their online course next year. The reference to harvesting knowledge from colleagues reveals a view that students know things that are worth sharing, but this image of capturing what exists is a long way from the idea that students might collaborate to create new knowledge.

A more radical view of knowledge and knowledge creation appears in the interview with Teacher N.

> So we play around with different ways of relating to each other and different ways of thinking about creating knowledge and different ways of trying to express our interests in learning and teaching and that philosophy um is a sort of core of the whole course trying to open up peoples' ideas about learning and teaching, trying to shift them to think about what they are doing in their practice and reflect on their practice, by doing something interesting that involves them and causes them to question themselves and causes us as tutors to question ourselves (Teacher N)

Teacher N's course is a course about teaching and learning online. The students on the course are teachers. Teacher N has written a book and numerous

articles about their approach to online learning. What they are saying comes close to our sense of epistemic fluency - 'different ways of thinking about creating knowledge' – but it has a reflective, 'hands-off' flavour that does not evince a commitment to having students *work* with different ways of knowing.

To summarise: we interviewed 19 innovative teachers to find out about the ways they made use of technology to support collaborative learning and about the intentions underlying their teaching approaches. In only a very small fraction of their utterances did they talk about wanting students to collaborate in knowledge work. We found very few signs of teachers wanting to talk about inducting students into the 'ways of knowing and thinking' characteristic of their discipline or profession. We found no traces of language showing a nuanced understanding of epistemic activity or epistemic forms. From such silences we infer that few, if any, teachers were setting out to create opportunities for their students to be legitimate participants in knowledge work, peripheral or otherwise.

Interviews with undergraduate students

We started with transcripts of interviews carried out during 2005 and 2006 with students from a research-intensive university. These interviews asked about conceptions of, and approaches to, learning through discussion. We selected the subset of just 10 transcripts that included explicit reference to 'knowledge'. These interviews were typically 30 minutes long and the resulting corpus amounted to just under 34,000 words. There were 17 separate occurrences of the word 'knowledge' of which 14 were student, rather than interviewer, utterances. Unsurprisingly, none of the students talked explicitly about 'knowledge building' or 'knowledge construction'. The majority of the uses of the word 'knowledge' were bound to quantitative or accumulative conceptions of learning: that is, learning seen as an addition to one's knowledge, rather than as a transformation of one's understanding.

> I think the main thing is that you learnt something from the readings and you have your ideas… you've learnt some things from the readings but then being able to discuss it with other people online, and also in the tutorials, er I think you really get to see what they got out of it as well, which can be completely different and that adds to your knowledge. (Student B)
>
> And then online, for me that's just really seeing where everyone's at, what everyone kind of thinks. But it doesn't really, I don't think it adds that much to my technical sort of knowledge about the facts, you know, sort of thing. (Student J)

There were, however, three instances of talk about knowledge that took a different tack. Two of these talk about the way that other students' perspectives on

issues can change one's own ideas about things.

The third and final quotation is more extended, including the interviewer's prompting questions (prefaced with an I). It is the one example from all our transcripts that comes close to capturing Collins' notion of epistemic fluency. This is in the first paragraph. The second half of this extract from Student C's interview also speaks to the idea of challenge leading to improved personal understanding.

> Student C: I think, I know that there is obviously no matter what I do there are going to be people who are a lot better, smarter and a lot more experienced than me so I always have an opinion but I also accept that there will always be people who disagree with me so it also helps me understand [how?] people who disagree with me think. So that if that does come up so for example in social work I am forced to act in a way which doesn't cohere with my personal beliefs. I am going to work with people who do believe that and how they behave and I can incorporate that into my work or whatever else I am doing.
>
> I: Right, right.
>
> C: Plus in my addition it also challenges my beliefs which is always good.
>
> I: Why is that good? Why is challenging your beliefs good?
>
> C: Umm because a belief is something that is based on knowledge and experience and your understanding of the world and if it is being challenged you are testing it. Like if someone challenges my values there something they [inaudible] to myself but a belief is based on what I understand and if they challenge that I obviously understand things better and I believe that my understanding of whatever we are studying is closer, to relates more complete by having it challenged.
>
> I: Right, so like if my belief is challenged, what?
>
> C: If my beliefs are challenged I believe that my understanding of concepts are more complete.

This is the closest our data comes to reflecting Collins' notion of playing an epistemic game with, or against, people who are better than you at the game. It is a very rare example of a student, or teacher, talking about their activity as an apprenticeship in knowledge work. That said, it is still firmly in World 2. Its focus is on personal development, rather than the improvement of ideas in World 3.

IMPLICATIONS AND CONCLUSIONS

In some ways, our analysis is dismaying. Twenty-first century learning ought to give a central place to the development of epistemic fluency. Whether due to lim-

itations of language or lack of ambition in pedagogy, we have found it hard to detect an explicit interest in this interpretation of the purpose of university learning.

We prefer to take a more positive view. From interviewing a small number of HE teachers in depth, and working professionally with a much larger number, we get a sense that most are still looking for convincing ideas about two major challenges: (i) how to ensure that their students are able to use their experiences of studying in a disciplinary context as a preparation for life in the modern world and (ii) how to make appropriate use of computer technology in support of students' learning. On the other side, students expect at least *some* aspects of their study experience to be useful in later life. They also expect to find themselves using computer technology at university, but don't have definitive views about *how* it should be used. We are in a period of experimentation and collective sense-making. Computer technology is already seen as offering some basic functionality: providing students with easy access to core data about a course, to reading lists and lecture notes, etc. Such uses are valuable and *may* be on a developmental path leading to pedagogically richer possibilities. What emerges from our research is a sense that those academics further down the path are still working out what they want to achieve through use of computer technologies, collaborative activities, online discussion, etc. If their practice was already crystallised, and the online space was already full of entrenched activity, there would be little scope for change. Our optimism comes from this sense of readiness for change – evident in teachers' demands for research-informed guidance - and for what might be achieved through a better realignment of technological capability and educational purpose. Articulating the characteristics of apprenticeship in knowledge work is a central part of this challenge.

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PART II
RESEARCHING STUDENT ASSESSMENT

Chapter 7
Evaluating student perceptions of group work and group assessment

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EFFECTIVE IMPLEMENTATION OF GROUP WORK IN HIGHER EDUCATION

Co-operative learning (also referred to as collaborative learning or group work) has been hailed as 'one of the greatest success stories in the history of educational innovation' (Slavin, 1996). This statement reflects the positive findings of co-operative learning on student achievements at school. Three main reasons for adopting group work are commonly cited: (1) group or collaborative learning is an effective form of learning (Slavin, 1996); (2) group work promotes teamwork skills that employers require and value (Cooper & Lybrand, 1998) and (3) efficiency in the use of staff time when student:staff ratios are falling (Sharp, 2006). In addition, group learning is considered to encourage life-long learning and may be better suited to some students (e.g., women and minority groups) than more individualistic styles of learning (Boud, Cohen & Sampson 1999).

Whilst there is evidence in support of the benefits of group work for student learning there are several factors that may impinge negatively on group work. These include cognitive and psychological factors (Cantwell & Andrews, 2002), lack of appropriate student skills (Prichard, Stratford & Bizo, 2006), the quality of the collaborative learning methods (Slavin, 1999), the group management skills of tutors and group assessment. Group assessment procedures are particularly problematic because of the need to assess individuals within a group (Boud et al., 1999).

The simplest method of group assessment involves each student receiving the same mark (Nicolay, 2002). However, there are two potential problems with this method. First, it assumes equal contribution by group members, an assumption that has been shown to be incorrect (Bourner, Hughes & Bourner, 2001; Mills, 2003). Secondly, universities require individual marks for students, for ranking purposes. To address these concerns numerous methods have been reported for deriving individual marks from a group assignment. Lejk, Wyvill and Farrow (1996) outlined no fewer than nine different methods for obtaining indi-

vidual marks from group work and the number continues to increase (Bastick, 1999; Sharp, 2006). Currently, however, there is no consensus as to whether one method is superior to another.

Given that group work has both benefits and drawbacks, what is the student's experience and satisfaction with group work projects in higher education? A number of studies have been undertaken to address this question in relation to specific projects and, generally, they have indicated a high level of satisfaction (Gatfield, 1999; Bourner et al., 2001; Barfield, 2003; Mills, 2003; Gupta, 2004). However, some studies have reported students making negative comments about group work. A major reason for negative comments is the issue of 'passengers' (i.e. poor contributors) (Bourner et al., 2001) or 'free riders' (Boud, 2001).

In 2002, Cantwell and Andrews developed a 30-item questionnaire (Feelings Towards Group Work) in which three main factors were identified: preference for individual learning, preference for group learning and discomfort with group learning. We considered Cantwell and Andrew's questionnaire an ideal instrument for the current study as it measures attitudes towards group work *per se* rather than student's experience of specific group projects, as previously reported.

Research aims

The present study was initiated by negative verbal reports from students about their group work experience within the Faculty of Science (University of Sydney, 2002). This was of concern since it indicated students were not benefiting from the positive aspects of collaborative learning. The main aim of the study was to investigate whether students preferred individual work to group work as implied by the Academic Board Review. Additionally, we were interested in determining whether different methods of group assessment would significantly affect students' attitudes to group work.

Context of the study

Information technology and pharmacology students from within the Faculty of Science were invited to participate in the study. These two disciplines were chosen as they used different group assessment methods (see *Group assessment procedures*). The Feelings Towards Group Work questionnaire was administered to both cohorts to measure students' attitudes towards group work *per se*. To determine students' attitudes towards the different assessment methods, two 10-item questionnaires were administered: one for information technology (Attitudes Towards Group Work Assessment), the second for pharmacology (Attitudes Towards Peer Evaluation).

Pharmacology. Students were 2nd year (2nd semester) science students who had chosen to study pharmacology as a part of their undergraduate degree. Most, but not all, had completed a similar course in pharmacology in 1st semester. 72% of the respondents were female at Time 1 which reflects the proportion of females in the cohort. At Time 2, 82% of the respondents were female.

Students were allowed to self-select the members of their group. Groups of 4 - 6 students were advised but in some instances groups of 8 were formed. Students remained in the same group throughout semester. Five compulsory group work sessions were scheduled: (1) two practicals with an assessable group laboratory report, (2) two computer-based sessions (no assessment) and (3) one workshop involving a poster presentation (assessable). The group assessment procedure involved tutor assessment of the assignment (product) and peer (but not self) evaluation of process.

The intention was that evaluations were to be kept confidential, however, many students chose and/or thought they were required to hand their evaluation to the student handing in the group report. Group work assessment accounted for 26% of the final mark awarded (semester work + examination).

Information technology. Students were 3rd year information technology students who had chosen to undertake an information systems project as a part of their undergraduate degree. These students would have been involved in some group exercises in 2nd year units and 1st semester 3rd year units. The gender ratio for this group was essentially 50:50, as was the ratio of the respondents (52% female at both Time 1 and Time 2).

Students were invited to find their own projects and to form their own groups: groups of 6 were advised. The 'client' was a person outside the School of Information Technology and usually outside the university thus providing authenticity to the project. 40% of the assessment was for individual work and 60% for collaborative tasks: both were tutor assessed. All students in each group received the same mark for the collaborative (group) work.

METHOD OF INVESTIGATION

Participants and design

The study involved two phases of data collection - the first held in week 1 of semester 2 and the second held in the final teaching week of the same semester. Participation involved completion of the aforementioned questionnaires (see *Context of the study*) – optimally by the same respondents at both data collection phases (Time 1 and 2). All potential participants were invited to participate in both phases of data collection and were informed that participation would involve

completion of a survey at two points during the semester. In the initial phase (Time 1) 118 pharmacology students, out of a cohort of 160 enrolled students, and 119 information technology students, out of 136 enrolled students, participated. A smaller number of students participated in the Time 2 phase of data collection - 65 pharmacology and 103 information technology students took part. Importantly, the samples voluntarily participating at Time 2 were taught and evaluated in the same way as those students choosing not to participate and thus provide a representative sample.

Group assessment procedures

For pharmacology, the group assessment procedure involved tutor assessment of the assignment and peer evaluation of process. The product (lab report or presentation) was assessed by staff using criteria given to students before completion of the group assignment. Individual marks were derived from the peer evaluation mark. The method used was an adaptation of that used by Bastick (1999) and was based on five performance criteria (reliability, preparation and participation, completion of a given task, contribution to group discussion and provision of feedback). The score for each criterion was calculated by multiplying the number in the group less one, by 20. Students were asked to distribute the score for each criterion between group members according to their performance. The average percentage of the total scores was then used to calculate individual marks based on the mark received for the product. This meant that some students received a mark that was higher than the assignment mark, others a lower mark.

For information technology, the product was assessed by staff using criteria given to students before completion of the group assignment and there was no peer evaluation. All students in a group received the same mark.

Measures

Feelings Towards Group Work Questionnaire. The original 30-item Feelings Towards Group Work questionnaire developed by Cantwell and Andrews (2002) was not sufficiently reliable for the present sample, and the reliability analyses resulted in the deletion of three of the original items in order to achieve acceptable levels of reliability for the current study - Cronbach's alpha for the Preference for Individual Work (I) subscale = .82; Preference for Group Work (G) subscale = .53; and Discomfort in Group Work (D) subscale = .64 (White, Lloyd, Stewart & Kennedy, 2005). Each item in a subscale was rated on a five-point Likert scale item so that a negative response is 1 or 2, neutral is 3 and positive is 4 or 5. The neutral mid-point of the Individual and Group Work Preference subscales (seven items) is a score of 21, the neutral mid-point for the Discomfort in Group subscale (four items) is 12.

Attitudes Towards Peer Evaluation and Attitudes Towards Group Work Assessment Questionnaire. Two questionnaires were developed by White et al., (2005) for the current investigation. The Attitudes Towards Peer Evaluation scale was developed to measure students' perceptions of the peer assessment process. The instructions for pharmacology students were as follows:

> This questionnaire contains a number of statements concerning your thoughts about the process of peer evaluation and its use to calculate individual marks in Pharmacology.

The Attitudes Towards Group Work Assessment scale was developed to measure students' perceptions of the group assessment process. The instructions for information technology students were as follows:

> This questionnaire contains a number of statements concerning your thoughts about the process of evaluating group work in Information Technology.

These newly developed scales consisted of 10-items, where each item is rated on a five point Likert scale, where a total score close to 10 would be considered a *negative* attitude toward group assessment, a score close to 30 would be considered *neutral*, and a score close to 50 would be considered *positive*. Both scales showed high internal reliability – Cronbach's alpha ranged from .83 to .88 for the Attitudes Towards Peer Evaluation; and from .70 to .87 for the Attitudes Towards Group Work Assessment. Refer to White et al., (2005) for full versions of these scales.

Procedure

At Time 1 all pharmacology students were administered the Feelings Towards Group Work and Attitudes Towards Peer Evaluation in the lecture theatre whilst the information technology students were administered the Feelings Towards Group Work and Attitudes Towards Group Work Assessment in groups of 20 – 30 in tutorial rooms. Thirteen weeks later, after each student cohort had completed their group work task, the same set of questionnaires were administered to them at Time 2. In each phase, questionnaire administration was counterbalanced to guard against order effects. All participants were given approximately 40 minutes to complete the questionnaires.

RESEARCH FINDINGS OF THE STUDY

Analyses of correlations between the measures

Prior to testing the main research questions, we adopted the standard approach to missing data that results when not every participant provides complete responses to all scales. This approach involves list-wise deletion of missing values in independent t-test analyses and correlational analyses. As a consequence, the Ns reported vary according to the number of complete data sets provided and subject attrition that is a common feature of field research that involves a 'follow-up' design.

A correlational analysis investigating the relationship between the group work measures was conducted on the total sample of pharmacology and information technology students (N = 140) at Time 2, after they had conducted their respective group work projects. As expected there was a significant negative correlation ($r = -0.18$, $p < .05$) between the preference for individual work (I) subscale and the preference for group work (G) subscales; a negative correlation ($r = -0.22$, $p < .05$) between the (G) and discomfort in group work (D) subscales and positive correlation ($r = 0.21$, $p < .05$) between the (I) and (D) subscales. Importantly, for convergent validity, the peer evaluation/group assessment questionnaires were negatively correlated ($r = -0.47$, $p < .01$) with the (I) subscale and positively correlated ($r = 0.18$, $p < .05$) with the (G) subscale. In other words, students who reported favourable attitudes towards group assessment also reported favourable attitudes towards group work in general.

Ratings data: Attitudes towards group work for the combined sample

The main aim of the study was to investigate whether students preferred individual work to group work as implied by the Academic Board Review. Looking at the survey responses broadly, student attitudes towards individual work were less favourable than their reported attitudes towards group work. At Time 1 or base-line, before any Semester 2 group work had taken place, the mean preference for individual work ($M = 19.44$, $SD = 5.21$) was significantly lower than the mean preference for group work ($M = 26.73$ $SD = 3.15$), where $t(367) = 17.90$, $p <. 001$, for the combined sample of pharmacology and information technology students (N=224). Importantly, this significant difference persisted at Time 2, after the group work projects had been completed, where the mean preference for individual work (M =19.22 SD = 5.46) was significantly lower than the mean preference for group work (M =27.13 SD = 3.24), where $t(238) = 15.19$, $p <. 001$, for the combined sample of pharmacology and information technology students (N=151).

Ratings data: Within and between differences in pharmacology and information technology samples' attitudes towards group work

A more detailed analysis was conducted to see if these differences were found *within* the two cohorts of students. Table 7.1 reveals that for pharmacology students at Time 1 the mean preference for individual work was significantly lower than the mean preference for group work, where $t(152) = 9.45$, $p <. 001$. Similarly, for the information technology students, the mean preference for individual work was significantly lower than the mean preference for group work, where $t(216) = 16.53$, $p <. 001$. Overall, these analyses reveal that there are more favourable preferences for group work than individual work, contrary to the Academic Board Review's concerns.

An independent t-test analysis was also conducted to see whether there were differences *between* the two cohorts of students. At Time 1, the pharmacology students mean preference for individual work was significantly greater than information technology, where $t(201)= 2.71$, $p = .007$. Additionally, at Time 1, the pharmacology students mean preference for group work was significantly less than information technology, where $t(201)= 2.41$, $p = .017$. At Time 2 there were no significant differences between the two cohort's preferences for individual work or group work.

Table 7.1. Means and standard deviations of students' attitudes at Time 1 and 2

	Time 1		Time 2	
	M	SD	M	SD
Pharmacology				
• Individual work preference	20.41	5.77	18.55	5.52
• Group work preference	26.21	2.70	26.87	3.05
• Discomfort in group	9.26	2.45	8.09	2.78
• Attitudes towards peer evaluation questionnaire	30.17	6.65	30.06	8.03
Information Technology				

• Individual work preference	18.53	4.45	19.62	5.41
• Group work preference	27.20	3.46	27.28	3.35
• Discomfort in group	8.79	2.83	8.40	2.70
• Attitudes towards group work assessment	30.20	4.67	30.34	6.95

Ratings data: Changes in attitudes towards group work for the pharmacology and information technology samples between Time 1 and 2

In order to test whether there were changes in student attitudes between Time 1 and 2, an independent samples t-test was conducted. As reported in Table 7.1, there was a significant decrease in pharmacology students' mean preference for individual work [$t(161) = 1.99$, $p < .05$] between Time 1 and 2; in contrast, information technology students' preference for individual work remained the same [$t(207) = 2.8$, $p > .05$] between Time 1 and 2; the mean preference for group work remained the same for both Pharmacology [$t(160) = 2.81$, $p > .05$] and information technology students [$t(211) = 2.82$, $p > .05$] between time 1 and 2; and the mean reported discomfort in groups decreased significantly for the pharmacology sample [$t(164) = 2.81$, $p < .05$] but not for the information technology sample [$t(211) = 2.81$, $p > .05$] between Time 1 and 2.

A stronger dependent samples t-test was also conducted on the data of the smaller sample of participants who participated at both Time 1 and 2. This analysis, which we have reported previously (White et al., 2005), revealed one additional significant finding – the mean preference for group work increased significantly for the pharmacology sample [$t(42) = 2.60$, $p < .05$]. Overall, students' responses were more favourable towards group learning and less favourable of individual work in Time 2 than in Time 1 — a small improvement, but a positive result.

Ratings data: Changes in attitudes towards group assessment for the pharmacology and information technology samples between Time 1 and 2

Students' perceptions toward two different models of assessment - peer evaluation and group assessment - were also analysed. Table 7.1 reveals that student

attitudes towards peer evaluation and group assessment did not change over time, remaining *neutral* from Time 1 to Time 2. *In fact*, neither model stands out as particularly positive or negative for the students. Before making any definite conclusions, however, further analysis was conducted on the open-ended data.

Open-ended data: Evaluating the content of student feedback about their group work experience

In addition to the rating scale data, open-ended comments on group work were also collected. Approximately 1 in 3 students provided comments about their group work experiences. Of this smaller cohort, 80% expressed negative attitudes. Tables 7.2 and 7.3 reveal the breakdown of these comments at both Time 1 and 2.

Table 7.2. Information technology students' comments about the process of group work at Time 1 and 2

Information Technology student open-ended comments	**Time 1 (*n* = 112)**	**Time 2 (*n* = 99)**	**Category**
Free riders still receive the same mark as the group/ Does not recognise variation in individual effort/quality	16	11	Negative
Need individual OR individual and group mark	7	4	Negative
Other negative comments (idiosyncratic responses)	8	5	Negative
Negative comment about group evaluation	5	0	Negative
Other comments	7	1	Neutral
Enjoyed group work/criteria was clear	2	6	Positive
Satisfactory/reasonable/neutral	0	3	Neutral
No comment provided	67	69	None

Note: At Time 1 comments provided by 26 females and 19 males. At Time 2 comments provided by 16 females and 14 males.

Table 7.2 reveals that the majority of concerns expressed by information technology students revolved around the fact that there was a single overall group mark, and that this group assessment strategy was not sensitive enough when recognising variations in individual effort. These negative comments relating to an overall group mark being allocated to every individual in the groups persisted

at Time 2. Interestingly, this cohort of information technology students also expressed some neutral and positive comments about their group work experience.

The profile of open-ended comments provided by the pharmacology students, where a peer evaluation strategy was adopted, was quite different to that of the information technology students. Specifically, Table 7.3 revealed that pharmacology students were less concerned about 'free riders' receiving the same mark as those students that put effort into the group project, and more concerned that the peer evaluation process for the allocation of marks was not anonymous. The lack of anonymity and confidentiality appeared to create further biases (i.e., reciprocity effects, pressures from friends within the group etc) in the allocation of marks to fellow group members. The proportion of concerns relating to this issue persisted between Time 1 and 2.

Table 7.3: Pharmacology students' comments about the process of group work at Time 1 and 2

Pharmacology students open-ended comments	**Time 1 (*n* = 112)**	**Time 2 (*n* = 57)**	**Category**
Lack of anonymity and confidentiality led to – people expecting reciprocal marks/giving unfair marks to friends/ pressure to marks others in a certain way	20	8	Negative
Don't like peer evaluation	1	0	Negative
Not enough range in marking	1	0	Negative
Too confusing/complicated	0	3	Negative
Other negative comments (idiosyncratic responses)	6	2	Negative
Positive comments about peer evaluation	3	1	Positive
No comment provided (none)	81	43	None

Note: At Time 1 comments provided by 22 females and 9 males; At Time 2 comments provided by 12 females and 2 males.

DISCUSSION: THE IMPLICATIONS OF THESE RESEARCH FINDINGS FOR IMPROVING TEACHING AND LEARNING

A continuing challenge for educators using group work is to ensure that it remains a positive learning experience for students. Group work is an important teaching strategy within the science curriculum as it can facilitate learning through knowl-

edge acquisition as well as developing generic graduate attributes, such as the ability to work as a team (Elliot & Higgins, 2005). The science students surveyed in this study were found to have a greater preference for group work than individual work, reinforcing the results of previous research suggesting that group work is generally a positive experience for students (Gatfield, 1999; Bourner et al, 2001; Barfield, 2003; Mills, 2003; Gupta 2004). The factor(s) accounting for the small but significant difference between the two groups, with respect to their attitude towards group work (pharmacology students mean preference for group work being lower at both time points) is unknown. However, the two cohorts did differ with respect to age and gender ratio. Pharmacology students were 2nd year undergraduates and 70% were female. Information technology students were 3rd year undergraduates and the gender ratio was 50:50. A further uncontrolled variable was the recruitment environment. Pharmacology students were surveyed as one group in the lecture theatre whereas information technology students were surveyed in groups of 20 - 30 in their tutorial rooms. This factor may explain the higher drop-out rate (see section 2.1) for the pharmacology cohort. Together these uncontrolled factors may contribute to the difference between the two groups.

Attitudes towards group work assessment, irrespective of method, were found to be *neutral*. This *neutral* attitude may explain why the method of assessment appeared to have little impact on students' perceptions of group. The observation that peer evaluation had little impact seems at variance with the general acceptance of the value of peer evaluation in enhancing group work (Lejk, Wyvill & Farrow, 1996; Lejk & Wyvill, 2001) and may reflect the concerns that students had about the type and/or how the peer evaluation method was implemented, in our study. Interestingly, a dependent samples t-test indicated that students' attitudes towards group work in pharmacology did improve slightly over the course of the study but this may have been due to other unknown factors and not peer evaluation.

Whilst peer evaluation has been adopted as a means of reducing the 'free rider' effect and improving the fairness of group assessment, little attention has been given to other factors that may improve students' feelings towards group work. The finding by Cantwell and Andrews (2002) that students who expressed a preference for individual work also reported higher levels of social anxiety, clearly needs to be factored in when managing group work projects. Our findings of a positive correlation between the preference for individual work (I) and discomfort in group-work (D) subscale confirms their finding.

The open-ended comments provided valuable information for directing educators on how to improve group work management and assessment strategies. Firstly, with regard to group assessment, Table 7.2 reveals that information technology students reported problems of inequity when, irrespective of their contribution to the group work, the same mark was awarded to each student. In contrast, students from pharmacology did not comment on inequity (Table 7.3).

Thus, peer evaluation appears to reduce students' concerns about the 'free rider' (Boud, 2001) or 'passenger' (Bourner et al., (2001) within the group. However, our study indicated that lack of anonymity and confidentiality impacts negatively on the peer evaluation process (see Table 7.3). To prevent this, we now ask students to submit their peer evaluations on-line via WebCT to ensure anonymity.

One strategy for promoting group function is to incorporate an individual student component within a group work project. We have successfully adopted this strategy in PSYC3012 - Social Psychology. Together, the group collects and analyses data and writes a research report, lacking a discussion. Each student then writes a discussion that is assessed individually. Allowing students the freedom to express their individual knowledge and ideas independently of other group members may be the necessary balance needed for optimal group functioning as has been indicated in the research literature on the importance of group goals and individual accountability (Slavin, 1999). Notably, the information technology project included a significant individual component (worth 40%) that may have contributed favourably to their preference for group work.

Whilst the ratings data showed that students had a favourable attitude towards group work, there were very few positive open-ended comments about group work. Group work is a unique learning tool, but it only works effectively if tutors have the necessary management skills. Thus, improving group management may increase the number of openly expressed, positive comments. This could be achieved via the introduction of tutor-training workshops in which the following topics are discussed: i) factors to consider when assigning students to groups; ii) communicating clear objectives and guidelines; iii) skills required by students for successful group work; iv) helping students manage their group responsibilities; and v) making explicit how the group activities help student learning. As a consequence of this study, an introductory tutor-training workshop has been integrated into the first week of the PSYC3017 Social Psychology syllabus.

In conclusion, this study indicated that group work was preferred above individual work irrespective of the method of assessment. These results are encouraging. Additionally, the open-ended comments revealed that peer evaluation eliminates problems associated with the 'free rider' concern of students when only a single group mark is allocated. Improvements in peer assessment procedures and provision of specific tutor training may further increase students' enjoyment of and benefit from group work.

Chapter 8
Assessment of understanding physics: a case study

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Faculty of Science

This is the story of a project which looked at some aspects of formal examinations in physics. It was conducted within the School of Physics by members of the Sydney University Physics Research Group, which was set up in 1992 by a group of academics with the aims of contributing to and applying scientific understandings of the processes and practices of learning and teaching physics at university level. The group adopted the view that because physics education has so many discipline-specific characteristics, research in that area is most appropriately done by physicists.

A good deal of educational research looks at what students do, how they learn and what they think, as well as the external influences that affect learning. Our original purpose was to gain some understanding of students' thinking that would enable us and our colleagues to become more effective teachers. We were thinking in terms of the well-established tradition of research and model-building about misconceptions, alternative conceptions and students' construction of their own concepts in science (Confrey, 1990; Duit & Treagust, 1998). We chose, as our source of information, answers to an exam question on a topic of some importance in all introductory undergraduate physics courses: gravity and weight.

In choosing that source of data we opened some connections to other flourishing areas of research in higher education: students' approaches to learning and, in particular, the influences of assessment practices and students' perceptions of the requirements of assessment (Struyven, Dochy & Janssens, 2005). Part of our project was concerned with the consequences of recycling an exam question, a topic about which we could find nothing specific in the research literature.

Our investigation was originally focused on students' reasoning and conceptions but as the project progressed we saw a need to concentrate more on what we, the teachers, were doing. Since our raw data were the answers to an exam question, the redirected focus was on what we as academics expect to find and reward in those answers.

THE ORIGINAL STUDY: STUDENTS' CONCEPTIONS AND REASONING

The project began in 1998 as an attempt to discover something about the reasoning patterns that students use when they answer a particular kind of exam question requiring a short written answer to a conceptual problem. That style of question had its origins in an introductory course, *Physics I (Life Sciences)*, developed at Sydney University during the 1970s for students majoring in biological sciences and related professions such as medicine. The course was innovative for its time in that it focused on applications and on the conceptual aspects of the subject rather than the traditional heavy emphasis on the mathematical derivations of results. A typical question would ask for explanations of phenomena or a descriptive solution to a problem. Over time the school started using the same style of question as one component of the exams in the more traditional courses for students majoring in physical sciences and related professions such as engineering.

To illustrate the style, here is the exam question used in our study:

> In a spaceship orbiting the earth, an astronaut tries to weigh himself on bathroom scales and finds that the scale indicates a zero reading. However, he is also aware that his mass hasn't changed since he left the earth. Using physics principles, explain this apparent contradiction.

The question was worth five marks and was allotted 10 minutes writing time in a three-hour exam worth 180 marks. It was included in the first-semester (final) exam for two different first-year courses, a *Fundamentals* course designed for students with no background in physics at the level of the Higher School Certificate and a *Regular* course for students who have previously studied the subject. One of us (MS) teaches the Fundamentals course. The original reason for including common questions in the exams for two different but parallel courses was to provide a common benchmark for evaluation and comparison of student performance in the courses. The question was chosen for our study because a good answer requires understanding and integration of the basic concepts of force, mass and acceleration which are part of the core of both the *Fundamentals* and *Regular* courses.

At first, our study focused on the kinds of understandings displayed by the students' answers. To do that a team of three researchers, including an undergraduate student, studied a sample of 100 answers from each of the two classes (200 answers altogether). We based our analysis on phenomenography, a research methodology developed by Marton (1986) and colleagues. The methods of data collection and analysis used in phenomenography are exploratory but the goal is usually to obtain clear descriptions of the data in terms of a set of categories, which is often arranged as a hierarchy. The epistemological stance is

that knowledge is subjective and relative and there are no initial assumptions about the nature of the categories which may emerge. Instead of evaluating the answers for the 'correctness' of the physics we read them with a view to identifying common patterns of description. The researchers used an iterative process of sorting the answers into groups with common features until they arrived at a consensus about the broadly different categories of answers. Those categories were then described and given labels. Further subcategories were identified, eventually yielding a three-tiered structure.

Most responses contained a comment regarding the existence or absence of gravity in the spaceship. Those comments formed the first or main tier of categories. The second tier (subcategories) contained answers that tried to justify the absence of gravity and/or explain freefall. The third tier (explanation categories) either used the concepts of mass and weight, or contained a discussion of scales and normal force to explain the absence of a scale reading. The final description of the categories, which was obtained in a later part of the study, is shown in Table 8.1, together with the number of answers in each category. Category 3, significant gravity, contains answers which include an explicit statement about a non-zero value of 'gravity' as well as many which used such a value without declaring it first. The miscellaneous category 4 contains all the answers which did not fit any of the main categories, 1 to 3. Although many of those answers mentioned the idea of gravity they turned out to be so disparate that we could not find a meaningful label for them. (Categories which are empty in this table emerged in answers from subsequent years.) The process of deriving the categories is described in detail in Sharma, Millar, Smith & Sefton (2004).

Table 8.1. Distributions of answers among the revised phenomenographic categories

Main categories with subcategories and explanation categories	**Fundamentals class 1998**	**Regular class 1998**	**Both classes 1998**
1) Gravity is zero at the spaceship. This is because:			
1.1 The weight of the astronaut is zero since the scales indicate a zero reading.	2	1	3
1.2 There is no gravity in space or the spaceship is outside the earth's g field. Described in terms of:			
a) scales & normal force.	2	7	9

Main categories with subcategories and explanation categories	Fundamentals class 1998	Regular class 1998	Both classes 1998
b) mass & weight.	42	24	66
1.3 The ship is experiencing free fall, equating free fall with gravity = 0. Described in terms of:			
a) scales & normal force.	0	2	2
b) mass & weight.	3	2	5
1.4 No reason or other reasons given. Described in terms of:			
a) scales & normal force.	1	2	3
b) mass & weight.	8	8	16
d) neither a nor b.	2	1	3
2) Gravity is approximately equal to zero at the spaceship. Described in terms of:			
a) Scales & normal force	3	2	5
b) Mass & weight	6	6	12
c) Mass & weight & free fall	0	0	0
3) Gravity has a significant value at the spaceship.			
3.1 There is no net acceleration of the spaceship due to cancellation of quantities.	0	5	5

Main categories with subcategories and explanation categories	Fundamentals class 1998	Regular class 1998	Both classes 1998
3.2 No mention of free fall …	0	0	0
3.3 The concept of free fall, acceleration at the same rate or falling together used.			
a) scales & normal reaction or contact force	13	16	29
b) mass & weight	0	1	1
d) neither or other reasons	8	10	18
3.4 Astronaut and spaceship are in free fall. Gravity inside the spaceship is zero.	1	1	2
4) Miscellaneous	9	12	21
Totals	**100**	**100**	**200**

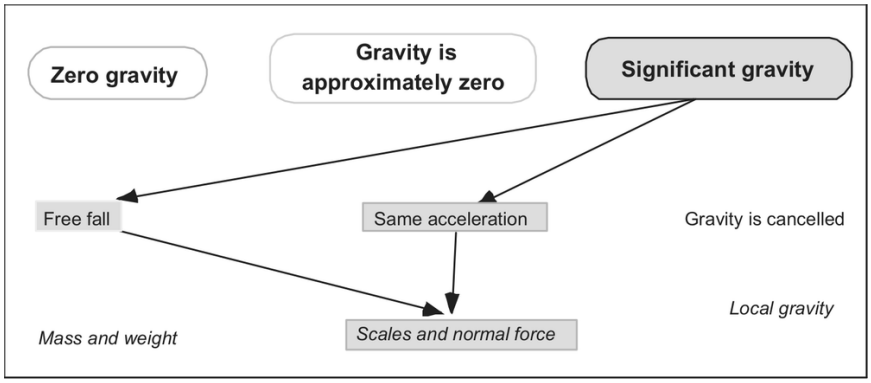

Figure 8.1. A map template for common reasoning paths and categories

As part of our original plan to understand the students' reasoning patterns we developed various maps in which we plotted all the common levels and details of

the descriptions from Table 8.1. Figure 8.1 is an example of a map which represents one kind of answer in category 3.3b, showing not only the student's main reasoning path but also the territories that were not visited in the answer. We conjecture that this representation of the many possible conceptions and reasoning paths can describe a multitude of examples on the same topic.

Although an inspection of Table 8.1 might suggest that there are more *Fundamentals* answers in the main category 1 and more *Regular* answers in category 3, statistical tests (chi-squared) gave no reason to claim any significant difference between the distributions among categories for the two classes. That result was a surprise, so we looked at the exam marks (Figure 8.2). It was no surprise that the experienced *Regular* students got better marks than the novice *Fundamentals* students but the marks also showed that the exam question was a tough one for both classes. A chi-squared test on those marks distributions suggests that the chance of getting those differences in marks by accident is about 0.2% – a statistically significant difference. Some details of the examination procedures are relevant here. One lecturer in the *Fundamentals* course wrote the question, the course director compiled the marking scheme and another lecturer in the *Fundamentals* course marked all the answers from both classes. Standard practice for marking first year physics papers is to appoint a panel of full-time lecturing staff as markers who gather in the same room during scheduled marking sessions. The work is divided so that all answers to the same question are marked by one person. The aims of that arrangement are to encourage concentration on the task by the markers and consistency of marking within each question, with the hope that variations in standards among markers will be averaged out for each complete paper – a process which is more economical than multiple marking.

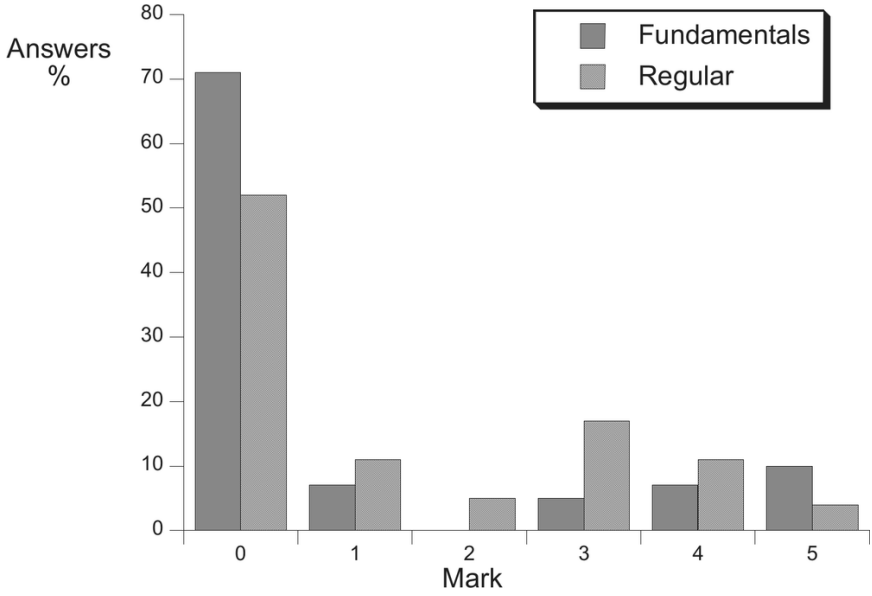

Figure 8.2. Marks for the sample of answers from the two classes, 1998

One point worth noting is that the official marking scheme, which would get a mark of 5, sits clearly in category 3.3a. So, although the original categorisation of the answers ignored the difference between correct and incorrect physics, a physicist can quite easily spot good and bad kinds of answers in Table 8.1. This apparent discrepancy, between the power of our category analysis and that of normal exam marking to distinguish between two different classes of students, leads to several new questions about what actually happens during the marking process, some of which we have followed up. Explicit comparisons of this kind between the power of phenomenographic studies and exam marking to distinguish between groups of students appear to be rare; the only instance that we have found is a study by Dahlgren (1978) of concepts in economics, cited by Gibbs, Morgan & Taylor (1982). First, however, we look at another line of investigation: what happens when a question like the one in this study is repeated in subsequent exams?

RECYCLING THE EXAM QUESTION

We have often heard it said that telling students what is in an exam or repeating old exam questions makes no difference to overall student performance. On the other hand, informal and anecdotal evidence suggested to us that many students

do use past exam papers as a guide to study. If that practice is both widespread and effective then one would expect to see some improvement in the answers to recycled questions. To our surprise, a search of the literature failed to turn up any specific research findings on the issue. To test our conjectures we put exactly the same exam question into the *Fundamentals* exam for another two consecutive years and classified all the answers using the phenomenographic categories from our original study. To help in this work, two undergraduate students joined the project. While the answers were being sorted we re-evaluated the categories, which yielded some minor changes. Full details of this part of the project may be found in Sharma et al. (2005).

Note that the particular exam question was not discussed in lectures, practical classes or structured tutorials and no model answer was published. Students were given no advance warning of the content or topics of the exam questions. Any specific knowledge of the question and its acceptable solutions that students may have had before the examination is therefore likely to have been gained by informal means, such as the student grapevine and individual study of past papers which are available in the university library.

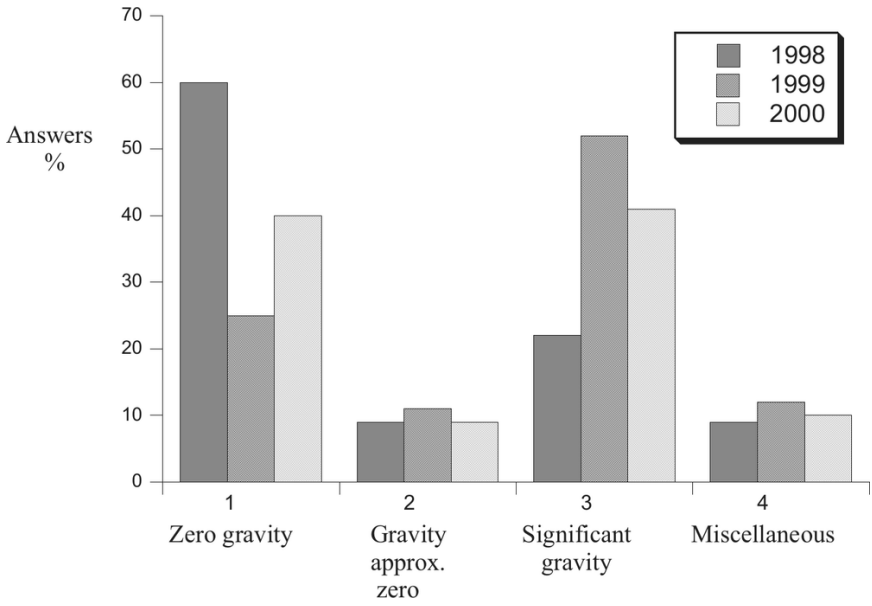

Figure 8.3. Percentage of answers in the main categories for the three years

Figures 8.3 and 8.4 show what happened. In terms of the main categories of answers, there is a shift between 1998 and 1999, from saying that gravity is zero at the spaceship to saying that it is significant. That was followed by a partial shift

back, between 1999 and 2000, to the earlier view. We have already noted that the subcategory which is congruent with the accepted 'correct' answer is 3.3 in Table 8.1. The popularity of category 3.3 doubled from 1998 to 1999 and almost maintained its new level in 2000. So it would seem that repeating the question did produce better answers the first time it was used, but not subsequently. Could it be that students thought that since the question had been recycled once we wouldn't do it again?

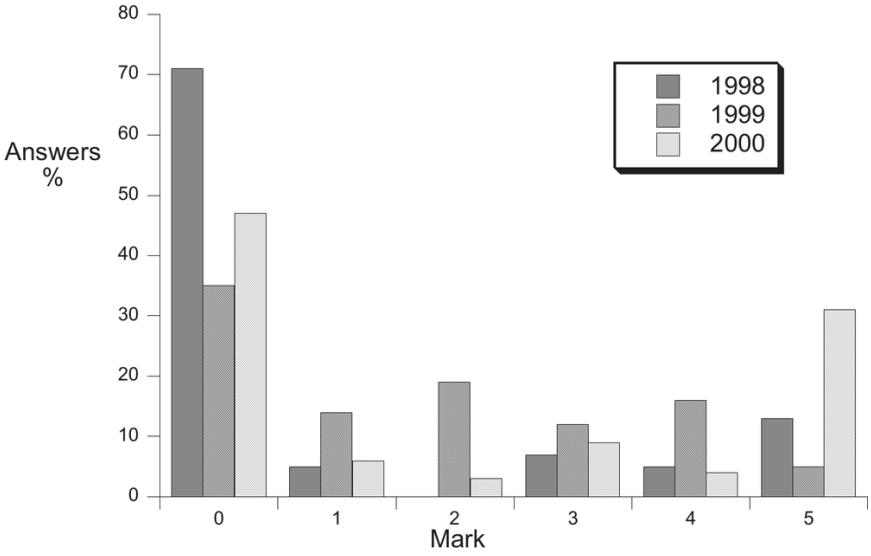

Figure 8.4. Distribution of exam scores over the three years

Although the question was recycled, the marker was not; new markers assessed the 1999 and 2000 exams using their own marking schemes. The differences in the patterns of marks (Figure 8.4), which are all statistically significant, are more startling than would be expected from the evidence of the changes in the categories alone. The shift, from 1998 to 1999, towards the more correct or 'congruent' category of answer was accompanied by a decrease in the number of students who got a mark of at least 3 out of 5 (Table 8.2) and an increase in the mean mark. These opposing trends in marks statistics are a consequence of the different patterns of distribution of the marks (Figure 8.4). It is also notable that the official marking schemes were different. Unlike the case in 1998, the markers in 1999 and 2000 generated their own marking schemes which were quite different in character. The scheme for 1999 consisted of an outline for a model answer, suggesting a holistic approach to marking, whereas the scheme used in 2000 was in the more conventional style of allocating marks for pieces of an answer. All

three markers had previous experience of marking first year papers. For more details see Sharma et al. (2005). The reasoning patterns and criteria used by markers clearly warrant further investigation.

Table 8.2. Comparison of marks and congruent answers

	1998	**1999**	**2000**
Mean mark ± standard error	1.07 ± 0.13	1.73 ± 0.11	2.10 ± 0.14
Students with 3, 4 or 5 marks	24%	20%	35%
Answers in the congruent category 3.3	22%	46%	38%

A NEW FOCUS: MARKERS AND MARKING

The realisation that a phenomenographic view of students' answers and the marks that they get for those answers are poorly correlated – divergent even – redirected the focus of our project to the process of marking itself. Working with another undergraduate student researcher, we embarked on some alternative analyses of our original sample of scripts to see if we could find some characteristics of good and poor answers as seen by the original marker of the 1998 class. Recall that the original study showed that the marker found a much bigger difference between the answers from two classes than that revealed by our phenomenographic categories.

We set up some hypotheses about features of the answers, other than simply being right or wrong, which might influence the mark awarded. We identified two factors that may independently influence the mark: fluency in the jargon of physics (for which we coined the term 'PhysicsSpeak') and the use of diagrams. There are some extraneous factors that could influence the outcome of the marking. For example, standard marking practice was to work through the bundle of scripts from each class separately, so that the marker would be unavoidably aware of the class for each student. The first step in a finer analysis of the answers was to type them all, with scanned diagrams where appropriate, into a computer database. In order to study the role of PhysicsSpeak we used computer scripts to identify and tally individual words and phrases, with automatic allowance for incorrect spelling and other trivia. From those tallies we selected items that we recognised as part of PhysicsSpeak and looked for differences in usage of those items between the two classes. Figure 8.5 shows the most popular items – those that were used in more than 20% of all answers, together with some related phrases. The most popular PhysicsSpeak words were the equality symbol and 'gravity'. Note that the word gravity did not appear in the exam question but

it had emerged as a key word in the earlier description of the phenomenographic categories.

We calculated probability values for a chi-squared test to see whether the use of each term by students in the two classes was different. There are only a few significantly different items; p-values of 0.05 or less are marked on the plot. The most significant difference in usage is the numerical part of the value of the quantity known as g at Earth's surface (9.8), which was about twice as popular with the Fundamentals students but it turns out that numbers have nothing to do with a good answer in this case.

Both groups liked using the abstract noun *acceleration* but shied away from the verb forms of the same idea, more so the Fundamentals students. Figure 8.5 also shows associations between items of PhysicsSpeak and marks. Now we see clearly that the best marks are associated with the verb 'accelerate' and with the concept of free-fall, terms that were used to describe the phenomenographic category 3.3 (table 8.1). We concluded that although there are differences in the use of PhysicsSpeak between the classes they are not sufficient to explain all the differences in marks. We also found a small trend to higher marks for more wordy answers, a trend which was the same for both classes.

The hypothesis that the inclusion of diagrams in an answer is associated with higher marks is supported by the data in Table 8.3. On average, pictures are associated with an advantage of about one mark. Of course this may be saying no more than that diagrams are an important part of a good answer, but we also found that the more experienced *Regular* students draw more diagrams than their colleagues in the Fundamentals class; 40% of *Regular* students in our sample included at least one picture compared with only 16% of the *Fundamentals* sample.

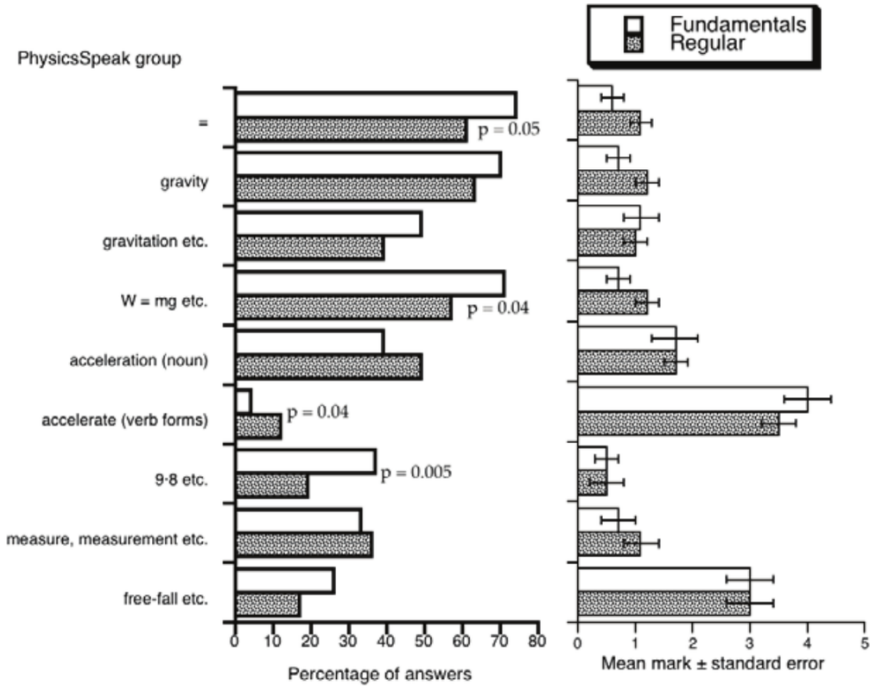

Figure 8.5. Frequency and marks for selected PhysicsSpeak phrases

In looking for other factors which may have contributed to the difference in the marks distributions for the two classes, we scrutinised individual answers for evidence of features that may have produced low marks for Fundamentals students, but could find none.

In summary, we think that we have identified some general features of students' answers, other than straightforward correctness, that contribute to good marks, but we still do not understand all the reasons why a phenomenographic approach did not produce a strong distinction between the two classes whereas the exam marks did.

Table 8.3. Diagrams and mean marks

	Fundamentals	**Regular**	**Both classes**
Answers with pictures	1.4 ± 0.5	2.0 ± 0.3	1.8 ± 0.2
Answers without pictures	0.9 ± 0.2	0.9 ± 0.2	0.9 ± 0.2
Totals	1.0 ± 0.2	1.4 ± 0.2	1.2 ± 0.1

WORK IN PROGRESS

We have data from a recent fourth use of the astronaut question in the exam for the *Fundamentals* course and, for the first time, the first-year *Advanced* course. All answers from both classes are being analysed using the existing phenomenographically-derived framework. This time we have better control of variables: the scripts were marked by the same person who assessed the 1998 papers and he was given the same marking scheme. Our analysis uses copies of the scripts from the two classes that have been mixed into a random sequence, with all evidence of the mark awarded and the student's class removed. (Those precautions were not taken in our original study because, at that stage, we were not interested in either the marks or the student's course.) When the categorisations have been completed we will then look at the marks and repeat our earlier studies on correlations between categories and marks, differences between classes, the use of PhysicsSpeak, the value of diagrams and other features.

DISCUSSION

The apparent discrepancy between our category analysis and exam marking in making comparisons between different classes led us to wonder if our category analysis was missing something. Granted that the phenomenographic approach did not consider correctness, were there some other factors that it missed but nevertheless influenced the exam marker? We have some preliminary evidence that some items in the technical language of physics may be important, independently of correctness, but we need to do more work on that idea. We also have evidence that the use of diagrams in answers helps in getting marks, but that idea needs to be tested in a wider context, using different questions.

The fact that the most common broad category across all three years is the absence of gravity in space reinforces a theme that emerges from the whole body of misconceptions research: most students hold some very robust alternative conceptions, which persist even when teachers confront such supposed misconceptions directly. (Confrey, 1990, pp. 10, 43-44, 46). It does seem, however, that the first repetition of the exam question in 1999 was associated with a considerable shift in conceptual understanding. Exactly how that may have happened we do not know, but if the connection between the recycling and improved understanding is real then we have a new research question: precisely how do students use problems from past exam papers? Do they merely use them as a guide to topics for study, as suggested by Entwistle and Entwistle (2003), or do they actually work through the problems? Our results suggest that there may be a significant number of students who do practice answering the old questions. We advocate a more detailed study of students' approaches to preparing for physics exams. A

study like that needs to be based initially on interviews and surveys with follow-up studies to evaluate the success of the students' strategies – connecting their exam answers with their study methods.

Finally, although it is clear that there are significant differences in the way that answers across the three years are spread among the phenomenographic categories, it is plausible that part of the variation in the patterns of marks may be attributable to differences in markers and marking practices, not just to differences in students' answers. That hypothesis raises some research questions which, we think, have not been covered well enough in the literature to date. Although the general problem of inter-marker reliability has been recognised for many years (Cox, 1967; Elton & Johnston, 2004) we believe that there is a need for some deeper studies on the actual, rather than ideal, principles and practices of marking exams, with specific reference to physics. Although it can be argued that there are better ways of assessing learning (Gibbs & Simpson, 2004) we can assume that physics exams will be used for a while yet. There is a need to find out what experienced teachers and markers actually do when they evaluate answers to qualitative-reasoning questions like our example of the astronaut's weight. We need to discover whether there are self-generated principles that guide the behavior of markers and, if those principles do exist, to what extent they match the wisdom of guides to good academic practice such as that by Biggs (1999). Such questions may be answered by collecting information directly from experienced markers about the ways in which they evaluate a variety of selected answers.

IMPLICATIONS FOR TEACHING, LEARNING AND ASSESSMENT

Quite apart from the variations in our results, the initial analysis for the classes of 1998 certainly produced insights into students' conceptions and those insights influenced the members of the project team who were also teachers and examiners of the *Fundamentals* course. Discussions among the teaching team led to revision of the content of those lectures and workshop tutorials which dealt with concepts of weight, gravity and orbital motion, with particular effort to counteract the idea that there is no gravity out in space. For example, lecturers introduced examples using extra concepts, such as buoyancy and the vacuum, which were explored in relation to the topic of free-fall. On a broader scale, insights from our analysis of reasoning patterns about the exam question was one of the stimuli that led to the development of interactive learning activities in our large lecture classes using classroom quizzes about gravity and other topics. Since our department acquired an electronic classroom response system, those quizzes have become a regular part of our teaching, but the design and content of the quizzes would not have been the same without the understandings gained from this research project. We

think that the act of doing research on students' understanding almost inevitably leads to a more learner-focused approach to teaching.

Analysis of exam answers using the techniques described here can be applied and extended by practicing teachers in many areas of physics and the other sciences. It has potential as a useful tool for understanding students' thinking, with consequent improvements in teaching and learning. Phenomenography, in particular, can produce complete, organised, summaries of the variety of students' reasoning about specific important topics. We consider the analysis of assessments to be a more authentic way of capturing variations in students' conceptions than those studies which ask students to respond to questions designed by an external researcher.

Furthermore, such analyses may be used to inform badly-needed studies of the details of marking practices. An independent value-free set of answer categories may provide a reference framework for evaluating patterns of marks and marking practices. For example a high degree of coherence between categories of answers and marks or a marking scheme might be interpreted as an indicator of validity.

We also suggest that, contrary to received wisdom, the practice of repeating judiciously selected exam questions (such as those requiring reasoning rather than recall of facts) and analysing the consequences can be a tool for monitoring genuine improvements in the amount of learning that takes place within a course, whether those changes are caused by improved teaching or by greater student awareness about important examination topics (Entwistle & Entwistle, 2003).

We plan to continue the project with a view to collecting concrete evidence, of the kind respected by physicists and other scientists, about what actually happens in examinations. One of our ultimate aims is to drive an evidence-based process of change in the way that we, and other science departments, conduct examinations.

ACKNOWLEDGEMENTS

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PART III

RESEARCHING STUDENTS' PREPAREDNESS FOR UNIVERSITY STUDY

Chapter 9
Students' experiences of learning in the operating theatre

Patricia M. Lyon

Faculty of Medicine

The research reported in this chapter draws on the work for my PhD (Lyon, 2001) completed whilst I was working in the Discipline of Surgery within the Faculty of Medicine. Employed as an educationalist, my role was to advise on effective teaching and learning strategies in clinical education. As part of their surgical studies, students rotate through a series of hospital attachments related to various specialties where they assist and observe the team management of patients, on wards, in clinics and in operating theatres. This is common practice in surgical education in medical programs around the world, and is founded on the apprenticeship model of learning. The emphasis, for the most part, is on learning the principles of surgery through involvement in patient care and the clinical activities of the specialty, supported by clinical tutorials. Students attend the operating theatre with their patient to observe the procedure when an operation is the chosen management option. They learn about the principles of management and postoperative care. They are not expected to have a thorough understanding of the technical details of surgery nor to develop technical skills in the operative procedure itself.

In my role as educationalist I was keen to find out how the surgical attachments were perceived by the students. I saw my role as assisting clinical teachers to focus on and interpret their students' experiences as part of the process of developing their teaching, as suggested by Prosser and Trigwell (1999). Through understanding the students' perspectives we are '… better placed to make sense of their engagement with and reactions to educational settings' (Taylor, 1994, p. 71). Data from student feedback questionnaires had indicated positive ratings for most features of the surgical program but mixed ratings on items relating to the operating theatre. Theatres offer considerable potential for medical students to construct a 'clinical memory' (Cox, 1996) by integrating tactile sensations of live pathology with visual images and verbal learning. They present an opportunity to observe real clinical problems and surgical decision making, to begin to appreciate what surgery means to patients, and to gain important insights into multi-professional teamwork. Despite its potential, the students had very mixed

opinions on its value for their learning. I arranged a student focus group to explore the issue. I had allowed one hour but 1.5 hours later we were still talking. A rich story began to unfold as students described the challenges for the learner in the complex and highly charged workplace of theatres.

A search of the published literature for educational studies in this setting provided little guidance on best practice. Whilst surgical educators have written at length about the characteristics of surgical attachments, the focus, for the most part, has been on curriculum content and objectives; assessment; and effective teaching at the bedside, on ward rounds and in clinics. In terms of reported studies we know the least about teaching in the operating theatre (Dunnington, DaRosa & Kolm, 1993, p. 523). What literature does exist is largely normative in character and focuses on teachers' perspectives with surgeons emphasising the potential of the operating theatre and its under-utilisation for clinical teaching. The small number of published empirical studies are also largely teacher focused, with the aim of identifying appropriate content and effective teaching behaviours to inform faculty development (Cox & Swanson, 2002; Dunnington et al., 1993; Hauge, Wanzek & Godellas, 2001; Lockwood, Goldman & McManus, 1986; Scallon, Fairholm, Cochrane & Taylor, 1992; Schwind et al., 2004).

The literature on effective teaching and learning in higher education assumes that the teacher has the capacity to change the learning milieu to meet the learner's needs (see for example, Ramsden, 2003) but the operating theatre is a workplace where patients' needs, and not the needs of students, come first. When medical students attend the theatre they become 'peripheral participants' in what Lave and Wenger (1991) describe as a 'community of practice'. In this context they need to be able to make the most of their experiences. Managing their learning in the complex and unpredictable reality of the operating theatre is more akin to strategies used in workplace learning than in other contexts in higher education. It is the literature on learning in work-based settings that proved to be the most relevant in the analysis and interpretation of the findings reported here.

METHODS

This study is focused around two main research questions: How do students learn in the operating theatre? and; How can students be helped to make the most of their learning in the operating theatre? The research consists of an interpretive case study using multiple methods including observations in the operating theatre on 12 separate occasions, two group interviews with 7 students, 15 in-depth student interviews, and 10 in-depth interviews with surgeons. Students were selected randomly for the in-depth interviews, but the more personal approach of snowball sampling (Merriam, 1998) was adopted for the surgeons. The interviews were unstructured and relied on the technique of 'funneling' (Minichiello, Aroni,

Timewell & Alexander, 1995, p. 84). This involved starting the interview with an open-ended invitation to the surgeon or student, for example, 'Tell me about your experiences of teaching/learning in the operating theatre', and then guiding them, as necessary, towards specific issues. Theatres were selected to represent the main surgical attachments in the medical program.

Qualitative methods were chosen to uncover the students' perceptions of their experiences of learning in theatres, 'to gain access to the motives, meanings, actions, and reactions of people in the context of their daily lives' (Minichiello et al., 1995). These were combined with a questionnaire administered to one cohort of 197 out of 237 students (i.e. a response rate of 83%). The questionnaire was designed to locate the students I had interviewed, within the larger student cohort. Questionnaire items were derived from the analysis of data from the focus groups and in-depth interviews.

Typed transcripts of the interviews together with the field notes from the observations were coded and retrieved using computer software to manage non-numerical unstructured data. The data were analysed using the 'immersion/crystallisation' approach (Miller & Crabtree, 1992, p. 19). The aim was to identify the themes that characterised the case. Conceptual labels were developed using the constant comparative method (Strauss & Corbin, 1990). The questionnaire data were analysed using SPSS for Windows (Statistical Package for the Social Sciences).

MANAGING LEARNING ACROSS THREE DOMAINS

The 'core category' (Strauss & Corbin, 1990, p. 121) derived from data analysis, which illuminates what the data were essentially about, was that of 'managing learning' in the operating theatre. In the early years of the medical program students acquire skills in managing their learning in traditional teaching sessions, at lectures, seminars and tutorials. They know how to make the most of these learning opportunities. The operating theatre represents a new and unique challenge. It is a professional workplace setting where the surgeon performs surgical procedures working with a team of highly trained anaesthetists and nurses. In order to make the most of this experience, students need to find ways to manage their learning across three related 'domains' (Lyon, 2003) each with its own challenges (see Figure 9.1).

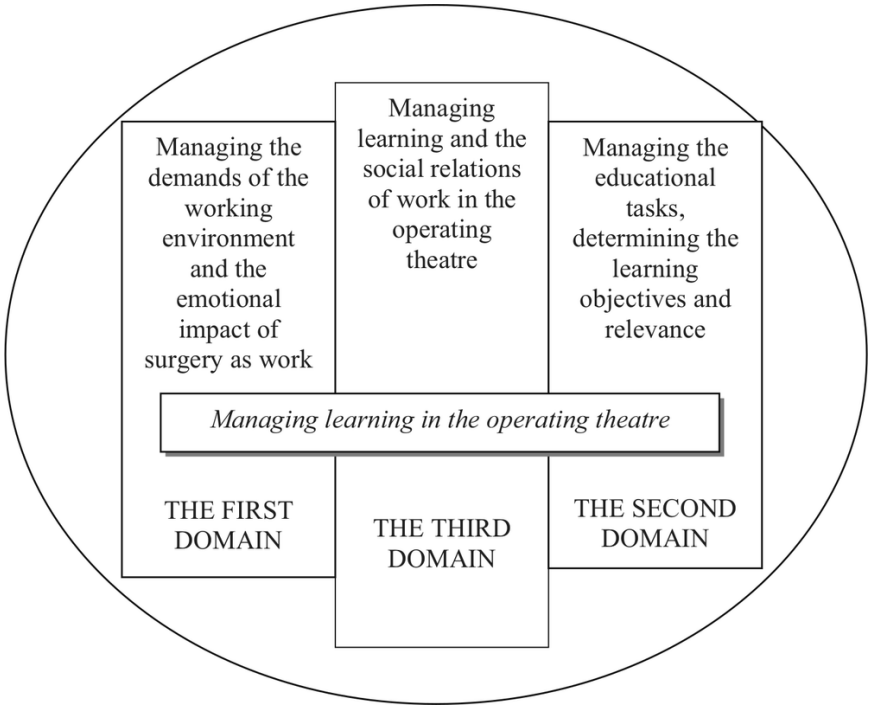

Figure 9.1. Managing learning across three domains

The first domain: Managing the demands of the workplace environment

The operating theatre is a noisy, busy and sometimes tense working environment. Students have to learn to negotiate the physical environment of the operating theatre with its designated spaces, some sterile, some non-sterile, each designed for a specific function; to learn the many theatre protocols; and to familiarise themselves with the culture. It can be intimidating. This is in part, because of the fear of doing something wrong and adversely affecting the patient outcome. In part, it is the fear of appearing foolish in front of a team of experienced professionals. More than 70% of students indicated their agreement with the questionnaire item, 'It's easy to be made to look a fool in theatre'. One student at interview commented:

> You can make a fool of yourself if you make a bold statement and you really didn't have a clue … So, You'll say, 'Would that be the …?,' this is what I was saying before, you've got to be fairly sure you're right if you're

> going to ask them to explain the anatomy to you because you don't want to be made a fool of … You can make a fool of yourself if you don't know the anatomy of the operation. You can make a fool of yourself if you don't know the etiquette of green, and you don't know the etiquette of sterile fields. Initially when you haven't scrubbed much you're reticent to ask to scrub just simply because it is a ritual you're unfamiliar with and everybody's going to be watching you and you don't want to look clumsy. That's something that you've got to overcome, … and you just keep on doing it and doing it and OK you might have to make a fool of yourself, ten, twenty times maybe, you know, before it's absolutely down pat. (Student 5)

Students have to learn to cope with the emotional impact of surgical procedures and the tensions that arise amongst the various players in the theatre when complications arise. Thirty-eight per cent of students indicated that they found the tension 'disturbing' in half or more than half of the theatre sessions they attended. Surgeons are mindful of this tension and the effect on the student:

> You [the student] are faced with a series of things that are really quite alarming. To see the first operation, … it is a fairly disturbing thing for most people. … In general it's frightening, and, … if you are watching something major, the amount of tension and emotion that is generated, is also very disturbing. You come to feel that this emotion must mean that there is something going wrong, and all this display of temper means that you'll never get out of this situation. (Surgeon 1)

Over the course of time, members from the three professional groups (anaesthetic, nursing, and surgery) in any particular theatre come to share a common history, a team culture with shared norms, routines, ground rules and humour. Students, rostered for four weeks at a time to the various surgical attachments enter this setting as a newcomer with no clearly defined role to play in the team. In response to the questionnaire item, 'I have no clear part to play in the team', 48% of students indicated it was the case in all or most of the theatre sessions they had attended with a further 22% finding it to be the case in about half of the sessions they attended. For students the experience is often one of being a nuisance, an outsider, and of getting in the way.

> You stand around a lot – you know you really feel very out of place and just like a nuisance more than anything else. You have learning needs but you aren't actually useful in any way … you just feel unnecessary. (Student 2)
>
> I was just going home in tears at the end of the day because I was just feeling like I didn't know why I was meant to be there. (Focus Group 1)

> [Descriptive note] The student tells me that the registrar had said to them earlier that they should be useful if they come to theatre but 'What can we do?' asks the student. He says the registrar had told them not to be 'parasites' and not to get in the way. (Observation 7)

The extent to which students are able to manage these challenges has a significant effect on what they learn from their experiences.

The second domain: Managing the educational tasks

Students who reported useful learning experiences came to the operating theatre well prepared with a positive intent to learn and were able at interview to clearly articulate the learning objectives as they saw them, and the relevance of going to theatre, whilst attending to the assessment requirements. At the time of the study the learning objectives were not clearly spelt out in any of the curricular documents, yet the majority of students could see the relevance of attending theatres.

Statistical analysis of the survey data indicated a significant correlation ($P<0.01$) between students' perception of the importance of understanding what happens during surgery, and their perception of the usefulness of time spent in theatre. Interestingly, students who had no intention of pursuing a surgical career could nevertheless see value in attending theatres. Those planning to be general practitioners or planning a career in medicine could see its value as preparation for internship, and for their later professional practice, when they will need to explain surgical procedures to patients:

> I don't ever imagine I'll be a surgeon … but knowing how they actually do an operation is useful because patients always ask you how they're going to do it. And you can only tell them if you've seen it. So I think that's very useful to know. [Patients ask] how long is it going to take and what position am I going to be in and all those things, they just don't appear in textbooks, you have to have seen it. (Student 2)

At the time of the study, students were required to complete various assessments including case histories based on patients they had studied. (With the introduction of the new graduate-entry medical program students are no longer required to submit case histories.) Students were critical of the workload and time involved in relation to the small percentage of marks allocated to these in the overall assessment scheme. Students were conscious of using time efficiently given their perception of what was needed to pass the final examinations. Learning from the operating theatre requires time: the time it takes to get changed and find the right theatre; the time it takes waiting for one's patient to arrive; and the time waiting between operations:

> The only problem with learning in theatres is that it takes so much more time, because you have to spend all that time waiting around, scrubbing up, and I think you do most of your learning in the first half of the operation … but you have to stay on to watch all the stitching and everything … (Student 14)
>
> … a lot of people would prefer to do that [studying from a textbook]. [It's] not that they're not interested but simply because at the end of the year comes the exams and the way the exams are structured it's much more beneficial to do this [than go to theatre]. (Focus group 1)

Students at interview were able to articulate their *own* learning goals when prompted which suggests that it is up to the student to define the objectives in relation to what they want to learn from the operating theatre, but given the unpredictability of their experiences, they need to be able make the most of their experiences whether positive or negative.

The third domain: Managing learning and the social relations of work

Medical students are at the end of the training queue in large teaching hospitals, behind interns, residents, registrars and surgical fellows. Whilst some surgeons will promote the medical student in the queue, as and when appropriate, 'sponsoring' the student and inviting him/her to scrub up and stand at the operating table, most students find they have to promote themselves, to earn a place in the team. Students who report getting the most out of their experiences learn to negotiate the social relations of work in theatre, to participate in the community of practice (Wenger, 1998) constituted by the operating theatre and its personnel. Students 'size-up' the learning milieu. They engage in a reflective process 'in which what is perceived is processed by learners and becomes the basis of new knowledge and further action' (Boud & Walker, 1991, p. 19). They reflect on the cues in the learning milieu of the theatre as they see them, sizing up the opportunities and challenges and making choices about their learning behaviours. This reflective process, which Boud and Walker refer to as reflection-in-action is the key to understanding experience-based learning. Central to the reflective process, they suggest, are two important aspects of the learning experience; *noticing* and *intervening*.

In one sense *noticing* is a central objective of the student's experience of attending theatre, where noticing is defined narrowly to refer to learning through observation of the surgical procedure and management of the patient. The operating theatre affords all students the opportunity to learn from observing the procedures, more or less, depending on their view of the operating field. Some students exploit the opportunities further. They notice not only the procedure but

what is happening in and around them. They take stock, sussing out the responsiveness of the surgeon. They take note of the attitude of the nursing staff; the emotional climate; the busyness of the theatre; the norms of the team with respect to rules of dress, etiquette and infection control; and the likelihood of a place at the table. They notice and reflect on how the surgeon treats other more senior surgical trainees. They are looking for 'student-oriented' theatres with surgeons who are willing to teach and sponsor them for a place in the team.

Where and when they consider it 'safe' and appropriate, they initiate interaction. They use a number of strategies or interventions (Boud & Walker, 1990) to influence their experience. These may include going forward and introducing themselves confidently, explaining why they are there and their interest in the case; assisting with the patient preparation without being prompted; asking directly to scrub in and assist; asking intelligent questions about the radiology; behaving professionally and presenting themselves as a legitimate learners worthy of a training place. They intervene, tailoring their approach to the demands of the particular theatre and its personnel, becoming 'active co-constructors' of their opportunities to learn (Taylor, 1996, p. 235).

> I do think you have to be quite assertive. You really have to go up to the surgeon and say, 'Hi, I'm so and so, and I am really interested in this. I would like to assist if you can possibly let me. I really want to see this or that'. And that, they respond usually quite well to. The student who goes into theatre and doesn't say anything and stands in the corner generally doesn't get very much out of it. (Focus Group 2)

Students who come to theatre with a positive intent to learn promote their presence as learners 'earning points' (Surgeon 10) by showing interest, preparedness, motivation, or prior experience, by behaving professionally and having the confidence to initiate interaction:

> (I questioned the student about whether she asks to scrub in or waits to be invited.)
>
> I guess I'd ask, … as long as I was in a situation where I was … had enough credibility to ask, I'd seen the patient before and knew something about what's happening and it was an appropriate operation to scrub in on.
>
> (I asked her how she establishes 'credibility'.)
>
> You see the patient beforehand, you know all about their story and physical signs (for when you're asked), maybe you've seen the surgeon before in unit meetings or on ward rounds. Perhaps the surgeon knows you by name and you've turned up on time, behaved professionally, told them who you are and they trust you (Student 3)

If the student is successful in achieving legitimacy, and if the surgeon trusts and has confidence in the student's ability to assist, he/she will act as a sponsor or advocate, when the situation is appropriate, creating a legitimate role for the student to play as a 'peripheral participant' (Lave & Wenger, 1991) with the potential for positive learning outcomes:

> … after my orthopaedic experience [overseas elective], when I did orthopaedics back here and I showed interest in it they actually let me participate in it … I mentioned to him that I did a bit of orthopaedics previously … and basically … it came out that I had some theatre experience … He showed me a couple first and when he felt comfortable that I knew what I was doing, and he was able to supervise me in case something went wrong, he let me in, allowed me to do it and it was pretty good. (Student 9)

Establishing credibility, negotiating a role to play, and having that participation supported and acknowledged as legitimate, is crucial to student learning in theatres. Survey data lend additional support to the analysis of data from observations and interviews, showing a significant correlation between questionnaire items indicative of students negotiating a role in the team, the willingness of surgeons to teach, and students' perception of the usefulness of time spent in theatres.

STRATEGIES TO PROMOTE EFFECTIVE LEARNING IN THEATRES

Models of learning from experience share a focus on reflection that they owe to David Kolb who provided the groundwork for modern experiential learning theory with his experiential learning cycle (1984). For Kolb, learning was grounded in experience and reflection on that experience. In the research reported in this chapter it is the students' capacity to reflect on their experiences of the operating theatre and act on the basis of that reflection that crucially affects their learning (Lyon & Brew, 2003). The model of learning from experience and of reflection in learning developed by Boud and colleagues (Boud, Keogh & Walker, 1985; Boud & Walker, 1991) from their research on work-based learning situations, was selected for its relevance in understanding students' responses to the operating theatre as a workplace, as well as for suggesting ways in which learning in professional contexts such as the operating theatre can be enhanced.

In their model they identify three stages of reflection associated with experiential learning activities: preparation for the event where the focus is on the learner and the learning milieu and the development of skills and strategies for reflection; reflection during the event with a focus on noticing and intervening;

and subsequent reflection after the event (Boud & Walker, 1991). Curricular initiatives which have been tried, planned and suggested in relation to these three stages will be described (see also Lyon, 2004).

Preparation for the event

Here the focus is on preparing the student for what the event has to offer which includes equipping them with strategies to assist them with their own reflection-in-action, i.e. strategies to help them to *notice* what will be occurring in the event, what situations they are likely to encounter, appropriate modes of dress and behaviour, what opportunities are likely to be found and in particular how to *intervene* usefully to make the most of the opportunities.

Three initiatives have been introduced to help medical students to prepare for theatres: a session in the hospital orientation program designed to alert students to the complexity of the workplace, to point out the relevance and potential of learning from the theatre and to show how previous students have intervened to use the opportunities, drawing on data collected for the research reported here; a half-day interactive teaching session conducted in the theatre suite which includes handwashing, gowning and gloving, theatre protocols, basic surgical instruments, and an overview of the steps typically involved in an operation; and a new section of text in the student handbook outlining the learning objectives together with a list of 'must see' operations.

Reflection during the event

Here the focus is on helping students in theatre to engage with the learning experience, to *notice* and to *intervene* to promote their own learning. Sometimes in theatre a senior registrar would be conducting the operation under the supervision of the senior surgeon who, when the operation was running smoothly would be free to direct students to *notice* things that might have otherwise have gone unnoticed, to assist the interaction between the learners and the learning milieu. In one particular interview a student recalled an occasion where the surgeon, alert to the learners' feelings, changed the learning milieu from within by limiting the aggression of another member of the team, assisting the learner to resolve negative emotions which inhibit noticing.

So the surgical and nursing staff have a role to play to help students make the most of their experiences. The findings from the research reported here have been presented at departmental meetings at various faculty committee meetings, to clinicians and allied health staff participating in the Master of Medical Education Program, at University of Sydney College of Health Sciences conferences, and more widely at medical education conferences, with interactive sessions to help clinical educators think about how to engage students more fully with the

learning experience.

The student handbook, mentioned earlier, now includes an intervention to assist students to monitor and reflect on their learning in action. It includes a template to help them make a written record to capture the learning event and is designed for students to take with them to theatres, to help them focus their attentions and to remain focused.

An additional way to enhance students' reflection in action is to help them to understand the model of reflection itself. This can be a useful way for them to extend their repertoire of responses in the operating theatre. So teaching the model to students is a suggested way of highlighting to them the importance of reflection as a way of helping them to manage their learning more effectively. Students who can apply Boud and colleagues' models of reflection and learning from experience to their own practice will be better able to manage their learning in complex settings.

Subsequent reflection on the event

Here the focus is to help students to process their experiences and to extract, consciously, learning outcomes from them. Three elements have been identified as helpful: returning to the experience, attending to feelings, and re-evaluation (Boud, Keogh & Walker, 1985). It did seem that the medical students in the study reported here had given some thought to their experiences, in respect of the first two elements, prior to attending the interview, maybe in preparation, and some said they had talked through their experiences with their peers. Some recalled times when surgeons had used the time in the lunch room to engage the student in reflecting on the morning's theatre session, or the next day on the ward or in a follow up tutorial.

Whilst the individual learner can work through the three elements alone, trained facilitators bring a range of techniques to help learners deal with challenging situations. A facilitator can assist students to deal with negative experiences which distract from further learning by helping them to express these feelings and then by discharging or transforming the feelings. Boud and colleagues argue that some of the benefits of reflection may be lost if they are not linked to action. In the new graduate-entry medical program students write a reflective portfolio, often revealing strong feelings about clinical events they have witnessed or been a part of, including experiences in the theatres. Follow up portfolio interviews conducted by faculty staff provide a formal opportunity for all students to re-evaluate their experiences and to make a commitment of some kind on the basis of their learning, in preparation for new experiences. Interactive personal and professional development workshops have been introduced to help students develop skills to deal with challenging clinical environments. In addition, interprofessional learning projects have been developed where medical students work

in the clinical setting with students from nursing and the allied health professions to help them develop effective team skills.

IMPLICATIONS FOR PRACTICE

It is useful to think of a spectrum of learning behaviours in theatres. At the one end of the spectrum are behaviours which demonstrate little or no attempt to engage in learning. These behaviours are indicated when students take up a passive role as unscrubbed observer standing back against the wall, making no attempt to extend or test their knowledge, looking bored and seemingly uninterested in anything but being seen by the surgeon to have their attendance recorded. At the other end are more active or more adaptive learning behaviours – best indicated by students who engage in a reflective process, successfully managing their learning across the three domains identified earlier in this chapter. They engage in a cycle of noticing, reflecting, intervening, noticing and reflecting. They size-up the learning milieu noticing the attitude of the staff, the emotional climate, and the opportunities to scrub up and assist. They use various strategies or interventions to maximise the learning outcomes. They recognise the need to promote themselves, to gain the surgeon's trust and to gain legitimacy. They present themselves as deserving students, showing interest and intent, motivation, professional behaviour and respect. They seek out 'student-friendly' surgeons they, in turn, can trust, surgeons who acknowledge their role as a teacher and are willing to act as an advocate for the medical students, inviting them to participate in the practice of the operating theatre. All other parts of the spectrum represent varying degrees of engagement with the learning milieu.

Learning behaviours are not fixed. The active approach can be thwarted by an 'unsympathetic milieu' (Boud & Walker, 1991, p. 17), on the other hand a particularly favourable mix of variables in the milieu can draw out more active behaviours in a student who would routinely respond more passively. Curricular initiatives have been developed to provide students with formal opportunities to actively prepare for the event, to help them to engage more fully with a challenging learning milieu during theatre sessions, and to reflect on their experiences. These open up the opportunities for all students to make the most of the operating theatre, extending their learning by creating new and useful integrated experiences.

In the operating theatre patient care is paramount and non-negotiable: the first responsibility of all team members is to the patient. All surgical procedures are serious work and all have an element of risk. Unlike conventional teaching situations the surgical teacher has very limited opportunities to change the environment to promote effective student learning. The operating theatre is more like work-based learning situations where it is too dangerous for novices to engage

fully in the actual tasks being performed, for example, learning to manage a nuclear power station or a chemical plant. Boud and colleagues' (1985) model of reflection and Boud and Walker's (1990 & 1991) model of learning from experience provide the educator with a practical approach to helping students to manage their learning in these complex multidimensional workplaces. The findings from the research reported in this chapter have implications beyond surgical education, to other work-based learning situations which present an equally challenging learning environment. Educators can engage the learners in these situations by promoting the cycle of noticing, reflecting, intervening, noticing and reflecting, and extend them by providing the learners with formal opportunities to actively prepare for the experience, to engage in reflection during and after the experience and to understand the nature of the reflexive process itself.

Chapter 10

The student experiences study: Using research to transform curriculum for Indigenous health sciences students

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Whilst the number of Indigenous students in higher education in Australia has improved in recent years, Indigenous attainment and participation remains lower than that of other Australians (Trewin & Madden, 2005). Between 1989 and 2001, the number of Indigenous students entering higher education doubled (Department of Education, Science and Training, 2002). However, Indigenous students remain underrepresented (1.2%) when compared to the Indigenous population as a whole (which is 2.5% when adjusted for age distribution caused by lower life expectancy). In addition, Indigenous students' progression through and completion of their degree programs has been consistently lower than non-Indigenous students. Overall completion rates for Indigenous students are approximately 45% compared with 65% with non-Indigenous students (Department of Education, Science and Training, 2005). However, for those Indigenous students who complete degree programs employment rates are strong and nearly identical to those of non-Indigenous students; underscoring the profound importance of successful educational outcomes for the future of Indigenous Australians (Department of Education, Science and Training, 2002).

This chapter describes the findings of The Student Experiences Study, a sustained program of qualitative research conducted at Yooroang Garang, School of Indigenous Health Studies in the Faculty of Health Sciences at the University of Sydney, over a period of 10 years. The study focused on the experiences of Indigenous students in both block mode and mainstream health science programs. The research was undertaken to elucidate the factors that promote Indigenous students' academic success, in order to refine and develop curriculum and management strategies which promote their attainment and participation in tertiary education. The findings of this study have been translated into curriculum changes which strive to improve educational outcomes for Indigenous students.

Improving educational outcomes for Indigenous students in undergraduate health sciences programs in higher education stands to make a difference to Indigenous health at both an individual and community level. Research suggests that, at an individual level, higher levels of educational attainment are associated

with better health outcomes (Ministerial Council on Education, Employment, Training and Youth Affairs, 2001). With the addition of one extra year of parental schooling, infant mortality drops between 7% and 10% (Ewald & Boughton, 2002, cited in Australian Institute of Health and Welfare, 2005). The health status of Indigenous Australians is worse than that of other Australians, as indicated by nearly every possible health measure. For example, compared to the total Australian population, the life expectancy at birth for Indigenous people is approximately 20 years lower and infant mortality rates are three times higher (Anderson, Crengle, Kamaka, Chen, Palafox & Jackson-Pulver, 2006). As Indigenous health professionals fulfill an essential role in the provision of health care to Indigenous Australians, improving academic success and completion rates for Indigenous health science students is critical (Commonwealth of Australia, 2002). It promises not only to improve the educational status of Indigenous people, but also has the potential to improve service provision and health outcomes in Indigenous communities.

SETTING

Yooroang Garang: School of Indigenous Health Studies, conducts undergraduate and postgraduate programs in Aboriginal Health and Community Development, as well as an Aboriginal Health Sciences Preparatory Program. The degree and preparatory programs are offered in block mode whereby students alternate between a total of six, week-long intensive sessions on campus per year, separated by off-campus periods when they study at home and work in their communities. Whilst on block, students are accommodated in shared apartments near the university. Block mode design meets the specific needs of Indigenous people, allowing students to maintain employment responsibilities and family and community obligations.

The majority of students in the block mode programs are mature-aged and have family, work and community responsibilities. While they are skilled members of their communities and workplaces, many of these students have not studied in a formal education system for many years or have not completed high school and thus require time and opportunity to develop the academic skills required for success in tertiary study. Most of the block mode students come from rural and remote areas of Australia, reflecting the profile of Indigenous students in tertiary education (Department of Education, Science and Training, 2005). Indigenous students studying in the semester-based programs are more likely to be recent school leavers who have completed high school.

Block mode delivery places different demands on both students and teachers. Teaching at Yooroang Garang includes not only activities directed at achieving educational outcomes within the classroom, but also managing the student ex-

perience outside the classroom, including such issues as travel, accommodation, being away from family and being in an unfamiliar environment with unfamiliar people. When they are in Sydney, the students view the school and its staff as family. Given that Indigenous people suffer high rates of ill-health, it is not unusual for students to be unwell during block or to have to return home for all too frequent funerals.

The school also administers the Cadigal program, a facilitated access program for Indigenous students which provides academic and cultural support for Indigenous students studying in semester-based health science programs, such as physiotherapy, occupational therapy, speech therapy. The Cadigal program allows a lower university entrance score for high school graduates, and considers other attributes like motivation, capacity to succeed, work and life experience for mature-age applicants. Compared to their non-Indigenous peers Cadigal students enter the Faculty with substantially lower entrance scores, less previous educational experience in the basic sciences which underpin the faculty programs as well as less experience with the academic skills required to succeed at tertiary study.

RESEARCH LITERATURE

There is a large body of international research related to student retention and success in higher education (see for example Tinto, 1993). However, the research into Indigenous Australian student experience is more limited. Common themes within existing literature on Indigenous student retention and success point to the importance of curricula which acknowledge and encourage students' cultures as Indigenous people and which provide a supportive environment within which students can develop the skills necessary for success in tertiary study. In addition, previous research addresses the reality that students' time for study is finite and must compete with financial, family and community challenges that Indigenous students commonly face.

In a survey of Indigenous students at the University of Western Sydney, Cobbin, Barlow and Dennis (1992) found that students cited such factors as the presence of a supportive atmosphere, student motivation, organisation and maturity as factors that enabled them to succeed. Interviews conducted by McIntyre, Ardler, Morley-Warner, Solomon & Spindler (1996) with Indigenous students in vocational colleges revealed that the most important factor identified by Indigenous students as contributing to academic success was the recognition of their aboriginality. These students expressed satisfaction when the programs were designed specifically for Indigenous Australians, the majority of students were Indigenous, the staff were sensitive to the needs of Indigenous students, and when Indigenous support was provided on campus. Similarly, research conducted by

Walker (2000) shows a positive link between student retention and success in courses which students identify as culturally appropriate and relevant to their goals. This research also identified that flexibility of study modes and curriculum processes, academic and personal support from Indigenous centres, a welcoming environment and orientation were important for success.

The factors which challenged the success of Indigenous students in higher education were also similar across these research projects. Walker (2000) cites such challenges as personal and family issues, financial difficulties, difficulties with the course material, cultural insensitivity of staff and an unwelcoming atmosphere. According to Bourke, Burden and Moore (1996), isolation, financial difficulties, homesickness and a lack of academic preparation for university study contribute to the attrition of Indigenous Australian students.

Studies of Maori student experience and academic persistence among Native American college students suggest that the factors which influence the academic success of Indigenous students in these contexts are very similar to those for Australian Indigenous students. Persistence for Native American students was facilitated by such factors as family support, structured social support through multicultural offices and clubs, the warmth of faculty staff, and some previous exposure to college through such activities as summer schools (Jackson, Smith & Hill, 2003). Hawke and Tui Ah-Loo (2002) suggest that loneliness and separation from family, lack of tertiary literacy skills, a mismatch between motivation to enroll and the culture of the institution all challenge the success of Maori students.

Our research makes an important contribution to the growing body of research on Indigenous student success and retention by qualitatively examining student experiences in the particular setting of health sciences. Much of the research already conducted had been quantitative research aimed at establishing baseline data and statistics (Bourke, Burden & Moore, 1996, Cobbin, et al. 1992, Lewis, 1994). Our Student Experiences Study was designed as a qualitative study to reveal the reality and complexity of the Indigenous health science students' experience of tertiary study. As noted,

> …much more research is needed on participation, and…it must be qualitative research…capable of identifying what actually fosters continuing engagement in education by Indigenous people. (Department of Education, Science and Training, 1995)

ETHICAL RESEARCH WITH INDIGENOUS PEOPLES

Our research has been guided by a social justice framework which recognises the importance of improving educational outcomes for Indigenous students and is

consistent with the principles of Indigenist research articulated by Rigney (1997). Teachers can have profound effects on both the lives and careers of students and, therefore must attend carefully to curriculum. Given past inequalities in health and education, this is especially so for Indigenous students. Thus, our study seeks to inform the development of culturally responsive curriculum which places Indigenous students at the centre of their learning. Social justice principles suggest that individuals should be able to participate meaningfully in activities in which they are engaged (Aboriginal and Torres Strait Islander Social Justice Commissioner, 2005).

Consultation, essential to participation, was at the core of this research.

> Aboriginal people … are the greatest source of knowledge of their own needs, their learning process and the ways in which learning takes place and the most effective ways and environments in which… [they] learn. (Sherwood & McConville, 1994, p. 40)

This research demonstrates important principles of ethical research with Indigenous communities (Aboriginal Health and Medical Research Council of New South Wales, 1999; Rigney, 1997). Firstly, the project arose from a need within the Yooroang Garang community, as Indigenous and non-Indigenous academic staff had concerns about student retention. Secondly, we consulted with the relevant Indigenous communities, including students, staff, and researchers who had experience in tertiary education of health workers or in the research process. Thirdly, Indigenous people assumed essential roles in the research project; for examp1e, a member of the research team is Aboriginal. Finally, an important ethical consideration in research with Indigenous populations is that the research benefits Indigenous people and their communities. The findings of this study have been translated into curriculum changes, which have the potential to improve educational outcomes for Indigenous students.

METHODS

The Student Experiences Study, conducted from 1997-2003, explored the experiences of Indigenous health science students to identify the factors which challenged or enhanced academic success, with the broad aim of improving academic outcomes (Daniel DiGregorio, Farrington & Page, 2000; Farrington, Page & Daniel DiGregorio, 2001; Page, Daniel DiGregorio & Farrington, 1997). The research focused firstly on the experiences of the students studying in block mode programs and, secondly, on Indigenous students entering the university through the Cadigal access program and studying in semester-based programs.

The study focused on 12 block mode students and 10 Cadigal students. The

participants represented the range of students who enrolled in our programs, including male and female, metropolitan and rural and recent high school graduates and mature aged. Data collection consisted of 20 intensive, semi-structured interviews, collected individually or in small groups, which were tape recorded and transcribed in their entirety with informed consent from participants.

Once the interviews were completed and transcribed, inductive analysis focused on identifying and coding discrete incidents in the interview data. During data analysis, unitising and coding occurred simultaneously and through constant comparison overarching themes began to emerge from the data (Glaser & Strauss, 1967). The themes were debated and cognitive maps developed for understanding the participants' experiences (Miles & Huberman, 1994). This process maximised investigator triangulation (Denzin, cited in Patton, 1990), ensuring the analysis of the data was thorough and rigorously debated. Measures were taken to ensure the trustworthiness, or soundness, of the study. This was done by providing an audit trail of all notes and materials from data collection and analysis, and by including thick description of the findings to facilitate the likelihood that the findings are applicable in another context (Lincoln & Guba, 1985).

FINDINGS

For the purposes of this chapter, we have selected findings which are similar across both block mode and Cadigal students and which led to curriculum development or changes in program management. Whilst our findings reflect the experiences of students in the health sciences, they have relevance for Indigenous students in any program.

Factors that facilitate success and retention

Motivations to enrol. Although our participants also noted individual motivations such as desire for career change, intellectual curiosity and satisfaction in having a degree, their primary reasons converged around the theme of community need. Participants in our study had an acute awareness of a gap in community health services gained from either personal or family experiences of poor health. The awareness of these gaps in community health services led to a real desire to contribute to the improvements of Indigenous community health and a belief that Indigenous people should be more involved in the decisions that affect their communities. Our students reflected,

> I realised I wanted to do something, one for myself and especially for my people…I think we need a lot more workers out there for our people. And I think we're the only ones that can help them. (Student 4, 1997)

Matters of culture. Participants in the block mode program identified that being in a program and a school for Indigenous people influenced their learning experiences in several ways. Shared understandings of Indigenous perspectives meant that students did not have to continually explain themselves. Students also noted having greater confidence to speak in classes when they were surrounded by their 'own people', as compared to their experiences in mainstream programs. As one student noted,

> Because it's Aboriginal people I'm not scared to talk up. But if it was mixed I would be. (Student 3, 1997)

In general, students appreciated the opportunity to study in a program designed for Indigenous students, addressing Indigenous issues. As one student explained,

> It's the loveliest learning experience I think I've had …It's nice being able to support each other …Being black is more colourful …It's just a feeling you get. (Student 5, 1997)

Cadigal participants, who are a minority in their mainstream classes, also noted the value of being with other Indigenous students because of their shared common experiences. The students forge important and valuable friendships with one another and these friendships have direct benefits to academic success. The students are able to provide moral support for one another, swap lecture notes and form study groups. One participant remembered at a particularly low point in his life that,

> [A Cadigal student] came around and had a chat to me…and that group of friends that you have plays a big role [in your success] 'cos everyone is there to support you and help you get that goal. (Student 13, 1999)

Participants also saw particular value in being able to observe and learn from more senior Cadigal students who acted as important role models. Seeing other successful Cadigal students in the years ahead was motivating because the participants identified strongly with these senior students and felt that their success enabled them to 'realise that they could do it just the same as everyone else' (Student 16, 1999). The experience of studying with other Indigenous people at Yooroang Garang led to an improvement in self esteem and confidence in their Indigenous identity. One participant explained that being with other Indigenous people provided an opportunity for them to learn more about their culture from others,

> I've been given a chance to grow, my cultural awareness has grown and my identity has grown and I'm a lot more at ease with my own Indigenous background now. (Student 17, 1999)

A place like home. Yooroang Garang provides an Indigenous student common room, several tutorial rooms for private study or support tutorials, a computer room, a photocopier for student use and resources such as anatomical models, charts, books and references. The value of having somewhere friendly and supportive like Yooroang Garang featured strongly in participants' comments about factors which facilitated success. Participants in both programs reported that in the supportive environment of the school, they found academic staff approachable and that it 'feels like home.' In addition the students enjoyed being in an environment in which they can identify as Aboriginal, and where there is a real acceptance of them as Indigenous people. A participant discussed how he appreciated,

> …being able to come up here and have somewhere to study with minimal disruption and with an understanding from an Indigenous perspective of why I have difficulties in certain areas. (Student 17, 1999)

Orientation programs. Participants commented on the benefit of orientation programs tailored to the needs of Indigenous students offered by Yooroang Garang. Participants noted that the orientation programs were particularly important as they enabled them to meet other students, gain experience in the study of difficult and unfamiliar subjects like anatomy, develop academic learning skills, and familiarise themselves with the geography and procedures of their new academic environment. The opportunity to develop contextualised learning skills was particularly helpful as illustrated by the following comment, '(the orientation program)… was really good…the teacher was teaching us how to learn.' (Student 20, 1999)

Reduced load enrolment and academic support. Indigenous health sciences students can elect to spread their first year enrolment over two years with concurrent enrolment in non-credit academic support courses. This adds an additional year of study but provides valuable time for learning skills development. Participants reported that having a reduced enrolment load enabled them to study at a slower pace and prevented them from being overwhelmed by the volume of material in their undergraduate subjects. Participants in their second year reflected that they would not have managed first year with a full load.

> In first year you're stunned with the amount of work to do. [In reduced load]…you get to spend more time on the subjects, you can sort of learn a

subject and know it really well. (Student 16, 1999)

Enrolment in the academic support courses provided students more time to ask questions, enhance their understanding of the subject material, and develop learning skills for each subject. As a participant described,

> In the lecture you can get a bit lost but [in the support tutorials]…you can sit down with someone who knows what they are talking about, got a lot of knowledge on their subject, and they can just sit down and talk to you and it just seems to make sense. (Student 15, 1999)

Factors that challenge study

Educational background. In most cases, participants' previous educational experiences influenced both preparation for tertiary study in health sciences and confidence in their ability to succeed. Our students were under-prepared either because they left school prior to completion, had not achieved the necessary university entrance score, or had not studied maths, biology or chemistry which are assumed areas of knowledge for health sciences programs. In addition, students reported having difficulties with academic skills (e.g., reading, comprehension, writing, and spelling). Conversely, many of our participants had completed some form of post-secondary-school education in short courses.

Students who recalled encountering racism in previous educational experiences internalised those messages and reported doubts that they could succeed at university study. In addition, some school teachers were very discouraging of participants' aspirations to study health at university which decreased the students' confidence in their ability. A participant reflected

> I had a careers teacher and every time I told him I wanted to do physio' it was like 'You should look for something else.' He never thought I'd ever get into Physiotherapy…so he sort of made me have doubts about going to Uni (Student 15, 1999)

Newness. Many of the challenges identified by participants were accentuated by the students' own newness to study, to each other, to the university environment, and to the city. Participants' newness meant that some of them were learning how to study at the tertiary level for the first time after having been out of formal education for several years and not having completed high school. The participants also described feeling scared, lost and overwhelmed in the new environment where they did not know anybody and where staff and students were unfamiliar. When difficulties were encountered, not only did the participants have to manage the particular difficulty, but they were further challenged by not knowing where

to seek assistance. Newness operated as a constant in the challenges that participants encountered, which negatively influenced their study.

Separation from home and family. Some of the factors that challenged students' study related to the fact that our students were studying away from home and family. Participants in the block mode program reported feeling disconnected and isolated from their families, concerned about childcare arrangements and distracted by what was happening at home while they were away. Shared accommodation also presented challenges because it was sometimes difficult to resolve lifestyle differences between rooming students.

Participants also cited the negative effect of personal and family crises on their success and mentioned these as factors which had led them to contemplate dropping out. Death and illness in the family left participants feeling torn between the desire to be with their family at these times and the need to maintain their focus on study. As one participant noted

> When my grandmother died… I just found it very hard to concentrate like my thoughts would be elsewhere (and) cos' I'm here and they're all in the country… I feel a bit helpless.. and I can't go away from Uni, I've got to stay down here and keep up to date… it's hard to get motivated again. (Student 18, 1999)

Curriculum issues. Various aspects of curriculum were found to challenge student success. Participants studying in applied science programs such as physiotherapy or occupational therapy noted that they struggled with the pace at which the material in the undergraduate subjects was presented and the degree of difficulty of the biological sciences subjects. Participants also commented that they found exam pressure a problem especially if the assessment was not progressive during the semester. Some participants found the format of multiple choice exam questions did not allow them to demonstrate their knowledge as well as written or practical assessments. The need to re-enrol in failed subjects complicated the students' schedules and sometimes led to timetable clashes and missed classes.

Negative learning experiences also influenced student success and had an impact on retention. Our students bring incredible determination to their learning experiences, however, that determination was sometimes short-circuited by frustrating learning experiences which made the students vulnerable to doubts about their own ability to succeed in the program. These negative learning experiences included those which highlighted gaps in their learning competencies or failed to adequately address their individual learning needs. These frustrating experiences had a common effect: students wanted to throw up their hands and walk away. They were not necessarily talking about leaving the program, but they did say that frustrating encounters made them want to walk away from the class, the in-

structor, the task, or the campus and some of them did.

USING RESEARCH TO TRANSFORM CURRICULUM

The scholarship of teaching is crucial because of the power it has to transform curriculum and lead to greater success for students. The findings of the Student Experiences Study have been translated into a variety of curriculum changes.

Empowering students in their new environment

It may be tempting for educators to assume that adult students, because of their developed problem-solving skills, need less attention paid to orientation to their new environment. Our research demonstrated that minor challenges have a cumulative effect and can combine to overwhelm students and seriously interfere with their study. To better address students' newness and to enable them to identify possible little problems and develop strategies which may prevent them from becoming big problems, we expanded our three day orientation program to include experiential learning sessions which facilitate interaction between students and academic staff. The case studies are constructed around common issues arising for an Indigenous student in a block mode program. A participant commented, 'the case studies were very valuable because they gave me insight into exactly the problems that I could face during my stay at Yooroang Garang.' (Student 2, 1998)

In addition, it is clear that in order to facilitate students' problem solving on campus, communication channels need to be explicit and effective. We have established designated individuals to whom students can voice concerns, including student-elected representatives, teacher mentors and program coordinators.

Address the influence of students' past educational experience

Strategies aimed at increasing the participation and success of Indigenous students in tertiary institutions must address the influence of students' past educational experiences. A history of colonialism and cultural marginalisation, has led to Aboriginal peoples' exclusion from mainstream education. As a result, many Aboriginal people have not had the standard of secondary level education generally a prerequisite for university entry. This is not to suggest an incapacity to learn, but rather that Indigenous students have not had equal access to education. Therefore, it is crucial to successfully incorporate literacy education at tertiary level so as not to perpetuate the exclusion of Indigenous people from higher

education nor to be complicit in maintaining the marginalisation of Indigenous students.

Recently, several academic staff members began to use a literacy technique called Learning to Read: Reading to Learn (Rose, 1999) which is designed to enable learners to read and write at appropriate levels. Preliminary research suggests that when literacy is embedded in the curriculum in this way, students are far more able to engage with the required content (Rose, Rose, Farrington & Page, 2006). This increased engagement with course readings has led to improved student confidence, group cohesion and discussion, and student ability to make meaningful connections across materials in different subjects.

Interestingly, vocational courses formed an important gateway to university study for our students. They provided an opportunity to develop academic learning skills and confidence which was particularly important since many participants had limited or negative formal educational experiences. The findings suggest broadening university selection criteria beyond the traditional emphasis on entrance scores because successful completion of vocational courses may indicate capacity to succeed.

Provide flexible enrolment and effective academic support

The 1992 Royal Commission into Black Deaths in Custody Report asserted that,

> Owing to the substantial historical educational disadvantage which Aboriginal people may have experienced, a course for Aboriginal students may necessarily be longer than might be the case if the course were provided to non-Aboriginal students (p. 97).

Institutions are encouraged to consider developing flexible enrolment patterns and formal, integrated academic support programs which our research indicates is an important retention strategy for Indigenous students. The reduced load option and concurrent enrolment in the non-credit academic support courses provided an opportunity for the students to revise and consolidate the material in their undergraduate subjects and develop learning skills within the context of each subject. The academic support courses were designed to provide 'contextualised and content specific material, a perceived relevance and an acknowledgment of metacognitive aspects of learning.' (McLean, Elphinstone, Devlin & Surtie, 1995, p. 77)

Provide culturally safe places and people

There is an increasing acknowledgment that, for many Indigenous students, university attendance is a cross-cultural experience, (Sherwood & McConville,

1994; McIntyre, Ardler, Morley-Warner, Solomon & Spindler, 1996; Christie, 1988; Harris, 1988). Bourke et al. (1996) also found that 'one of the most potent factors in the decision of Indigenous on-campus students to withdraw from University life was isolation' and that there are benefits that come from having 'the support offered to Indigenous students…organised into one discrete support unit' like Yooroang Garang. The findings of our study suggest that by providing students with a small, culturally safe community within a larger community in which they can meet, feel accepted and supported, mix with other Indigenous students from other courses and use resources especially designated for their use works to prevent a sense of isolation. In addition, the environment within Yooroang Garang had a positive effect on their identities as Indigenous people. As advocated by Tinto (2000), the structures we build are as important as the values we espouse.

Participants reported a strong objection to academic staff who did not have an awareness of Indigenous culture, either as it affected the community as a whole or the participants as learners. In an effort to ensure that academic staff at the University practiced with cultural sensitivity and were better able to achieve successful outcomes for Indigenous students, staff from Yooroang Garang facilitated two workshops for university staff related to teaching and learning issues for Indigenous students. The workshops drew participants from a variety of schools and departments and so had the potential to significantly affect teaching practice for Indigenous students across the University. Evaluations suggested that all participants were likely to change their approach to teaching as a result of the workshop. In an evaluation of the workshops, an academic staff member commented that the best thing about the workshop was 'the application of best practice in teaching, applied in a safe environment - it both validated our current practice, and inspired us to continue working toward enhanced teaching practice.'

CONCLUSION

Researching practice is the truest path to improving students' educational experiences and it is imperative that educators are able to demonstrate that education is not unexamined work. Dynamic curriculum informed by research has particular poignancy for Indigenous health education where there is a palpable link between the education and the improvement of the health status of Indigenous people. Our study has underscored the importance of empowering Indigenous students to be successful in the transition to the tertiary environment. Indigenous student success is facilitated when curriculum responds to student need, for example, through tailored orientation programs, explicit channels of communication, designated advocates, flexible enrolment, and structured academic support programs. Above all else, curriculum strategies must be implemented in a way

which places Indigenous people, their experiences and perspectives at the center of their learning and in a place in which Indigenous people feel safe.

Our findings suggest that providing students with a small, culturally safe community within the larger community in which they can meet, feel accepted and supported, mix with other Indigenous students from other courses, and access resources especially designated for them works to prevent a sense of isolation.

ACKNOWLEDGEMENTS

This study was only possible because students spent several hours with us, entrusting us with their experiences, reflections, and insights. We are grateful to them for their investment in this project and for reminding us of what it means to be educators.

Chapter 11
An integrated approach to teaching writing in the sciences

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First year biology courses at the University of Sydney have traditionally incorporated assessment activities requiring students to write reports. Despite increases in the size of the student cohort during the past 10 years (n=1000 – 1600), we have maintained the philosophy that writing is integral to learning biology (Moore, 1993) and to the development of generic skills. The curriculum therefore needs to reflect a sense of the importance of 'writing as learning' rather than just being seen as a tool for assessment, or a task for formative assessment (Keys, 1999; Lea & Street, 1998). In this way the concept of communicating meaning is seen as the main role of writing, and students can be helped to move away from a surface approach of 'how long does it have to be?' (Nightingale, 1988). Integration with the discipline material and structure is an essential component of the learning process such that writing also helps to develop analytical abilities, scientific knowledge construction and retention (Dorfman & Taylor, 1998).

The aim of this chapter is to describe the creation of a collaborative program, involving language and learning specialists and biology staff, focusing on the significance of writing within the scientific discipline and practice, and emphasising the development of student independence and autonomy in the learning process. We used a research approach to develop the teaching program, which has been sustained and enhanced by the application of new insights from our ongoing research into student learning, as shown in Table 11.1.

RESEARCH INFORMING THE TEACHING OF WRITING IN THE SCIENCES

Insights from research in applied linguistics

There is a rich tradition of ethnographic and linguistic research into the social construction of knowledge in the sciences. Although early research tended to focus on the more prestigious sites of discovery and publication (Latour & Wool-

gar, 1979; Gilbert & Mulkay, 1984; Latour, 1987; Bazerman, 1989; Myers, 1990), later research has been concerned with pedagogical environments where students are being apprenticed into scientific disciplines, discourses and communities (Swales, 1990; Bhatia, 1993; Halliday & Martin, 1993; Martin & Veel, 1998; Candlin & Plum, 1998; Hewings, 2001). One of the most influential research approaches in this area is genre analysis which involves both ethnographic and linguistic perspectives. Genres are 'staged, goal-oriented social processes' (Martin, Christie & Rothery, 1987); 'staged' because they move through structured stages 'oriented' towards a 'goal' or social purpose. Genres are 'communicative events' which share 'communicative purposes' taking place within a discourse community (Swales, 1990, p. 58). A key advantage of analysing genres is that analysis not only serves research purposes but can be used for developing academic writing pedagogy. Studies in the different traditions of genre analysis over the last 25 years have provided a rich resource for the researching and teaching of written texts in their context (Hyon, 1996; Jones, 2004). In Australia, genre analysis has been shaped by the influential theory of systemic functional linguistics (SFL) pioneered by Halliday (1985), a comprehensive description of how language choices make meaning in their context of use. This theory provides a systematic description of the interrelationships between language and the contexts of situation and culture 'how the linguistic features of a text relate systematically to the features of its environment' (Halliday 1985). In addition, this theory has been the basis for much ground-breaking research into the language of science (Halliday, 1988; Halliday & Martin, 1993; Halliday, 2004).

Table 11.1. An overview of the integration of research and teaching in writing in the first year biology curriculum at the University of Sydney

Date	**Research and Teaching Activities**	**Outcomes**
1994 - 1996	Educational research informing the teaching of writing.	
	Use of literature on academic writing and genre analysis to address problems with undergraduate writing in science.	Application for funding and proposal development.
	Implementing *Writing in Biology* program, and training staff.	Implemented, with CAUT funding, and evaluated.

Date	Research and Teaching Activities	Outcomes
1996 - 2000	Evaluating *Writing in Biology* program to improve learning environment.	
	Ongoing evaluations by staff (n=60) and students (n=1000-1500), through quantitative and qualitative surveys, and focus group interviews.	Most evaluations positive, changes implemented, particularly in the area of feedback, and further evaluated.
	Publishing descriptions of the innovation and outcomes of initial evaluations.	See References: e.g., HERDSA and Communications Conference, ESA.
2000 - 2006	Research into student learning within the program	
	Collaborative projects on: ■ Effects of attitudes to writing and prior experiences ■ Writing to learn in science ■ Using feedback on writing	Publications in International Journals and presentations at International Conferences, University Teaching Showcases. Outcomes of projects fed back into the teaching program through seminars and further training for staff, and information online for students.
	Using methodologies based on approaches to study and phenomenography.	

Genre analysis and pedagogy within the SFL tradition (often referred to as the 'Sydney School' (Jones, 2004)) is largely associated with the seminal

research of Martin and colleagues working in primary and secondary school contexts and workplace contexts (see for example Veel (1997) in the area of school science and Rose, McInnes and Korner (1992) in the area of workplace science). Genre analysis in this tradition provides descriptive resources which enable connections to be made between the micro language choices made at text level with the macro level, sociocultural influences driving those choices.

> For example, a student's choice of the modal auxiliary 'must' in their discussion of the causes of dwarfism in pea plants 'The absence of gibberellic acid in dwarf plants *must* be responsible for their dwarfism' would be inappropriate in the context of how scientists make claims based on their results, whereas the use of 'may' would be acceptable 'The absence of gibberellic acid in dwarf plants *may* be responsible for their dwarfism'.

Although both usages are grammatically correct, clearly one choice is more appropriate. Making students aware of the range of appropriate choices, such as 'might' or 'could' and their variation in meaning helps them understand that language choices are not determined by a set of rigid grammatical rules but are part of a system for choosing meaning within a particular sociocultural context for a particular purpose. Such text examples can become part of a bank of resources for designing curricula for apprenticing students into discipline writing practices.

One such curriculum approach, genre-based literacy pedagogy, a literacy teaching and learning cycle model, has developed from genre analysis in the SFL tradition (see Figure 11.1).

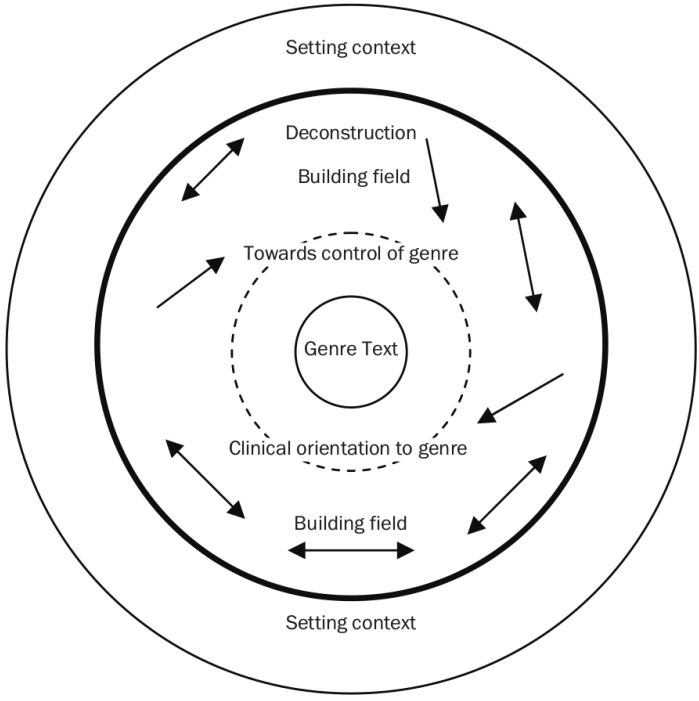

Figure 11.1. A genre-based teaching and learning model (Martin, 1999, p. 131)

This curriculum model (Martin, 1999) engages students in an interactive teaching and learning cycle where they acquire knowledge and understanding of the target genre and how to apply this in producing their own text. The cycle is typically divided into 3 phases, modelling or deconstruction, joint construction and independent construction. The cycle can be entered at any point according to students' needs and teachers can move back and forth between phases as appropriate. The modelling phase makes explicit all aspects of the genre from social context to vocabulary or grammatical features, joint construction engages students in the process of writing an example genre with the teacher as guide, individual construction moves students on to writing a draft text for peer and teacher feedback before writing the final version. After this stage, students and teacher can critically examine the target genre, questioning the cultural values behind its structure and purpose and re-writing it as a different genre. See Martin (1999) or Cope and Kalantzis (1993) for more information on the genre-based teaching and learning cycle. The success of this model for literacy teaching in pre-tertiary contexts has meant that it has now been widely adapted to teach spoken, written and visual academic genres at tertiary level in both classroom and

online contexts (Drury, 2004).

Research processes and applications to teaching

Our research into academic writing aimed to make explicit both the products and processes of writing required for success in first year biology (Prosser & Webb, 1994). Using genre analysis in the SFL tradition, we identified and analysed the pedagogical and assessment genres of first year, examples of which, together with their genre classification (or macro genre - a larger text comprising a number of genres) are shown in Table 11.2.

Table 11.2. Examples of writing tasks in first year biology

Text type	Question/Topic/Purpose	Genre with specific type in brackets
1) Factual description: practice writing exercise	To describe the characteristics of a seedling.	report (composition)
2) Laboratory report: assessed assignment	To determine the respiration rate of germinating mung beans using a respirometer.	macro genre: report, procedural recount, discussion
3) Field report: visit to the Botanic Gardens: assessed assignment	Write a brief description of the field characteristics which you would use to distinguish the Cactaceae from species of Euphorbia.	discussion

Authentic examples of each genre, namely student texts and staff models, were collected and analysis of a representative sample was undertaken to create a more generalised description of the genre (Drury, 2002). Analysis involves describing, firstly, the typical stages (schematic structure) the genre moves through to fulfill its purpose (thesis statement, argument etc.); secondly, the choice of cohesive features which link together these stages in a meaningful way and lastly, choices in vocabulary and grammar which are motivated by the more macro level features of the genre but which in turn influence these macro levels. An example of a partial genre analysis of a student response to the field report task in Table 11.2 is shown in Table 11.3.

Table 11.3. A partial genre analysis of a highly valued student response to the field re-

port task

Schematic Structure	**Text: Discussion Genre**	
(Paragraph 1) Thesis 1	1)	On close examination of the tables, there do not appear to be any characteristics that enable the family Cactaceae to be distinguished from the genus *Euphorbia*.
Argument 1.1	2)	***Both*** succulents have spines and fleshy stems for water storage,
Argument 1.2	3)	may grow as either trees or shrubs,
Argument 1.3	4)	and ***both*** may or may not flower at the same time.
Argument 1.4	5)	Despite the fact that the Cataceae do not have leaves, the *Euphorbias* only sometimes have leaves,
Re-state Thesis 1	6)	thus the presence or absence of ***these*** is not a distinguishing feature either.
Counter Thesis 2 Argument 2.1	7)	Textual sources reveal (Curtis, 1983, p. 921) however that the two have quite different flowers which allow them to be distinguished.
Argument 1.5	8)	As not all of the succulents selected for examination in the field were in flower,
Re-state Thesis 1	9)	***this*** distinguishing characteristic does not appear in the table.

*Comment: The text is divided into clauses for analysis. Themes or sentence beginnings are underlined and reference words are shown in **bold italics**. Both of these textual features are important in developing this text as a series of stages, arguments and counter arguments, before making a conclusion. Further analysis could provide a richer account, for example, the varying use of tense to distinguish between the author's observations in the field and his/her generalisations from these.*

While genre analysis was taking place, ethnographic data was collected from interviews with students and staff. Staff provided information on the curriculum context including any guidelines, support materials and activities for writing, the learning goals for writing and the staging and composition of assessment tasks. Staff also identified typical student problem areas and their criteria for successful writing. These collaborative meetings allowed biology staff to build up a metalanguage for talking about language use and provide important discipline knowledge for language and learning staff. At the same time, student interviews

provided insights into their problem areas in writing, their writing processes, their perceptions of staff expectations and what they thought would help them to write more successfully.

The detailed genre analysis of student and staff texts provided a rich corpus of resources for teaching materials and activities within the curriculum framework of genre-based literacy pedagogy. This curriculum model was adapted as a teaching and learning cycle for writing in first year biology as shown in Figure 11.2. As can be seen, there is an emphasis on preparation activities such as modelling and assessing which allow students to build their knowledge of the target genre and its context before they engage in writing. By evaluating examples of the target genre, students can develop a metalanguage to talk about strengths and weaknesses in the writing and suggest their own criteria for assessment. They then use these criteria, complemented by those of staff, to assess their own practice and give feedback on peer and group writing. In this way, students are better prepared for the individual writing tasks which are part of the later assessment and feedback process.

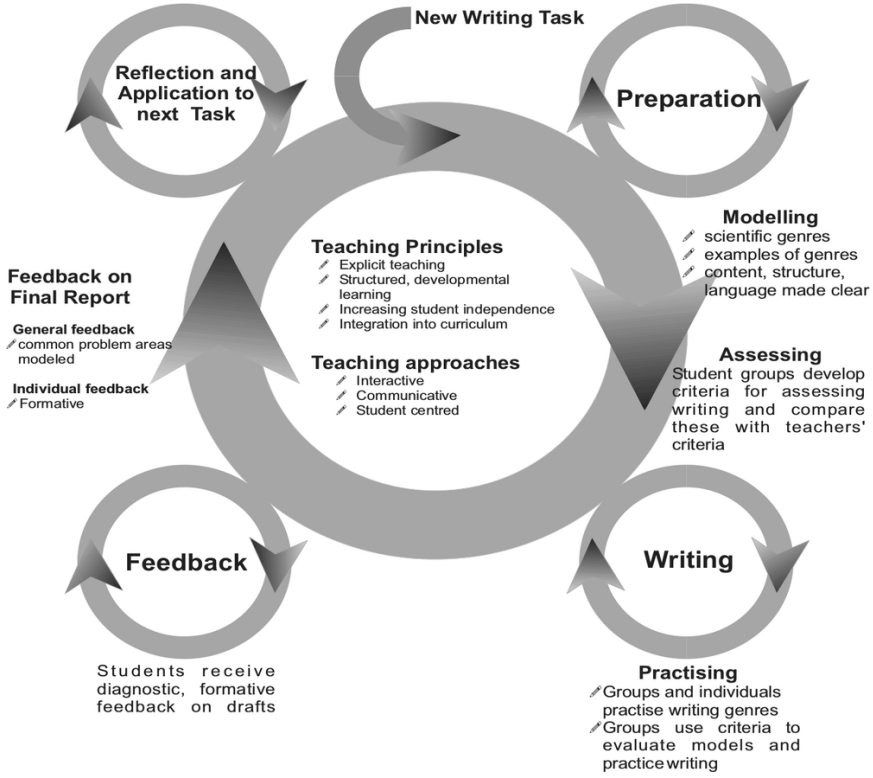

Figure 11.2. The teaching and learning cycle in first year biology at the University of Sydney (Taylor & Drury, 2002)

EVALUATION TO IMPROVE THE TEACHING OF WRITING

A cycle of evaluation, during 1995 to 2000, surveyed staff and students to provide quantitative and qualitative data on perceptions of the writing program. These data demonstrated increasingly positive perceptions of all aspects of the program and provided information on where changes should be made. Due to increasing student numbers some cuts were affected early in the program, specifically the introductory diagnostic tests used to establish written literacy levels in incoming students. However, the overall structure, including extensions in the area of feedback, has remained an integral part of the first year biology course for the past 12 years (Peat, Taylor & Franklin, 2005b). The accumulating evaluation data about the program raised questions about the diversity of kinds of student conceptions

and prior experiences, and prompted us to use more formal approaches to investigate the efficacy of the program. We therefore designed research projects to determine the extent to which prior experiences, confidence and attitudes to writing affected the way in which students used the resources. With this knowledge we could create profiles of incoming students and thus more effectively direct them in use of the program components. We also needed to better understand students' perceptions of writing in the program and the extent to which they learnt biology while writing.

RESEARCH INTO STUDENT LEARNING

We used two main methodological approaches to answer these questions, based in theories associated with approaches to learning (Biggs, 1987) and phenomenography (Marton, 1981).

Methodologies

Approaches to learning. We based our research on methodologies adapted from previous studies on student approaches to learning (Entwistle & Ramsden, 1983; Biggs, 1987; Biggs, 1989; Prosser & Trigwell, 1999; Ramsden, 2002). One project focused on determining the prior experiences of our student cohort with reference to academic writing and establishing any relationship to their subsequent approaches and outcomes in the writing program. We adapted the Study Process Questionnaire (Biggs, 1987) to provide quantitative measures of prior experience of writing, attitudes to the experiences of writing, approaches to writing and performance indicators prior to, and after, participation in the writing program (Taylor & Drury, 2004). We further refined our writing questionnaire for a quantitative study to determine the extent to which scientific knowledge and use of an appropriate writing style is developed through the writing process (Ellis, Taylor & Drury, in press). A cluster analysis was used to identify groups within our sample which showed similarities in the variables used in the questionnaires, such as common approaches and conceptions. We used the theoretical 3P model (Trigwell & Prosser, 1997) to describe the way in which students develop their understanding during the stages of the writing program, and identify the relationship between students' experience of writing and the quality of their learning.

Phenomenography. Phenomenography provides a structure for examining the variation in understanding of a concept, as experienced by individuals (Marton, 1981), through the creation of a list of critically different hierarchical categories which reflect all perceptions of the phenomenon to be categorised (Trigwell, 2000). A series of iterations of analysis allow the categories to be confirmed

and quantitative data developed. Our studies used qualitative data about students' conceptions of writing and learning biology from open ended questionnaires. These data were analysed, using a phenomenographical approach, to characterise the process of writing and its outcomes, and the scientific understanding developed by students through writing.

Research outcomes

Using the approaches to learning methodology, we were able to create a profile of students with respect to their prior experiences of writing, their subsequent attitudes to writing, their approach to writing and their performance outcomes in writing during the program. We found significant correlations between the extent of prior experiences of writing, positive attitudes to writing and approaches to writing. This study therefore confirmed that prior experience had a significant effect on students' engagement with the activities in the writing program but incoming achievement levels at the Higher School Certificate (HSC), as measured by University Admission Index (UAI), were not good indicators in terms of students' writing. This enabled us to identify characteristics of incoming students who may be embarking on the program with a clear disadvantage.

A cluster analysis allowed us to understand whether students had established a link between the process of writing and understanding biology. Unless there is a link established, the writing process remains a technical exercise with no relation to the biological information being studied, as had been demonstrated for many students during our previous research (Ellis, Taylor & Drury, 2006). We identified two groups of students within the sample. One group experienced writing as a way of understanding and employed deep approaches to writing. A second group employed a surface approach to writing and had no clear conception of writing in biology. These research outcomes showed a broad range of approaches to writing, and conceptions of writing, which were also reflected in the overall performance of students in the writing program and in their engagement with biology during the writing process.

Outcomes of the phenomenographical analysis identified categories of conceptions of learning through writing and student approaches to learning through writing as shown in Table 11.4. These have clear implications for the way in which staff approach their teaching in the program, since being aware of the types of students we are working with changes our approaches to teaching and makes the interaction more effective.

Table 11.4. Phenomenographic categories showing the variation in the experience of learning through writing (Ellis et al., 2006)

Categories of conceptions of learning through writing	**% of student responses (n=165)**
Writing as a way of learning about the writing process and science information	55
Writing as a way of understanding biology and its applications	45
Categories of approaches to learning through writing	
Writing to create a report by following a process	71
Writing to understand and explore biology	29

Using these research outcomes, we considered more carefully the links between areas where students lacked experience or confidence in writing, and the points in the learning cycle where we could provide extra help. We then made more explicit, in the student manual, our explanations of ways in which students could engage with the learning cycle to help with building confidence and developing writing experiences they may have missed at school. Integral to all these outcomes is the central role of feedback in developing students' writing. We enhanced the provision of feedback and created a range of online resources and self assessment materials for use during the writing process (Peat, Taylor & Franklin, 2005a). This included creating sheets for students and staff detailing the criteria for feedback and marking. Students now have access to one-to-one discussion on a draft of their written report and can access, and participate in, online discussion and question sessions on their report writing (Taylor, 2002). We have also initiated further studies into the way in which students understand and use feedback on their writing (Taylor, 2006; Drury & Muir, 2006) which are allowing us to further refine our feedback procedures.

The significance of the student profiles, and categories of conceptions and approaches, identified in our research is now explored through discussion with staff, to help them relate to the way students work with the program and to help in understanding student patterns of learning. We have also designed training and marking sessions for tutors and report markers, and have enhanced the marking process through double marking sessions.

Our research has confirmed that students need a structured and explicit approach to the teaching of writing, focusing on modelling the criteria for good writing, and on giving, and working with, feedback. These outcomes become part of an iterative development cycle in our teaching, whereby students and staff become aware of the ways in which perceptions and approaches relate to their

performance in writing, and emphasising the aims of the activities and making the assessment more explicit (Peat et al. 2005b).

ISSUES

Overall, the program has undergone constant evaluation and change over the twelve years of its inclusion in the biology course. We still cannot measure explicitly whether student writing has improved as a result of our program, since successive cohorts show different profiles and therefore cannot be compared. In addition our expectations of the level of student performance have increased quite dramatically over the past 10 years. Students have, however, risen to these challenges and have a much better awareness of the importance of writing as evidenced by their asking for more opportunities to practice. A key requirement for initial writing preparation activities in the program, namely the provision of diagnostic exercises early in the course (Ellis et al., 2005; Ellis et al., in press), still proves too difficult a hurdle to surmount with such large cohorts and in a teaching environment where face to face class time is being further reduced. To address this issue, we are therefore currently exploring online initiatives for student self diagnosis and reflection, based on the model of the learning cycle.

CONCLUSIONS

The outcomes of research into student learning in the writing program have allowed us to further reflect on the significance of academic writing in the science curriculum. Specific requests by students have caused aspects of the program to be incorporated into other first year biology courses. We have also built up considerable support from teachers in higher year courses, across a range of degrees, to incorporate the messages, and extend the activities, from the first year writing program into their curriculum. Genre analysis and pedagogy have proved to be a robust approach for the development of teaching resources for different discipline areas. A significant body of resources has been created which has extended our knowledge of writing in the sciences at tertiary level. Thus we are steadily consolidating a focused and motivating writing experience, for students in the undergraduate science degree programs, which is supported by our ongoing research program in student learning.

Chapter 12
Investigating students' ability to transfer mathematics

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Faculty of Science

It is a fundamental, if implicit, assumption of the modern day education system that students possess the ability to transfer the skills and knowledge learnt in a particular context to a different context. However, there has been much debate amongst researchers regarding factors that affect the occurrence of transfer. The nature of transfer, and the type of transfer that occurs in different contexts, have been examined and debated for at least a century (see Barnett & Ceci, 2002; Rebello et al., 2004) for brief surveys). The importance of transfer cannot be overstated - if knowledge and learning cannot be applied outside the original learning context, they are very limited in usefulness. Transfer has even been described as the 'ultimate goal of education' by some researchers (McKeough, Lupart & Marini, 1995).

The aim of this project was to quantitatively measure the ability of first year science students to use skills and knowledge learned in mathematics courses, in other contexts; specifically science. The ability to transfer mathematics skills into a chosen science discipline is of crucial importance in students' development as scientists, and in their future careers. It is also likely that the findings of this study will contribute more generally to our understanding of transfer involving other areas of university study and, indeed, to the transfer of knowledge and skills gained in the university to new situations that graduates are likely to face.

TRANSFER OF MATHEMATICS KNOWLEDGE AND SKILLS

At the University of Sydney, as in many other universities, students of science and engineering are required to study mathematics as a subject in its own right. It is expected that they will be able to use the skills and knowledge acquired from their mathematics courses in other disciplines; that is, that they will be able to transfer their mathematics to other disciplines. Lecturers in these other disciplines typically complain that students either do not have sufficient mathematics or are

unable to apply it in context. Such complaints are not new, nor are they restricted to the University of Sydney. In universities across the world there has been a proliferation of courses which teach mathematics 'in context', purportedly as a solution to the problem. Unfortunately, there is little evidence to suggest that such courses solve the problem at all. Gill (1999b) discusses precisely this situation at King's College London, and argues that teaching mathematics in a particular context ties the mathematics to that context and does not improve the situation. Zevenbergen (2001) points to research showing that embedding mathematics in contexts can serve as a distractor for some students, and warns of the difficulties caused by embedding mathematics in word problems.

Clearly, there is no easy solution, and the studies reported in this chapter do not directly address the problem. Rather, they are an attempt to answer the questions:

- To what extent are students able to transfer mathematical skills and knowledge?
- Is there a way to measure transfer ability?

Another question that was investigated concerned the possible linkage between an understanding of graphs, defined as 'graphicacy', and success in solving other mathematical problems, noted by Gill (1999a). Gill concluded that there is mathematical understanding related to understanding graphs and slopes that may underpin higher order mathematical concepts. However, he was unable to say whether an integrated understanding of graphs is a result of, or a pre-requisite for, deep mathematical understanding. Answers to questions such as these may be useful in designing strategies to improve transfer.

The research was begun by four academics, one from each of mathematics, physics, microbiology and computer science within the Faculty of Science at the University of Sydney, aided by a research assistant and a BSc(Honours) student, who interacted with students, helped with data handling and participated in generating and testing hypotheses. During the initial stages, an academic from the Institute for Teaching and Learning at the University of Sydney assisted with framing the project and focusing on the process of investigation.

THEORETICAL BACKGROUND

There have been many studies of 'generic' transfer - the type that enables the education of primary school children to be useful and that makes workplace and sporting training worthwhile. In one sense, the obviousness of transfer is such that it does not need to be stated, yet researchers have encountered many difficulties when it comes to describing transfer, either qualitatively or quantitatively. There

has been a great deal of research conducted on transfer over the past century and recent work, such as that of Barnett and Ceci (2002), has narrowed the gap between different views of transfer.

Measurements of transfer

Most studies that have attempted to measure transfer have been quantitative only in the sense that the data sets generated were large enough to perform some kind of statistical analysis. But the only studies known to the authors that try to quantify transfer in some way are those that used a pre- and post-test methodology (Hake, 1998; Singley & Anderson, 1989). In these studies, the transfer was measured as a type of gain.

The present study is thought to be unique in the attempt to quantify the degree of transfer of assumed knowledge. Accordingly, a transfer index had to be devised, tested and revised. This process is explained, followed by a description of the analyses that were carried out.

Models of student thinking

There is a large and diverse body of literature in the field of transfer, from both cognitive psychologists and educational scientists, but it is only with the adoption of accepted frameworks for transfer and educational science that helpful debate and comparison of research can be undertaken. Such frameworks, by Barnett and Ceci (2002), Redish (2003), Tuminaro (2004) and Rebello et al. (2004) were applied in this project to interpret our results.

While there are several different models of memory, the framework of dividing memory into *working* (short-term) memory and *long-term* memory was considered useful. Working memory can only handle a small number of data blocks but long-term memory contains vast amounts of information. Transfer of information from working to long-term memory may be difficult and time consuming and requires repetition and time (up to weeks).

Taxonomy for transfer

Due to the diversity of transfer research, it was important to situate this study within a common reference or framework to enable comparisons with different studies and to discuss results. Although acknowledged by its authors as lacking 'sharp edges' (in regard to generating quantitative predictions), Barnett and Ceci's (2002) taxonomy is useful for positioning this project in regard to other work, and in seeing the way forward for future research by those concerned with transfer.

The taxonomy has the following dimensions of context (see Figure 12.1):

Knowledge domain; Physical context; Temporal context; Functional context; Social context and Modality. According to these dimensions, the project described in this paper only deals with non-near transfer in the Knowledge Domain, since all the other contexts were the same for the students involved.

Figure 12.1. Barnett and Ceci's (2002) taxonomy for far transfer

A Content: What transferred			
Learned skill	Procedure	Representation	Principle or heuristic
Performance change	Speed	Accuracy	Approach
Memory demands	Execute only	Recognise and execute	Recall, recognise and execute

B Context: When and where transferred from and to					
	Near →				**Far**
Knowledge domain	Mouse vs. rat	Biology vs. botany	Biology vs. economics	Science vs. history	Science vs. art
Physical context	Same room at school	Different room at school	School vs. research lab	School vs. home	School vs. beach
Temporal context	Same session	Next day	Weeks later	Months later	Years later
Functional context	Both clearly academic	Both academic but one non-evaluative	Academic vs. filling in forms	Academic vs. informal questionnaire	Academic vs. at play
Social context	Both individual	Individual vs. pair	Individual vs. small group	Individual vs. large group	Individual vs. society
Modality	Both written, same format	Both written, multiple choice vs. essay	Book learning vs. oral exam	Lecture vs. wine tasting	Lecture vs. wood carving

MEASURING ABILITY TO TRANSFER MATHEMATICS SKILLS AND KNOWLEDGE

The ability to transfer mathematics was quantified by comparing marks obtained for mathematics questions with those obtained for numerical questions that depended on use of the same mathematics knowledge and skills but were set in a

scientific context. The marks were analysed to generate a Transfer Rating (Britton, New, Sharma & Yardley, 2005) that expressed the ability of each student to transfer the mathematics knowledge to the scientific questions. Further consideration of the results suggested some improvements to the test instrument and to the method of calculating the transfer ability – leading to production of a Transfer Index that could be used to study correlations between variables affecting performance in science and mathematics subjects.

The first instrument

In order to test the ability of students to transfer mathematical skills and knowledge to other disciplines, we designed an instrument consisting of mathematical questions set in the context of particular scientific disciplines. We wanted each question to contain enough discipline-specific information that it could be answered using mathematical knowledge only, without any previous knowledge of the particular discipline.

The first task was to select a topic or set of concepts taught in first year mathematics that would be used by the different science disciplines after it was taught by the mathematicians. However, due to the diversity in mathematics requirements of introductory science courses it was decided to focus on content taught in senior high school. The topic chosen was exponentials and logarithms, which is covered in the final two years of high school in the Mathematics Higher School Certificate in the state of New South Wales course (NSW Board of Studies, 1997), is assumed knowledge for first year university science and is briefly revised in first year mathematics.

At the outset, two alternatives were considered for the structure of the instrument. The discipline-specific questions could depend on identical mathematical concepts in the same sequence for the different disciplines, or the discipline-specific questions could be taken from the same narrow area of mathematics with no constraints about a one-to-one matching of concepts or sequence. Since the students were initially expected to attempt questions in several different science disciplines, questions written according to the first alternative could be answered using pattern recognition. Hence it was decided to follow the second alternative.

Each researcher wrote several questions that were taken from the same narrow area of mathematics with no constraints about a one-to-one matching of concepts or sequence. The questions were read by others on the team and modified to give maximum comprehensibility and ease of reading and interpretation. The issue of comprehending questions from unfamiliar discipline areas was critical (New, Britton, Sharma & Brew, 2001). Initially, the questions included explanations which were not entirely comprehensible to those who had not written them. It is clearly difficult for academics to correctly gauge the general understanding of their specialist areas when writing background information.

The questions went through several cycles of modifications.

As the iterations of the discipline-specific questions converged, the mathematician in the group used the concepts that appeared in the discipline-specific questions to design a series of mathematics questions, which were read by all researchers and modified. The first draft of the instrument contained two questions from each of microbiology and physics, three from computer science and one from mathematics, each question containing several parts. Following a trial of the instrument with higher year students (third year and above) from the participating disciplines, the questions were modified and some sections completely eliminated to give a test that could be realistically expected to be completed within one hour.

The final version of the instrument used with first year students consisted of a physics component based on exponential decay of the number of photons in a photon beam, a microbiology component based on killing bacteria, a computer science component based on Big-Oh notation and a mathematics component which consisted of four straightforward questions. Where possible, the components had a similar structure, so that the application of a particular skill in different contexts could be tested.

The following extracts from the instrument illustrate some parallel components (Figure 12.2).

Physics

Consider a beam of photons with identical energies all travelling in the same direction, head-on into a particular medium. The number of photons which survive as the beam passes through the medium decreases exponentially. The distance over which the number of photons is halved is called the half-thickness of the medium. Let N be the number of photons which have survived at a distance x into the medium, and let g be the half-thickness.

a. If $N(x) = N_0 \times 2^{-kx}$, where N_0 is the initial number of photons, and k is a positive constant, express k in terms of g.

b. Suppose a medium is 10mm thick, with a half-thickness of 0.5 mm, and that 10^{10} photons enter the medium head-on.
Draw a graph of log N against x, with a scale marked on the axes.

Microbiology

The bacterium *Staphylococcus aureus* ('golden staph') found in poultry stuffing is killed by heat. After a quantity of poultry stuffing has been heated to 62^{o}C, the cell concentration of the golden staph bacteria decreases exponentially. The Decimal Reduction Time at 62^{o}C, *D62*, is the length of time required for the cell concentration to decrease to 1/10th of its original value. Let N be the cell concentration of the bacteria at time t

minutes after the stuffing has been heated to 62°C.

a. If $N(t) = N_0 \times 10^{-kt}$, where N_0 is the initial cell concentration and k is a positive constant, express k in terms of D_{62}.

b. For golden staph, the decimal reduction time at 62°C, D_{62}, is 8 minutes.

Draw a graph of log N against t if the initial concentration is 10^5 cells/g.

Mathematics

a. If $P = 5e^{kt}$ and $P = 10$ when $t = 3$, find k.

b. If $y = 4e^{-0.1x}$, draw a graph of ln y against x, for $0 \leq x \leq 10$.

Figure 12.2. Parallel questions in Instrument 1

Administering the instrument. There were several versions of the instrument, with the discipline-specific components in different orders, but with the mathematics components last in every case. Thus a selection of students would start with each discipline-specific component, to ensure a sufficient number of responses to each discipline, and to stop students simply choosing their favourite discipline. This procedure was also designed to lessen the effect of pattern recognition in answering later components based on earlier ones.

The students were told that there were components from the different disciplines and that they should be attempted in the order in which they appeared on the instrument. After answering other components for 50 minutes, all students were asked to do the mathematics component. Student identification numbers were requested so that further analysis could be done, and all students signed Human Ethics Clearance Forms so their student records could be accessed.

Calculating transfer. The student responses to each part of a question were marked using a simple marking scheme - 2 marks for a correct answer; 1 mark for a partially correct answer; 0 marks if the question part had been reached and considered by the student and was either incorrectly answered or not attempted. If the student appeared to have had insufficient time to attempt the question, evidenced by failure to attempt any subsequent questions, a blank was recorded instead of zero. (The distinction between a blank and zero was important for various calculations.) The scores for each component were then converted to scores out of 10.

Most of the 45 students who had made a serious attempt had run out of time and not completed all three discipline-specific components. Hence, the means and standard deviations for each of these disciplines were calculated using only the scores achieved by students who had attempted that particular discipline-specific component first, whereas scores for all 45 students were included in the

statistics for the mathematics component (Table 12.1).

Table 12.1. Means and Standard Deviations for Scores on each Component

	Mathematics	**Physics**	**Microbiology**	**Computer Science**
mean	6.6	4.0	3.6	5.5
s. d.	2.3	2.9	2.8	2.8
N	45	13	16	16

Using the means and standard deviations given in Table 12.1, each student was assigned a 'transfer rating':

Transfer rating = z-score for first attempted component – z-score for mathematics

The formula compares the relative performance of a student in his or her first non-mathematical subject with performance in mathematics. Using this formula, a transfer rating of zero is assigned to a student who has performed at the mean in both mathematics and the other science discipline attempted. Such a student would be considered an average transferrer. A positive transfer rating indicates that the student has performed better (relative to the sample) in the scientific discipline attempted than in mathematics (relative to the sample). Such a student is considered to be a (relatively) good transferrer. The histogram of numbers of students in the sample with particular transfer ratings is bell-shaped, with the majority of students in the sample identified as average transferrers.

Unfortunately, there were some limitations in the use of the formula, particularly in the case of students who perform very poorly in both the mathematics component and the other discipline. The problem is obvious when the following example is considered. A score of zero in both mathematics and, say, the microbiology component would give a transfer rating of -1.29 - (-2.90) = +1.61, which is a very good transfer score relative to the sample. Yet it would obviously be wrong to describe this performance as indicative of good transfer abilities. In fact, it is simply not possible to test the transfer ability of a student when the marks scored in both components become too low, because any attempt to measure transfer ability presupposes that the student actually has some knowledge of mathematics to transfer in the first place!

Secondly, the formula will never assign a particularly high transfer rating to a student who performs extremely well on the mathematics component. For example, a student scoring 10 on both the mathematics component and the microbiology component may well be an excellent transferrer, but will be assigned a transfer rating of only 0.89. However, it is always difficult to effectively gauge

the ability of someone who gets everything correct.

The graph of transfer rating against mathematics scores (Figure 12.3) highlights these problems. It shows a highly negative correlation between mathematics scores and transfer ratings ($r^2 = 0.301$, $p<0.01$).

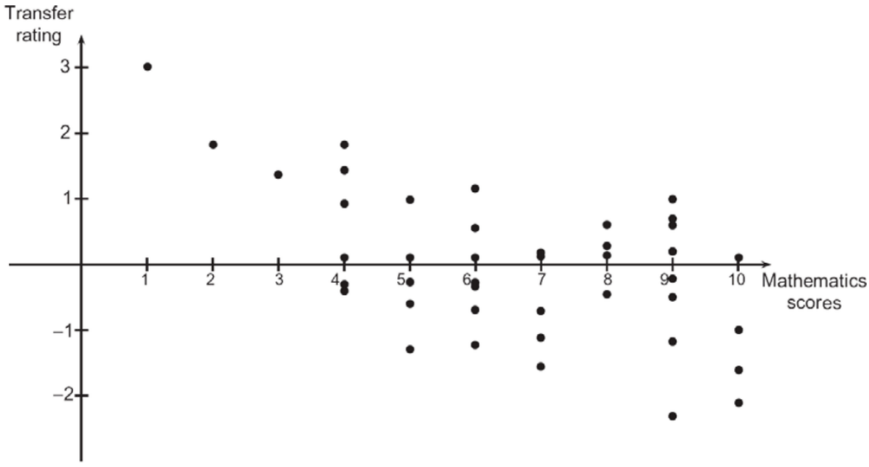

Figure 12.3. Transfer ratings vs. mathematics scores (note that 3 data points lie so close to other points as to be indistinguishable)

Assuming that the ability to transfer depends on the prior possession of some knowledge, it makes sense to consider the transfer ratings only for those students with a mathematics score close to the mean, or higher. If those students with a mathematics score lower than one standard deviation below the mean are disregarded, the remaining points on the graph (mathematics scores of 5 and above in figure 12.3) show no significant relationship between the mathematics scores and the transfer rating ($r^2 = 0.033$, not significant). This is satisfying, since the transfer rating is a measure relative to the mathematical ability of the student in question. However, in view of the major restrictions on the use of *transfer rating*, an alternative approach was developed building on the experience of the first experiment.

The second instrument

A new instrument was developed, consisting of a pure mathematics section (section A) that would be attempted first, with questions about logarithms and exponentials, and a discipline-specific second part (Section B), containing only a single multi-part microbiology question about bacterial concentration (Roberts,

Sharma, Britton & New, 2007). It is significant that microbiology is not taught until second year at the University of Sydney, so no student was necessarily advantaged by being intimately familiar with the physical context chosen for Section B. The two sections of the test bear a similar relationship to one another as that between the mathematics and science sections in the first instrument.

Administering the test. First year science students at the University of Sydney volunteered to sit the test, in response to lecture visits and email requests. The test was administered to two separate groups of students, less than two weeks apart. Sample sizes were N=30 and N=19, respectively, for the two groups. The students gave permission for their university records to be accessed, yielding their first semester university results and high school results (if applicable). High school results included the Entry Ranking (UAI, standing for the University Admissions Index - a ranking out of 100 used for entry into universities in New South Wales) and marks for individual subjects. The university records also provided age and gender, which are considered important in any attempt to explain learning phenomena. It is important to note that the students who volunteered for participation in the study were self-selecting - they were not randomly selected and, as such, non-representative of first year science students. They were generally high-achieving students, as shown by the mean UAI of 94, and of the 49, only 7 were female.

Calculating transfer. Each question in Section A was matched to a question in Section B that required the use of the same mathematics, generating seven pairs of matched questions (Table 12.2).

Table 12.2. Matching of Section A questions to Section B

Section A	**Matching part in Section B**
1(a)	1
1(b)	2(d)(i)
1(c)	3
1(d)	-
1(e)	3
1(f)	-
2(a)	2(d)(ii); 3

Section A	Matching part in Section B
2(b)	1; 2(d)(ii); 3
2(c)	2(d)(ii);3

A student who gave the correct answer (score of 1) in corresponding question parts in both sections was awarded 2 marks for transfer for that part, while an incorrect answer (score of 0) in both sections resulted in a mark of zero (Table 12.3). If Section A was answered correctly but the corresponding question in Section B was incorrect, the mark was also zero, as this indicates that transfer has not occurred. Lastly, if Section A was answered incorrectly but Section B was correct, the student was awarded 1 mark. This reflects the view that transfer has occurred, but to a lesser degree than when answering correctly on both sections. There may be a subconscious process at work when answering Section A that prepares students for Section B, which provides an interesting question for further studies to address.

Only four out of seven parts in Section B are involved in the matching, and hence in the generation of the Transfer Index. This is a by-product of the natural setting of this project. The research team endeavoured to examine transfer in a real educational setting, rather than contriving a test with a one-to-one matching between all questions on both sections. There are difficulties associated with this approach, involving a tradeoff between having a natural, non-contrived setting, and being able to use a greater proportion of the test answers in the calculation of the Transfer Index.

Table 12.3. Allocation of transfer score to matched questions

Section A score	1	0	1	0
Section B score	1	1	0	0
Transfer score	2	1	0	0

It should be noted that there is a distinct difference between the situations represented by the two right-most columns in Table 12.3. If a student displays knowledge in Section A and not in Section B, he or she has clearly not transferred that knowledge. Yet if a student scores zero in both sections, little can be adequately said about transfer - how can someone transfer something that he does not appear to possess? The Transfer Score does not attempt to discriminate between the two situations.

The overall *Transfer Index* given to a student was the normalised sum of the individual transfer scores on the seven pairs of mapped questions.

$$Transfer\ Index = \frac{\sum_{n=1}^{7} TransferScore}{14} \times 100$$

CORRELATIONS

Information on students' performances in selected high school and University subjects was compared with test results and Transfer Indices obtained using the Second Instrument, to see whether useful correlations could be found.

High school variables

The Entry Ranking (UAI) and marks for individual high school subjects were obtained for 36 students, all of whom had attempted at least one mathematics subject and at least one of physics, chemistry or biology. The average mark for the High School science subjects (*HSAvScience*) was calculated to provide an overall measure of a student's competence in science. High School physics (*HSPhysics*) was also considered separately as it is the science subject expected to be most sensitive to varying degrees of graphicacy. The mathematics that is regarded as a prerequisite for first year science at the University of Sydney can be taken at three levels but the lowest level was not considered in the analysis, since it was taken by very few of the cohort who did the test. This left Mathematics Extension 1 (*HSMathsE1*) and the more difficult Mathematics Extension 2 (*HSMathsE2*). The High School variables therefore were *UAI, HSPhysics, HSAvScience, HSMathsE1* and *HSMathsE2*.

Test variables

The variables specific to the test include *Section A* and *Section B*, which are the normalised marks from the two sections of the test. *Transfer* is the Transfer Index as described above while *Graph* refers to the normalised mark of a student on the graphing-related questions of Section B: Q.2(a), (b) & (d). The first two parts of these graphing questions require comprehension and graph reading skills, while part 2(d) requires comparison between graphs, interpretation and calculations, showing higher order cognitive thinking according to Bloom's taxonomy (Bloom, 1956).

University and generic variables

The University variables are averages of the first semester university marks in all mathematics (*UniMaths*) and science (*UniScience*) subjects. All but two of the

students completed two mathematics subjects (mostly calculus and linear algebra courses), while all but six completed at least one subject in biology, chemistry, physics or earth sciences. The Generic variables were obtained from individual student records, with *Age* calculated to the nearest month at the time of the test. All of the variables are summarised in Table 12.4.

Table 12.4. Categorisation of project variables

High School	Test	University	Generic
UAI	Section A	UniMaths	Age
HSPhysics	Section B	UniScience	Gender
HSAvScience	Transfer		
HSMathsE1	Graph		
HSMathsE2			

Statistical correlations were performed in seeking to answer the following questions:

- Which, if any, of the Test variables best predict UniMaths and UniScience?
- Do any of the High School variables predict Transfer, or other Test variables?

A One-Sample Kolmogorov-Smirnov test (K-S test) showed that only one of the four Test variables (*Transfer*) was drawn from a normal population, so all correlations were performed using a non-parametric test, Spearman's rho (ρ_S).

Table 12.5. Correlation of Test Variables with University Variables

	Uni Maths	Uni Science		Uni Maths	Uni Science
Section A	ρ_S=0.56	ρ_S=0.59	Transfer	ρ_S=0.62	ρ_S=0.61
	N=47	N=43		N=47	N=43
	p<0.01	p<0.01		p<0.01	p<0.01
Section B	ρ_S=0.66	ρ_S=0.63	Graph	ρ_S=0.58	ρ_S=0.64
	N=47	N=43		N=47	N=43
	p<0.01	p<0.01		p<0.01	p<0.01

Table 12.6. Correlation of Test Variables with High School Variables

	UAI	HSAv Science	HSPhysics	HSMaths E1	HSMaths E2
Section A	ρ_S=0.45	ρs=0.44	ρ_S=0.48	ρ_S=0.56	ρ_S=0.61
	N=36	N=36	N=26	N=11	N=20
	p<0.01	p<0.01	p<0.05	n.s.	p<0.01
Section B	ρ_S=0.57	ρ_S=0.36	ρ_S=0.25	ρ_S=0.92	ρ_S=0.57
	N=36	N=36	N=26	N=11	N=20
	p<0.01	p<0.05	n.s.	p<0.01	p<0.01
Transfer	ρ_S=0.58	ρ_S=0.39	ρ_S=0.22	ρ_S=0.57	ρ_S=0.57
	N=36	N=36	N=26	N=11	N=20
	p<0.01	p<0.05	n.s.	n.s.	p<0.01
Graph	ρ_S=0.51	ρ_S=0.38	ρ_S=0.31	ρ_S=0.79	ρ_S=0.58
	N=36	N=36	N=26	N=11	N=20
	p<0.01	p<0.05	n.s.	p<0.01	p<0.01

(for Tables 5 and 6, n.s. = correlation not significant; N = sample size)

Highly significant correlations were found between all University and Test variables, while the relationships between Test and High School variables are less uniform: some combinations show no correlation and others show very significant correlation (e.g., *HSMathsE1* with *Section B* or *Graph*). In addition to the associations between the Test and other project variables, a very interesting association was found between *Transfer* and *Graph* ($\rho_S = 0.72$, $N = 49$; $p < 0.01$). This was the strongest correlation besides the extremely high ones involving *HSMathsE1*, and it supports the findings of Gill (1999a) that 'mathematical understanding related to the understanding of graphs and their slopes… may underly [sic] the ability to understand a number of higher order concepts'.

Models for predicting transfer

The chronological order of the variables in the project is High School → Test → University, while *Age* is measured at the time of the Test, and *Gender* is independent of time. This places a limit on the predictive powers of variables (e.g., *UniMaths* cannot predict *HSMathsE1*). Only models that included Test variables

were considered, after eliminating all relationships without significant correlation (e.g., *HSMathsE1* with *Transfer*, Table 12.6). Ignoring the possible dependence of *Graph* on High School variables, two sets of regressions models were studied:

- those predicting *Transfer* from *Age, Gender* and the High School variables *UAI, HSAvScience*, and *HSMathsE2*
- those predicting University variables from *Age, Gender* and the Test variables *Transfer* and *Graph*.

In all of the models, *Age* and *Gender* were included, as these are often significant factors in education research.

Results of multiple regression. For each of the models, the relationships between the independent variables and the dependent variable were determined, and variables with a non-significant impact (based upon the significance of the standardised Beta coefficients, β) were progressively removed in a series of iterations, until the remaining variable(s) had satisfactory levels of significance.

Analysis of the first model resulted in exclusion of the variables *Gender, Age* and *HSAvScience* (*Gender* due to there being no females amongst the students selected by the model). The R^2 value for the resulting model (Figure 12.4) was 0.38 ($N=20$, $p<0.05$). *HSMathsE2* ($\beta = 0.50$, $p<0.05$) was a much more significant predictor of *Transfer* in this model than *UAI* ($\beta = 0.21$, $p<0.05$).

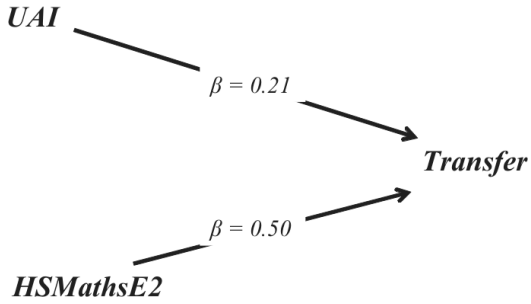

Figure 12.4. Final model for predicting Transfer

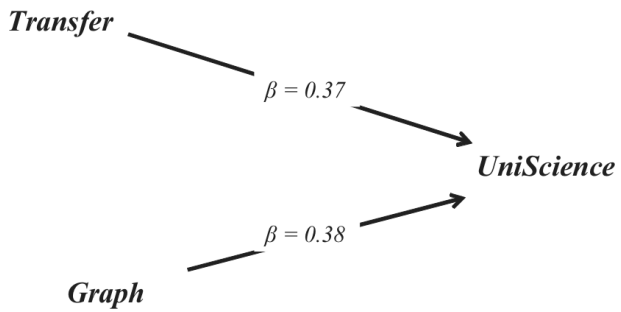

Figure 12.5. Final model for predicting UniScience

The second category of model moved from prediction of Test variables to using Test variables as the independent variables, with dependent University variables. For *UniMaths* as the dependent variable, the variables *Gender*, *Graph* and *Age* were excluded, leaving *Transfer* as the only significant independent variable ($R^2 = 0.38$, N=47, $p<0.01$). *Graph* and *Transfer* were the only independent variables with predictive value for *UniScience* ($R^2 = 0.48$, N=43, $p<0.01$) and standardised coefficients (β) of 0.38 ($p<0.05$) and 0.37 ($p<0.05$), respectively (Figure 12.5).

Our analyses show that, of the High School variables examined, only University Entry Ranking (*UAI*) and the marks for the most difficult mathematics subject (*HSMaths E2*) have any value in predicting mathematics transfer ability, with *HSMaths E2* being the most reliable predictor. Based on the Second Instrument, the results of the questions relating to graphicacy as well as the calculated Transfer Index were both useful in predicting university science results.

APPLICATION OF THE RESEARCH TO IMPROVING TEACHING AND LEARNING

To date most of our emphasis has been on development of tests to measure transfer and meaningful ways to analyse the data generated. It has been seen that the ability to transfer mathematics is a good predictor of performance in first year University mathematics and science, and is itself correlated with the Entry Ranking and the mark in high school Mathematics Extension 2. At this time it is not known to what extent the ability to transfer mathematics can be increased by training, or if a low level of numeracy in scientific disciplines due to poor transfer ability can be augmented by remedial teaching in a few key areas of mathematics.

So while there have been few conclusions that would suggest changes in teaching practice to improve transfer, work on the project has taught us two im-

portant lessons that have clear implications for teaching and learning. Firstly, communication between mathematicians and academics in other scientific disciplines is essential. We discovered that our use of mathematics is often different, in ways which are unlikely to be helpful to students. The second lesson arises from the difficulties that we all encountered in understanding questions written by our colleagues, set in the context of disciplines other than our own. We must take extreme care in our teaching to ensure that we do not assume more knowledge on the part of students than they possess.

One interesting finding has been that transfer ability is positively correlated with graphicacy, although we do not know whether superior ability to interpret graphical representations of mathematical data is a cause or consequence of superior ability to transfer mathematical learning. However the strength of the correlation has encouraged some of us to change our emphases in teaching. We now devote more time to explaining the interpretation of graphs in the context of our own scientific disciplines. Further work is needed to confirm that this approach improves mathematics transfer and numeracy.

So far our investigations have only analysed data concerning transfer of mathematics knowledge and skills related to one area, that of exponentials and logarithms, but they could be applied to other mathematics contexts and to other cohorts of students. In so doing, our approaches will allow identification of other useful questions, the answers to which will inform our teaching practices and build a community of practice across the various disciplines that rely on mathematics transfer.

ACKNOWLEDGEMENTS

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Chapter 13
Participatory action research in an arts transition program

Nerida Jarkey

Faculty of Arts

BACKGROUND AND CONTEXT

The transition process for students commencing an undergraduate arts degree at the University of Sydney can be impersonal and overwhelming. The university has total student enrolments of 45,000 and a staff of over 6,500. The Faculty of Arts is one of the largest in Australia, with more than 7000 students, almost 6000 of whom are enrolled at the undergraduate level.

'Arts students' are defined not by the subjects they study, but by the degree program they enroll in. When students enroll at the University of Sydney, they enroll in the faculty that offers the degree program they wish to complete. This faculty is responsible for them throughout their candidature—for the administration of their degree program, for their retention and progression, for their completion of the requirements of the degree and for their overall learning experience.

The Arts Faculty prides itself on the outstanding breadth of choice we offer our students when it comes to selecting subjects and majors both within and beyond the faculty, and on the many opportunities we provide for interdisciplinary learning. These features are also highly valued by students. In feedback from both current students and recent graduates, respondents often mention the range of choice available as one of the most positive aspects of their degree in arts.

However, this flexibility does not come without a price. The Bachelor of Arts, in which over half of our undergraduates are enrolled, has no core subjects at all, and so provides candidates with no shared learning experience. Students in our fourteen other degree programs may share core units in one subject area, but have even more choice than Bachelor of Arts students when it comes to their other subject areas, and often complete majors offered by one or even two other faculties.

It is hardly surprising, in this context, that our students have little natural sense of belonging to a cohort, nor a strong sense of identity with their degree program or with the faculty. Focus groups held in 2001 indicated that even

students in relatively small arts degree programs such as the Bachelor of Arts (Informatics) and the Bachelor of Social Sciences lacked a sense of belonging and felt out of touch with others in the same program. In follow-up focus groups conducted in 2002, we asked students to describe their experiences in the first few weeks of their first year. The vocabulary they used left us in no doubt about the depth and significance of their feelings: 'Nightmare', 'LOST LOST LOST', 'stressed out', 'awkward', 'isolating', 'impersonal', 'fearful', 'scary', 'confusing', 'extremely sucky, hellish, and bollocks'. (Jarkey, 2004, p. 188). Even after studying in the faculty for a year or more, many students report that they are still quite overwhelmed and unsure about how to get the support they need.

The scholarly literature on the tertiary transition experience has much to say about the issues we face. Academic and social integration are well recognised as crucial elements in ensuring a smooth transition to tertiary learning (Beasley & Pearson, 1999; Peat, Dalziel & Grant, 2001; Pascarella & Terenzini, 1991). This integration can, to a certain extent at least, take place naturally in smaller faculties, and in those in which students have a higher number of 'core' or compulsory subjects and a narrower range of choice. Students meet each other frequently in classes and share many common learning experiences. They have similar timetables with common free time, which they can spend together in shared recreational spaces. In this environment, most soon develop friendships and supportive academic and social networks. Our focus groups revealed that this was certainly not happening naturally for arts students at Sydney—not surprising given the very different context they found themselves in during their first year.

Transition and mentoring programs have been found to assist by integrating new students with the learning community and engaging them with the university. McInnis, James and Hartley (2000, p. 53) point out that these programs are important for all students, but particularly those who experience problems. The research of these authors (2000, p. 55) further reveals the value of developing different approaches in addressing the varying needs of students depending on their area of study. What works in the context of one faculty may not be effective in another.

For these reasons, in 2002, we began to organise a program to support the first first year experience in arts, and to help our commencing students value and benefit from the opportunities that come hand-in-hand with the potential challenges of studying in the context of our faculty. This program invites senior student volunteers to help welcome first years to the faculty at enrolment time, to participate in organising 'Arty Starty Day', a transition workshop for initial orientation and networking, and to provide ongoing support and encouragement through a peer-mentoring program.

AIM OF THE INVESTIGATION

The investigation reported in this chapter is an ongoing one; it commenced, as the program did, in 2002 and has since become an integral part of the program itself. This investigation was initially motivated by the fact that, although our students were telling us that they needed a sense of identity and belonging in our faculty, and the literature was advising us that a mentoring program would help, we did not have a clear sense of just what such a program would look like if it were to successfully contribute to meeting our students' needs.

Thus, the central question for our investigation was, and continues to be: 'What are the key features of a mentoring program that will help first year students to develop a sense of identity and belonging in the context of our faculty?' The aim of the investigation is to use the understandings we gain in response to this question to develop a mentoring program that really does make a difference to our first year students' sense of identity and belonging, and so, ultimately, to the quality of their learning experience in their arts degree program at the University of Sydney.

The Arts Network Mentoring Program is just one part of a suite of initiatives we have developed in the faculty over the last few years to try to address our students' needs. However, the outcomes of our investigation to date suggest that it is rapidly becoming a key element in a positive transition experience for our students, and their sense of being valued members of the faculty learning community.

THEORETICAL APPROACHES THAT INFORM THE INVESTIGATION

The fundamental theoretical approach we have come to adopt to inform our investigation is that of critical social theory, an approach that focuses on integrating theoretical understandings with practical outcomes involving social change. Within this broad domain, our approach can be characterised as 'critical educational science', which Carr and Kemmis (1986, p. 155) describe as 'a form of research which is not research *about* education but research *for* education'.

Our research methodology is participatory action research. The rationale for adopting this methodology is threefold. Firstly, firmly in the tradition of critical social theory, action research is not only about creating understanding and knowledge, it is also about creating change (Seymour-Rolls & Hughes, 1995; Hughes, 2004). This is precisely our goal: first to understand how to foster a sense of identity and belonging amongst our students, and then to actually do so. Secondly, and again in the tradition of critical theory, when action research is participatory it is about negotiating processes and sharing decision making in ways that are

empowering to all those involved. We cannot, and would not wish to impose a ready-made, faculty identity on our students; what we can do is foster a context that invites them to be active participants in creating a shared sense of identity. Our third rationale for the methodology we have adopted is that participatory action research addresses shared concerns by drawing on the collective resources of all stakeholders in a collaborative process. This process involves four, interdependent, cyclical elements: planning, acting, observing and reflecting (Kemmis & McTaggart, 1988). It is this action research process, and the generous involvement of our students and staff in it, that we see as crucial to the outcome of positive change in our program, in our faculty, and in the transition experience of our students.

It is important to acknowledge limitations on the extent to which we can realise the ideals of our theoretical approach and research methodology in the context of our program. As pointed out by Ospina, Dodge, Godsoe, Minieri, Reza & Schall (2004, p. 48):

> Just as the ideal of democracy animates political life but is often not fully realised, the democratic aspirations behind action research are much harder to achieve in practice than in theory.

While our student participants are actively involved in most key decisions in the program, staff participants do retain ultimate power over decisions related to significant financial commitment and to university policy. Furthermore, we would not wish to pretend that staff participants manage, in all other respects, to overcome the deeply rooted power imbalance embedded in our interactions with students, in particular in relation to language and discourse (Foucault, 1980). Nevertheless, we take heart in the vision of Paulo Freire (1970):

> The core of Freire's approach is to realise the liberating potential of reflection plus action. The combination of theory and practice in a single process (praxis) has potential to overcome the oppressive structures that can result from the alienating duality of mind and body (theory and practice, reflection and action). This is a powerful idea for cultural change. (Hughes, 2004)

METHODS OF INVESTIGATION: THE PARTICIPATORY ACTION RESEARCH CYCLE

The cycle of investigation – planning, acting, observing and reflecting – is an integrated and continuous one. Nevertheless, in some sense we think of the cycle as 'beginning afresh' in Semester Two each year, when we invite students who participated in the program in Semester One to join general and academic staff to

reflect on what we have learnt from the previous year's program and to plan for the following one. Those students who join staff in this reflection and planning session are primarily either first year participants who are intending to become mentors, or previous mentors who are looking forward to participating as mentors again.

The data we use to facilitate this planning come from two sources. First are the observations we have collected from the previous cycle. Second are our own reflections on these observations and on our own experiences, from our current perspective of temporal distance from the experiences and actions observed, and from our current role as planners for the next cycle. This stage of the cycle is represented as (1) in Figure 13.1.

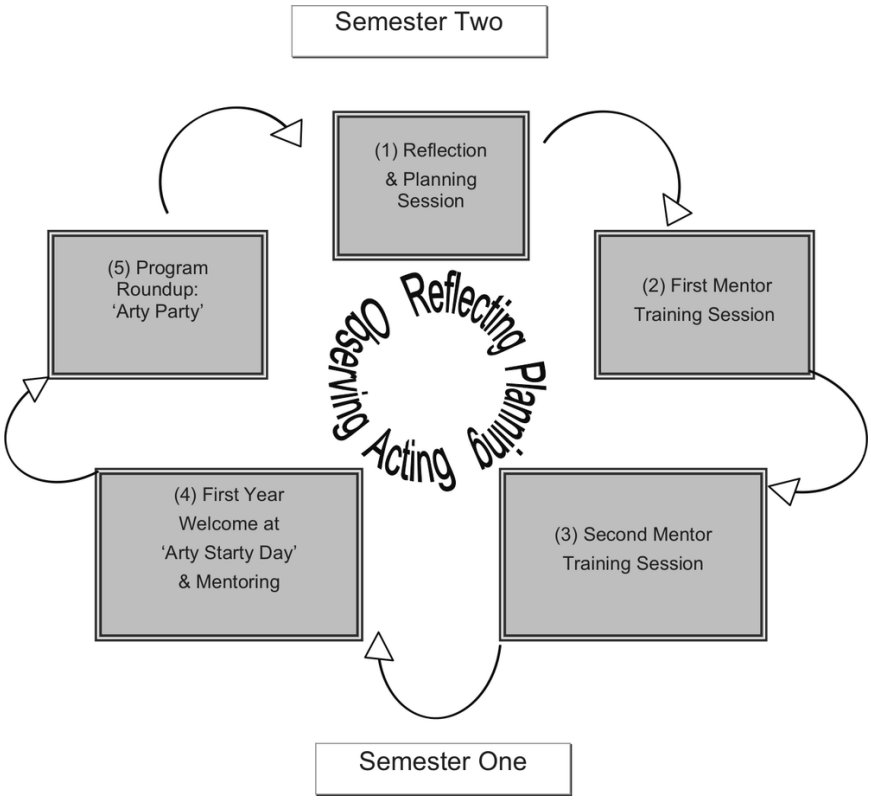

Figure 13.1. The participatory action research cycle

The stages of reflecting and planning continue as the 'acting' stage of the cycle begins, with the first mentor training session at the end of Semester Two - represented as (2) in Figure 13.1. We take this opportunity to ensure that new

participants are aware of the changes and innovations we have made to the program as a result of the input of past participants, and of any further changes and innovations we are considering for this iteration. Of course, we invite the new participants to contribute to refining and to realising these innovations. This is particularly important, as it fosters a sense of ownership and involvement in the cyclical action research process with all members of the new team, not only those who were able to attend the initial reflection and planning session.

Understandably, those new to the team often do not contribute quite as freely as the more established members in this first face-to-face encounter together. However, many soon find their voice in our online discussion board, through which we keep in virtual contact over the summer break between the first training session and the second. The fact that mentors themselves often initiate discussion threads on topics related to program planning and evaluation tells us that they feel that their input is genuinely valued. In the 2005-2006 program, for example, a 'Cool Activities' thread was launched by a new mentor the day after our first training session, and elicited twenty one postings from ten contributors, seven of whom were new mentors.

The cycle progresses very clearly from a focus on planning to a focus on acting, as we meet face-to-face again at the second mentor training session (shown as (3) in Figure 13.1) to make final preparations for welcoming the new first year students on 'Arty Starty Day' at the beginning of Semester One and for mentoring them over their first few crucial weeks at university (shown as (4)). Throughout these acting stages, we continue to observe in a variety of ways. At face-to-face events such as the training and welcome sessions we use brief feedback surveys, and complement these with informal, post-event 'debriefings'. Our online discussion board, in which the first years as well as the mentors now have a voice, continues to be a fertile shared ground for ongoing observation and reflection. And the official 'round-up' to our program—'Arty Party' (represented as (5) in Figure 13.1)—along with longer online surveys administered later in the semester, are chances to elicit responses to the program as a whole and to its value in the broader context of the transition experience.

Before the cycle 'begins' again in Semester Two, the feedback we have received from participating mentors and first years is further contextualised by input from faculty staff who have participated in various program events, and from colleagues in other faculties and at other institutions who are responsible for similar programs. Finally, the scholarly literature continues to be another valuable 'lens' through which further observations can be made and understandings facilitated (Brookfield, 1995, pp. 36-39).

FINDINGS OF THE INVESTIGATION AND RESULTANT CHANGES TO THE PROGRAM

The basic findings outlined here may well have been revealed to some extent through an alternative research methodology. However, the level of our understanding of their significance to our student participants, and the nature of the changes made as a result, are shown below to be attributable to the participation of all stakeholders in the research process and its outcomes.

The importance of relationships

When asked to reflect at the end of the program on the aspect that they find most valuable, around two thirds of first years (66% in 2006) and an even higher proportion of mentors (70% in 2006) identify making friends with others in their course and building and participating in supportive networks as key aspects for them. The following is typical of the kind of comments we often receive from first years:

> [The most valuable part of the program was] meeting people who are doing the same course as me. We are all still really good friends and we see each other all the time. It was a good chance (and one of the few opportunities) to spend a prolonged period of time getting to know people in your course. (Online survey of First Years, June, 2006)

The fact that first year students build social networks through mentoring programs, and the fact that they value these networks highly, came as no surprise to us; this was precisely what the literature had led us to expect (e.g., Peat, Dalziel & Grant, 2001) and was one of our strongest motivations for establishing the program in the first place. However, there were two findings about the importance of relationships that we had not anticipated.

The first of these was the extent to which not only first years, but also mentors found the program helped them expand their own networks and sense of identity within the faculty:

> [The most valuable part of the program was] the opportunity to meet so many other great mentors and mentees – it makes you feel like you are significant and play an important role in the Arts Faculty. The Arts Faculty is so huge, sometimes it can feel quite anonymous: mentoring makes the faculty seem much smaller and more friendly. (Online survey of Mentors, June, 2006)

The sense of being leaders in a movement for change in the faculty – a

movement that is based on interpersonal relationships and shared experience – is something that often emerges in our reflection and planning sessions as the element of the program in which mentors feel most pride.

A second finding that we had not expected was the extent to which students' desire to build meaningful and ongoing relationships extended to relationships with faculty staff and program facilitators. This understanding emerged, for example, through the mentors' reflections on the training sessions run for the 2003 and 2004 programs, when we were planning for 2005.

In both 2003 and 2004, we had invited professional trainers to lead the training sessions. While mentors had responded very positively to these sessions in on-the-spot feedback, when they reflected on the experience in the context of the whole program and in their role as collaborators in program planning, their preference clearly emerged for training to be facilitated 'in house', by those with whom they would have a continuing relationship.

Although considerably less polished and professional, our training sessions are now far more focused on building skills in the context of building relationships. They are fully facilitated by faculty staff who have an ongoing commitment to the program, in close collaboration with our most experienced mentors.

The importance of creativity

As noted, the literature suggests that faculty-specific approaches are ideal in addressing the varying needs of students depending on their area of study (McInnis, James & Hartley, 2000, p. 55). Accordingly, we have always utilised talents and strengths characteristic of Arts Faculty students, staff and alumni in ongoing program development. In particular, the Arts Network Program has always been distinctive in its use of creativity and humour, and has always facilitated involvement and participation through this creativity.

One example of this kind of activity in our program is an interactive role-play on Arty Starty Day, facilitated by faculty staff from Performance Studies, Paul Dwyer and Ian Maxwell. After an initial performance of a play about the challenging life of a first year student, audience members participate actively in recreating some of the scenes with a view to finding ways of dealing with some of the challenges. Another example of collaborative creativity is an interactive drumming performance we held in Orientation Week in 2006, in which everyone who came had a drum or percussion instrument, and so was simultaneously an audience member and a performer.

However, it has only been through the reflection and input of mentors in the program, through our action research cycle, that we have come to appreciate the importance of facilitating program participants to take more responsibility for this creativity themselves. This understanding emerged during mentors' reflective input to planning for our 'Arty Party' program round-up events in 2004 and 2005.

Staff were keen to involve our alumni in these events, and, in consultation with mentors, invited Adam Spencer (University of Sydney Alumnus and then host of the Australian Broadcasting Commission radio show *The Triple J Morning Show*) and Charles Firth and Andrew Hanson (Arts Alumni and stars of the Australian Broadcasting Commission television show *CNNNN* and *The Chaser News Team*) to join us for the 2004 and 2005 events respectively.

Mentors, however, made it clear that, while they very much valued the input of these well-known and well-loved former students, they also wanted to be responsible for some of the creative action themselves. Resultant highlights were *Yellow Maple Leaf and Two Chopsticks: a light operetta on the joys of life at the University of Sydney* (Arty Party 2004)[4], *Mentor Mayhem: the musical* (Arty Party 2005)[5], and the hilarious and most memorable *Great Quadrangle Tutu Run of the Century* (Closing Ceremony, 2004).

Perhaps even more significant in terms of broad participation and collaborative creativity have been the introduction of the Arts Network Photographic Scavenger Hunt (since 2004) and the Arts Network Theatre Sports Spectacular (since 2006). These activities have come about as the result of mentors' reflections on how to engage first years as actively as possible in the program, and are largely planned and facilitated by the mentors themselves. They provide enticing and supportive opportunities for both mentors and first years to assert their individual and collective identities as Faculty of Arts students.

In the Photographic Scavenger Hunt, which takes place on the afternoon of Arty Starty Day, each mentor group (one mentor and six to eight first years) is given a disposable camera and invited to create a series of challenging and interesting photographic tableaus as they explore the campus together. These pictures are then shared on the program website and at the end-of-program Arty Party.

Theatre Sports is an activity that has more recently found its home at the Arty Party. The mentors enlist the help of other senior students in the faculty who are experienced in facilitating this activity. However the mentors themselves choose the nature of the games, keeping in mind the fact that they will be a new expe-

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4 Appropriation, abridgement and contortion of lyrics by Arts Network Mentor Sikeli Neil Ratu; Original score by Divers Dead White Males with particular apologies to Edward Elgar, W.S. Gilbert and Sir Arthur Sullivan, Vic Mizzy, Warner Bros, Tim Rice and Lord Lloyd-Webber; performed by Melanie Cariola, Katharine Sampford, Louise Harris, Rachel Hardy, Amanda Setiadi, Christine Janssen (Mentors) and Nerida Jarkey (Program Director); narration by Ian Maxwell (Performance Studies); musical support by Mami Iwashita (Japanese Studies).

5 Music and words adapted by Arts Network Mentor Rachel Hardy from *Avenue Q: The Musical* by Robert Lopez and Jeff Marx; performed by Tom Tramby, Trieste Corby and Rachel Hardy (Mentors), accompanied by Elise Hopkins on piano (Mentor).

rience for many first years. What a joy it is to see the first years, who are often extremely nervous and hesitant when they first join us at the beginning of semester, throwing themselves without reservation into these highly interactive and amusing games just a few short weeks later.

The importance of image

Not only are the Program activities a lot more collaborative and fun as a result of the creative input of our student participants, but the whole image of the program is significantly more 'funky'. The more we have engaged in critical reflection with our mentors and first years, the more apparent it has become that 'funkiness' is a crucial component of the identity they wish to construct for themselves.

In the early days of the program, for example, our students explained that they found considerable difficulty in feeling a sense of ownership over events with names like 'Transition Workshop' (now 'Arty Starty Day') and 'Program Roundup' (now 'Arty Party'). Mentors also alerted us to the fact that the original program name, 'The Faculty of Arts Transition and Peer Support Program' was likely to evoke memories of High School buddy programs amongst prospective first year participants. They were instrumental in changing the name to 'Arts Network Mentoring Program', which not only emphasises the network-building aspect of our activities, but also seems decidedly more attractive to first years.

We have found evidence for the value of our funky new image, along with our interactive and creative activities, in two places. Firstly, in each year since the program started, our participant numbers have grown significantly. In 2003, approximately one fifth of commencing Arts students registered for the program. By 2004, the proportion had increased to one in four, and in 2006 well over one third of our new first years signed up to be involved. Further evidence emerged last year in the major online forum for students in the final year of high school, the 'Bored of Studies' Student Community Forum (Bored of Studies, 2006):

> Hi, Anyone going to be joining the Arts Network Mentoring and Transition program? (http://www2.arts.usyd.edu.au/ArtsNetwork/index.cfm) I've been looking at the website and reading it, I think I'll sign up. (Manifestation, 19 Jan 2006, 10:20 PM)
>
> Hmm. This sounds quite handy. I'll probably sign up. Thanks for the tip-off. (Seryn, 19 Jan 2006, 10:34 PM)
>
> I like how on the site it says 'A highlight of our program is the 'Arty Starty' Day', they really won me over with the 'arty starty' lol [laugh out loud] this is so the faculty for me. (DeepDarkRose, 19 Jan 2006, 11:35 PM)
>
> I know I cracked up at that too, it sounds good. I just hope some lovely people/s will befriend me or I will befriend someone/people. See you there. (Manifestation, 20 Jan 2006, 1:13 AM)

> yeah apparently there's a photo hunt that we have to do to bond or something… i can't think of a better way to start uni than to run around like crazy taking photos of people stuck up trees, adulthood, here we come! (DeepDarkRose, 20 Jan 2006, 11:50 PM)
>
> Haha… it is fun, I went last year. And this year I'm a mentor, so you might end up stuck with me! (Beanbag with Legs, 21 Jan 2006, 12:21 PM)

CONCLUSION

Fostering a sense of cohesion has proven challenging in a faculty as large and diverse as the Faculty of Arts at the University of Sydney. However, as one of our mentors so aptly put it, 'Because of the sheer size of the Arts Faculty and all the disparate majors we can do, it's wise to instill a sense of network and community early on.'[6] The importance of this sense of network and community is clearly stressed in the literature on tertiary transition, as is the value of mentoring programs and the need for faculty-specific approaches in achieving this goal. Just what constituted an appropriate approach in the context of our faculty was the question we needed to answer as we commenced our transition and mentoring program in 2002.

Through a process of participatory action research over five program cycles, we have gained understandings about some of the key features of a mentoring program that can help our first years to develop as sense of identity and belonging in our faculty community, and we have refined our program accordingly. The key features we have uncovered to date as most relevant to students in establishing a sense of identity and belonging in our context are the importance of relationships, the importance of creativity, and the importance of image. In each of these three areas, we have needed to pay careful attention to our students' voices to determine the breadth of the relationships they seek, the kind of creative activities they are motivated to be involved in, and the nature of the image they wish to establish for themselves. In this way we have been able to support them in creating their own communal identity as arts students, rather than asking them to conform to an imposed or received sense of what an arts student is. Our students' positive responses to the changes we have made in our program strongly support the suggestions we found in the literature regarding the value of initiatives that are sensitive to context, rather than adopting a one-size-fits-all approach.

While more traditional forms of evaluation, such as on-the-spot feedback questionnaires, do continue to give us valuable information about the response of our participants to various program events, it is the collaborative and integrative

6 Mentor comment on Web CT discussion board, 10 November 2005 (quoted with permission).

dimensions of the whole participatory action research cycle that provide us with the deepest understandings about our students and our program, and lead to the most meaningful change.

PART IV
CYCLES OF RESEARCH AND CURRICULUM CHANGE

Chapter 14
A collaborative approach to improving academic honesty

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Faculty of Economics and Business

Academic dishonesty is widely acknowledged in universities as a worsening trend, attributed to an expansion of the internet (Underwood & Szabo, 2003), increased class sizes and decreased personal contact, more reliance on the international student market (Ashworth, Bannister & Thorne, 1997), greater student diversity (Lambert, Ellen & Taylor, 2006), higher tuition costs (Sheard, Markham & Dick, 2003) and increased competition for employment (Underwood & Szabo, 2003). However, despite the strong interest in the public media and across the sector in Australia, Marsden, Carroll and Neill (2005, p. 8) observe that 'there is no empirical evidence to support the popular contention that dishonesty is on the rise.' They provide a valuable contribution of self-reported dishonesty. Nevertheless, Jocoy and DiBiase (2006) observe that self-reported figures bear little resemblance to actual cases detected. Lambert et al. (2006) point out a further conundrum: while 5.8% of students report being caught for academic dishonesty, those same institutions' official records indicate a detection rate of only 0.2%. Clearly academics are choosing to deal with dishonesty through informal channels.

Two critical incidents prompted action on academic dishonesty in the Faculty of Economics and Business at the University of Sydney. First, in 2002 a senior peer review team visiting the Faculty noted that academic dishonesty was a 'serious problem'. Second, the 2002 Student Course Experience Questionnaire (SCEQ) revealed that as many as 5% of students in one postgraduate program perceived dishonesty as a serious concern.

This chapter reports on a social constructivist approach to addressing these concerns about academic honesty. The research here describes the iterative, evidence-based processes undertaken by the Faculty, over a four year period, developing what has become a holistic strategy to focus strongly on prevention and education. The approach thereby aligns with Park's (2004) call for institutional responses to protect credibility and reputations in ways that reflect specific cultural contexts. Further, the orientation is also consistent with McCabe (2005) who urges proactive strategies that build a community of trust, where ethical behav-

iour is valued and academic integrity is the expected behaviour.

With this educative institutional approach to promoting academic honesty in contrast to detecting plagiarism by the individual student, the following section reviews the academic honesty literature. The social constructivist framework and emergent methodology is then described. The three cycles of collaborative action research, employed to systematically address the problem, follow with discussion. Finally, the implications of this approach for change and future directions are outlined.

LITERATURE REVIEW

Academic dishonesty is not only considered a form of fraud but fundamentally contradicts core academic values. Students at the University of Sydney are considered to have acted in an academically dishonest manner if they have 'presented another person's ideas, findings or written work as his or her own by copying or reproducing them without due acknowledgement of the source and with intent to deceive the examiner' (University of Sydney, 2006, p. 5). However, ambiguity and uncertainty surrounds plagiarism and free-riding. Where does using others' words or ideas without appropriate acknowledgement become 'literary theft' (Park, 2004; p. 291) as opposed to simply poor paraphrasing, referencing or language? Where is the fine line that separates collusion from legitimate collaboration and peer learning? When does inadequate contribution to a group assessment become free-riding rather than simply a different type of contribution (James, McInnis & Devlin, 2002)?

There is a long history of researching academic honesty in North America. Revisiting many of the same institutions surveyed by Bower (1964) in regard to how often and why students cheated, McCabe and Trevino (1993) found that while cheating (in the 12 months preceding the survey) in tests and exams had increased over the thirty years, from 39% to 64% of students self-reporting such behaviour, plagiarism was unchanged (66% in 1964; 65% in 1993).

More recently, McCabe (2005) notes that 51% of students across a sample of over 40,000 students on 68 campuses in North America self-reported plagiarism – a reduction attributed to anonymity concerns introduced with web surveying. McCabe (2005) observes that the free-response comments suggest that this younger cohort is more lenient on both plagiarism and collusion. A perception gap also exists with their teachers who consider both far more serious. Von Dran, Callahan and Taylor (2001) reveal similar concerns, for example 40% of students regard falsifying research results and copying text without referencing the source as minor events worthy only of reduced marks. In contrast, academics felt such practices should result in expulsion and a fail grade for the assessment respectively.

The importance of the institutional context, particularly the student culture,

is underlined in a number of studies. Institutions with an 'honour code' continue to exhibit far less self-reported cheating than those without (McCabe & Trevino, 1993). However, the institution with the lowest dishonesty level in their sample did not have a formal code but rather a strong informal obligation introduced first at orientation and reinforced thereafter. In contrast to individual differences, such as age and gender, which explain only 3% of the total variance, McCabe and Trevino (1997) show that 21% of the variation can be explained by contextual variables with peer disapproval (15.6%) far outweighing both peer behaviour (4.7%) and fraternity membership (0.8%). After 15 years of researching academic integrity, McCabe (2005, p. 30) reiterates the importance of an institutional response 'rather than investing in detection and punishment strategies [such as] reacting to an increasing number of faculty complaints by simply subscribing to a plagiarism detection service … we would do better to view most instances of cheating as educational opportunities'.

There is no equivalent research in Australia. Whilst overseas research provides valuable background to inform institutional responses, findings cannot be generalised as the tertiary context is fundamentally different. For example, unproctored exams and honour codes have not historically been part of Australian university culture. Furthermore, there is some evidence that Australian students are less likely than American students to regard the use of ideas from a book or paper without adequate acknowledgement as cheating (Waugh, Godfrey, Evans & Craig, 1994 in Marsden et al., 2005).

Business students in North America self-report more dishonest behaviours than engineering, science and humanities students (McCabe & Trevino, 1993). However, in Australia, self-reported behaviour across twelve faculties in four Australian universities shows engineering students significantly more likely to cheat (41% of all students admit to cheating) than students in other disciplines (including economics/accounting) and science students more likely to plagiarise (81% of all students admitting to plagiarism) according to Marsden et al. (2005). A disturbing finding is that students further into their program self-reported more dishonesty. Their study concludes that a decision to be dishonest is a function of demographic, situational and personality variables.

Recognising that there are disciplinary differences, Sheard, Markham & Dick (2003) contrast perceptions of postgraduate (coursework) and undergraduate students studying information technology in one institutional context. They find that postgraduate students self-report less cheating, while the top three reasons for preventing cheating are the same (namely, 'want to know what your work is worth', 'pride in your work', 'can get good marks without cheating') and these get stronger with every year of study.

There is mounting evidence of ways forward as some approaches are discounted and others are consistently proposed. Teaching ethics has limited impact on cheating (Brimble & Stevenson-Clarke, 2005). Revising policies to emulate

honour codes also has limited impact on cheating (Von Dran et al., 2001). The evidence on informing students of the rules is contradictory with Kerkvliet and Sigmund (1999) claiming an impact and Marsden et al. (2005) showing no significant impact. Where there is agreement is that 'shifting students' focus to achieving learning outcomes will promote behaviours that encourage them to engage in learning rather than cheating in order to achieve academic success' (Sheard et al., 2003, p. 106). Von Dran et al. (2001) propose that staff need to be actively engaged with understanding, communicating (including modelling) as well as enforcing such behaviour. Marsden et al. (2005, p. 9) call for 'new ways of communicating academic honesty policy.' This chapter seeks to show how in one site such approaches have been introduced over the last four years.

METHODOLOGY

Broadly, the methodology adopted in the Faculty of Economics and Business site can be understood as action research. Action research enables participants to engage directly with others in understanding and acting on issues of concern. While action research (Lewin, 1946) has a long history in education, and especially in the professional development of teachers, its application in higher education for institutional change within university practices has been more limited (Treleaven, 2001).

Throughout the four years of focusing on improving academic honesty, there have been considerable shifts in the approaches to the academic honesty project as leadership has changed and wider understandings of how to effectively engage institutional change have been gained. In summary, these understandings allow the methodology to be reconceptualised from a single intervention to fix a problem (technical action research) to an institutional process adopting collaborative action research processes (Reason & Bradbury, 2001). Cycles of planning, acting, observing and reflecting (Kemmis & McTaggart, 2001) have spiralled outwards dynamically to seek better explanations and options for change. In each cycle, examining underlying assumptions has shifted not only the mode of action research (from technical to collaborative) but also the theoretical framework (from positivist to social constructivist), thereby redefining the scope and appropriate strategic action as Grundy (1982) highlights:

> At base the different philosophical stances which underpin the various modes, relate to the source and scope of the guiding 'idea' of the project and the disposition which determines the type of strategic action (p. 353).

Further, this reconceptualisation as collaborative action research emphasises the emergent nature of the interventions and its commitment to inform subsequent

cycles of action on the basis of evidence generated by research, from within and beyond the process itself.

The analyses and sense-making of the developments in this academic honesty project have drawn on substantial sources of data collected over the four-year research period. The data used can be clustered around three major types: institutional; student and staff feedback; and resource materials. Institutional data includes policy documents; working party and committee reports and minutes; resolutions; and documentary evidence provided in funding applications. Student and staff feedback includes course (SCEQ) evaluations; student and staff interviews; usability studies; student feedback relating to the introduction of the online self-paced learning module, self and peer assessment software (SPARK), and phrase-matching software; and faculty forums. Resource materials provide documentary evidence of action such as the development of online modules and websites to address the problems. Much of this data has been analysed and reported elsewhere, using quantitative analysis of data collected from the self-paced online academic honesty module, SPARK and text-matching software usage; and interviews with students and staff. (See Clarkeburn & Freeman, 2006; Freeman, Hutchinson, Treleaven & Sykes, 2006; Freeman, McGrath-Champ, Clark & Taylor, 2006; Clark & Freeman 2006.)

This chapter seeks to assemble the research findings from this data to present a systematic overview of the emergent and iterative process of organisational change in respect of academic honesty in one site. Such a summative and reflective approach may be suggestive of a model of change that has other applications beyond this problem of academic honesty.

CYCLES OF DEVELOPMENT

It is possible to distinguish three cycles in the development processes of academic honesty in the Faculty, consistent with three cycles of planning, acting, observing and reflecting. These are outlined below (see Figure 14.1).

Reactive first cycle

The development of academic honesty procedures commenced in 2003 with a set of polarised assumptions characterised by an ‘us and them’ mentality. Students were regarded as the main actors in academic (dis)honesty, taking ethically unjustifiable actions by plagiarising and free-riding. Although staff recognised the problem, most just wanted someone else to fix it. These positions were supported in the current literature on students engaging in plagiarism and emphasising motivations as the personal realm of the students (e.g., Franklyn-Stokes & Newstead, 1995; Norton, Tilley, Newstead & Franklyn-Stokes, 2001). Accordingly, the Fac-

ulty attempted to 'fix the problem' by developing singular atomistic actions to detect student dishonesty and increase faculty compliance with minimal impact on teaching staff. This early strategy can be best described as knee-jerk – seeking quick and easy ways to fix the perceived student problem through compliance.

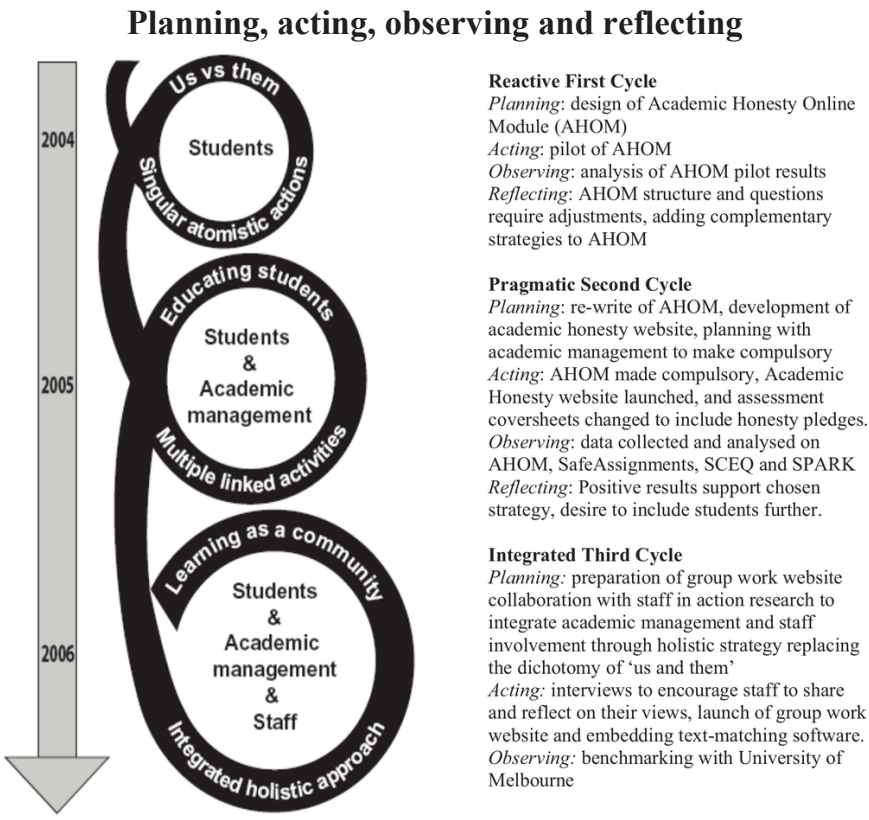

Figure 14.1: Cycles of development in academic honesty project

A trial of plagiarism detection software was actively pursued, consistent with observations by McCabe and Pavela (2004) of staff requests for enhanced detection methods. However, following a report on the faculty's detection pilot, the University's Academic Board rejected continued mandatory use on the basis of protecting students' copyright and intellectual property rights. The faculty complied, albeit with some dismay and disappointment. In these circumstances, staff largely refused to entertain further non-mandatory use, noting that the very students likely to be caught would probably choose not to participate.

As a result, the main strategy was to develop a compulsory stand-alone online module focused on the areas where students were most confused (McCabe, 2003): plagiarism in written work and free-riding in group work. The module served as a way for the faculty to detect compliance by disallowing claims of unintentional plagiarism by students. To be able to track student compliance, it was necessary to fit the module into the faculty's learning management system. It was also hoped the module might deter students by outlining consequences of dishonesty and highlighting benefits of academic honesty. Additionally, revisions were made to include the faculty policy on academic honesty in the unit of study template and to include a student pledge that work was not plagiarised on individual and group assessment cover sheets.

The online module was piloted with volunteer students in 2004. The second pilot was a compulsory part of a unit of study where students (n=297) were asked to complete a set of self-test questions about academic honesty, then study material on academic honesty, and finally answer the same questions again. The module evaluation revealed three significant pieces of information. First, less than 25% of students were able to correctly identify examples of plagiarism; second, student perceived high levels of plagiarism among their peers; third, the majority of students claimed that they were academically honest because it is ethical or beneficial to them, rather than out of fear of getting caught (Clarkeburn & Freeman, 2006). Students suggested that the module should be compulsory for commencing students. Interestingly, they also found estimating breaches of honesty in other students difficult and uncomfortable (Clarkeburn & Freeman, 2005; Clark, Freeman, Yench & Westcott, 2005).

These results provided an opportunity to reflect on the role and delivery of the academic honesty online module and other academic honesty strategies within the faculty. These reflections were shared in two faculty forums. As a result, the faculty's academic honesty approach remained focused on the online module with recognition that support was necessary. The module's function, therefore, shifted to an educational tool beneficial to students, rather than a method of primarily increasing compliance. First, it was made accessible for all students throughout their studies; second, it was designed so that students could freely consult information while answering the self-test questions; and third, the questions regarding peer dishonesty were removed.

Pragmatic second cycle

The pragmatic cycle of developing academic honesty in 2005 extended beyond a focus on students to include academic management. The results from the pilot studies and literature elsewhere (e.g., Carroll, 2002; Varvel, 2005) significantly altered the underlying assumptions. Students were now viewed as uninformed, but willing, participants in the promotion of academic honesty. Staff indicated

their support, though many had become disenfranchised by the university's punitive approach adopted in early 2005, with mandatory reporting requirements and very serious sanctions after a second confirmed case of dishonesty. In response, the faculty's academic management implemented multiple linked activities to promote academic honesty among students. The main intention was to educate autonomous learners about honest academic writing and group work and to engage staff in active discussion about academic honesty. The faculty thus intended to maximise support for students to adopt the faculty understanding of academic honesty.

This approach led to a broader set of strategies. First, in semester 2, 2005 the module was made compulsory for all new students before submitting their first assignment. Second, the academic honesty website was expanded to facilitate further learning and made available to academic staff as well. Additions included PDF take-away summaries and step-by-step paraphrasing support. Videos of students talking about academic honesty, also used in orientation and induction activities, could be viewed online. Third, pledges relating to non-plagiarised work were extended to assessments submitted electronically. Fourth, development work and pilots were initiated for the promotion of text-matching software (SafeAssignments) as a formative tool for supporting students to check their work prior to its submission for assessment. Fifth, further development work was carried out to introduce a tool to promote confidential self and peer assessment (SPARK) to enhance academic honesty in group work.

After a year of faculty-wide use, the academic honesty online module data was analysed and three positive outcomes could be concluded. First, a 17% increase in recognition of plagiarism by students; second, students viewed breaches of academic honesty more seriously; and third, 45% of students believed the module provided them with adequate knowledge about academic honesty (Clarkeburn & Freeman, 2006).

The Student Course Experience Questionnaire (SCEQ) reinforced that progress was being made. Conducted in late 2005, it demonstrated that students perceptions of academic honesty as a problem to be addressed was no longer of concern. In comparison to 2002 when 5% of free-response comments relating to the aspect perceived most in need of improvement related to plagiarism, not a single comment was made in the 2005 surveys.

Integrated third cycle

A focus on learning as a community that included students, academic management and staff characterised the integrated third cycle. Until the start of 2006, assumptions underlying the efforts in the two earlier cycles had been based on a liberal modernist view of the autonomous individual who was, and should remain, free to make life decisions. The approach had been to provide the learner

with adequate information upon which to make informed individual choice to maintain or reject academic honesty in their own work.

A new view emerged of students being part of a larger learning community in which promoting and upholding shared communal values was important (Walzer, 1984; McCabe, 2005). With students as members of an academic community, the faculty encouraged adoption of its key community values, most importantly 'integrity and ethical practice in academic endeavours' (University of Sydney, 2007). This approach aligns with promoting 'ethical, social and professional understanding'; one of the University's five key graduate attributes around which curricula are constructed.

The faculty approach is now based on an integrated holistic approach of continuous improvement involving students, staff and academic management. Students are viewed as part of the academic community, replacing the dichotomy of 'us and them'. Academics are encouraged to take an active part by reflecting on their own assumptions relating to academic honesty and to design assessments that are less likely to enable dishonest group work or writing practices. As academics are encouraged to share their views with students and colleagues, a greater sense of collective responsibility can prevail. The resultant benefit to the culture is consistent with a McCabe's (2005) village metaphor, one ripe for proactive development strategies that focus on peer accountability driving all community members' actions.

In practice, this has meant re-writing sections of the academic honesty online module to more explicitly promote shared community values and motivate students to adopt them. A website to support staff in discouraging (and detecting) academically dishonest writing in assessments is under construction. Self and peer assessment software (SPARK) has been piloted and evaluated focusing on formative development of group work assessment within the Faculty (Freeman, Hutchinson et al., 2006), and in other sites (Willey & Freeman, 2006), rather than ex-post adjusting summative marks according to contribution. A new group work website has been launched for both staff and students to promote ethical and productive use of group work as part of the learning process. Further, opportunities for promoting positive group work practices to reduce the likelihood of free-riding have been enhanced by researching and introducing team based learning (Michaelsen, Knight & Fink, 2004; Freeman, McGrath-Champ et al., 2006). Increased effort has also been placed on embedding text-matching software (SafeAssignments). Discouraging cheating in online tests and exams, completed in computer labs, has been adopted by introducing software (Exambient) which isolates computers from the University network and prevents browsing the internet, opening other programs, and printing during online quizzes and exams.

Though these student-focused proactive strategies, including those focusing on academic development, are still in their early days compared with some of

the elaborate approaches engaging students in North American universities, students are increasingly encouraged to become part of the academic community. Peer mentoring, which has become a popular component in the student transition to university, now pays attention to supporting new students entering the learning community. Orientation and induction activities specifically include students on panels responding in their own words to the importance of an appropriate approach to academic writing and group work.

Moving through these three cycles in a little over three years, the engagement with academic honesty has spiralled outwards to generate a learning community within the faculty that is transforming the initial emphasis on compliance and catching students.

DISCUSSION

The aim of this chapter was to report on institutional learning, undertaking a collaborative action research approach within a faculty addressing academic honesty. Institutional learning problems, like those presented by academic honesty, have no off-the-shelf solutions. An appropriate approach is necessarily contextualised within each learning community and thus we have described the iterative journey taken in the Faculty of Economics and Business that reflects the nature, culture and progress towards valuing learning and teaching in this particular context (Hutchings & Shulman, 1999).

Without considering the context and seeking out appropriate leadership for strategic learning and teaching initiatives, academic honesty is conceptualised as a problem that is inevitably approached technically and atomistically, employing an information-transmission model. Furthermore, innovative leadership recognises that it cannot force change without seeking to engage the community in changing their conceptions. Translating the initiative into the relevant disciplinary language and setting can arguably, as Huber and Morreales (2002) have stated, move towards creating institutional change and learning by both staff and students.

The collaborative approach developed in this faculty has involved staff in design, implementation and research, thereby actively following the university's commitment to strengthen the nexus between research and teaching. Alongside strategic working groups for research-enhanced learning and teaching, the faculty's efforts have not only begun to facilitate a cultural change in academic honesty but also acknowledged and rewarded staff for their participation in diverse ways. Within a research-intensive environment, engaging in evidence-based decision-making with research outcomes has tangible value.

Further development within the faculty has commenced with a recent teaching improvement grant to help embed honest group work and writing practices

in core units of study as part of a graduate attributes project. Other collaborative research initiatives with staff are embedding academic honesty within assessment methods, evaluating students' approaches to research and referencing and thereby enabling better scaffolding and support for honest academic writing. Research into staff views and the faculty's approach to academic honesty are not only part of the evidence-based approach to decision-making in the faculty but clearly direct those efforts towards building a positive, educationally-focused community of learners.

The major limitation of this research is the singular site of the study. Although our results within each cycle might not be generalisable because of the specific context, the research should be of interest to others seeking to understand the processes of creating the desirable institutional framework described by Park (2004) and McCabe (2005). Future research opportunities include better understanding the role of staff, both academic and professional, in the processes of generating an integrated holistic approach that focuses on community building and educational development of students rather than catching and punishing students.

The faculty's integrated holistic approach is being broadened and deepened. The academic honesty module is being shared with a sister faculty at the University of Melbourne as part of an ongoing benchmarking relationship and with other faculties at the University of Sydney. Showcasing the approach with the Australian Business Development Council Teaching and Learning Network is also aimed towards achieving systemic change across the country by working with senior academic managers of Business faculties. As such, the faculty is amongst those who trust the integrity of its students (ACODE, 2005). Our learning endorses the view that '… if we have the courage to set our sights higher, and strive to achieve the goals of a liberal education, the challenge is much greater than simply a focus on reducing cheating' (McCabe, 2005, p. 29).

This collaborative action research model is consistent with the theoretical framework based on a social constructivist approach to both promoting academic honesty as a positive educational practice and engaging students and staff in institutional change. Just as McCabe's work demonstrates a transition from emphases on cheating to integrity and thence to learning, so this collaborative action research project has shifted its focus from detect, deter, and deal (Carroll, 2002) to a commitment to develop a leading, learning community of practice in the Faculty of Economics and Business. A significant feature of such a learning community centres around the core ethical values of academic honesty and is located within institutional practices that support, encourage and demonstrate such practices.

Chapter 15

Transforming learning: using structured online discussions to engage learners

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It is widely recognised that the landscape for higher education has undergone rapid change, with increasing pressure to be accountable, perform according to measurable standards, compete for funding and accept a greater diversity and increased number of students. This has necessitated the need to 'do more with less' (Ramsden, 2003, p. 4). However in parallel there have also been changes that have fostered innovative teaching and learning practices. These include new possibilities for place, space and mode of learning through the use of technology, increasing student competency in the use of this technology, a greater focus on student learning and the building of collaborative relationships between universities and the professional community (Huber & Morreale, 2002).

Teaching and learning in the health sciences has an added complexity with the expectation that graduating students are ready to practice in an increasingly complex working environment. The knowledge explosion and need for public accountability of professional practice necessitates a shift to equip students with skills to continually evaluate their own practice and provide evidence based clinical practice. There is pressure placed on teachers of health science students to adopt tripartite roles as teachers, researchers and clinical practitioners (Bignold, 2003). Health science education is being further squeezed by the need to educate greater numbers of students in clinical settings that are constrained by the physical environment that places patient safety above opportunities for students to learn professional skills.

The factors described above coupled with the University of Sydney's adoption of the learning management system Web Course Tools (WebCT) provided the impetus for the authors to explore the use of asynchronous discussion activities in their group of undergraduate students and reduce face-to-face teaching time.

Online asynchronous discussion forums are widely accepted and utilised in tertiary education to promote student engagement and group collaboration. Learners are able to interact by negotiating, debating, reviewing and reflecting upon existing knowledge, thus building a deeper understanding of the course

content (Garrison & Anderson, 2003; Palloff & Pratt, 1999). Yet, the potential afforded by a collaborative online environment is often criticised because learners fail to take full advantage of the learning experience, and lecturers become entangled in the time drain required to moderate the ensuing discourse (Spector, 2005).

This chapter will draw on the authors' experiences in and research about facilitating online discussions in the blended learning environment of an undergraduate allied health science course. Action research cycles conducted from 2000 to 2006 will be used to map the development, analysis and modification of the online discussion tasks.

Context

The cohorts of students described in this research were those enrolled in the Bachelor of Applied Science (Orthoptics). The course is a four year undergraduate program which provides students with knowledge and skills of investigating, managing and researching disorders of the eye and vision systems. Upon graduation, employment exists in a broad range of clinical, community and corporate environments.

The clinical program forms an integral component of the course and strives to provide an environment which facilitates the transfer of knowledge, skills and attitudes fundamental to the development of a competent beginning orthoptic practitioner. Workplace expectations demand a practitioner who can service a broad patient population including all ages, differing racial backgrounds, and populations with particular needs such as brain injured, developmentally delayed and vision impaired.

The quantitative data analysed for this research was taken from the student cohort enrolled in the third and fourth years during 2003-2005 with an average enrolment of 40-50 students per year. These years were selected as the students spent one semester of third and fourth year off campus completing a full semester clinical unit. Prior to 2000 students had attended regular on-campus tutorials during the clinical semester. These tutorials were transferred to the online environment in 2000 resulting in minimal compulsory on-campus attendance.

RESEARCH PROCESS

We used an action research framework which brings 'practice and theory, action and research together' (Gibbs, 1995, p. 30). It enables lecturers to analyze their practice, make planned changes, reflect on the effect of the changes and plan for additional changes, by carrying out a systematic cycle of action, with both teacher and learner input. Each cycle informs future curriculum design addressing specific problems and leads to improvements in practice. Salmon (2002) also

supports the use of action research as an approach to researching online communication as it binds together constructivism with the reflective nature of online discussions. This allowed us to demonstrate how the initial triggers of reduced staff time and increased student numbers led our development in the use of online discussions, which after systematic review and analysis raised further areas of inquiry and questions, requiring modifications, further investigation and evaluation. The direction of the modifications were also influenced by student evaluations, reflections about their learning and informal feedback. Figure 15.1 following, outlines the action research cycles we moved through over a number of years as we developed greater understanding of how to improve student interaction and learning in asynchronous discussion activities.

Adopting an action research approach to our study, demonstrates key aspects of the notion of scholarship of teaching described by Trigwell, Martin, Benjamin and Prosser (2000, p. 156), namely an active process that 'involves reflection, inquiry, evaluation, documentation and communication'. Critical to this process is focusing the research activity on understanding how the area being studied improves the quality of student learning, by understanding the student experience and participation of students in the research process. As stated by Huber and Morreale (2002, p. 21) 'what matters in the end is whether…students' understanding is deepened, their minds and characters strengthened, and their lives and communities enriched'.

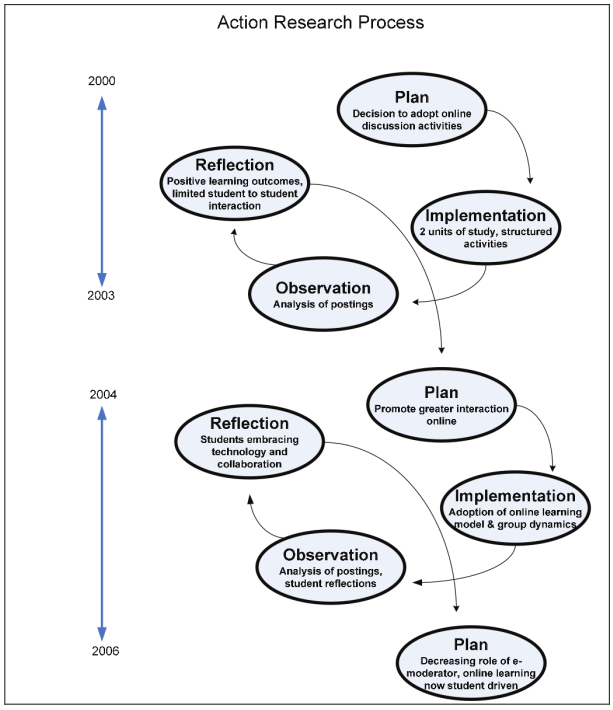

Figure 15.1. Action research process

ACTION RESEARCH CONDUCTED FROM 2000 TO 2003

Plan

There were a number of influences which led the authors to adopt the use of asynchronous discussion activities in two units of study in the 3rd and 4th year of the course. Primarily the decision was resource driven: a doubling in the number of students, staff reductions, and a finite number of clinical placements where students could gain clinical exposure to a range of patient conditions, and a new curriculum opportunity with the development of a new unit of study. This coupled with centrally supported WebCT resulted in a low risk of experiencing technology failures while implementing these activities. The authors felt confident that successful face-to-face tutorial experiences could be easily transferred online, and in fact delivery online would improve the repetitive nature of the face-to-face tutorials. It also allowed students equitable access to all tutorials rather

than the one they were scheduled to attend on-campus. Using this medium would also enable greater contact with students whilst remote from campus, encourage peer support, a team approach to solving problems, and promote linkage between theory and practice. In summary it was felt that the online discussion activities would enhance and extend the learning opportunities for the students and present the authors with an exciting opportunity to experiment with a new medium for teaching and learning.

The theoretical framework that guided our design of online discussion activities, and intended learning outcomes was that of a social-constructivist and experiential learning perspective (Levy, 2006). Students would examine their clinical experiences in light of underpinning knowledge, and derive new understandings through dialogue with their online community consisting of their peers, clinicians and lecturers, who could work collaboratively, share resources and solve clinical problems.

Implementation

As both the students and authors were new to WebCT an on-campus orientation session was held to assist students navigate through the site and access the discussion activities. Time was spent reviewing the discussion tool and its intended use. Students were introduced to their allocated groups (8-10 per group) and discussion activities were structured around questions and clinical cases. An explanation of student requirements was provided including a minimum of 5 postings (equivalent to students posting 1 message for case) in one unit for students to be eligible to take part in practical exams and an assessment of the quality of student postings. Figure 15.2 shows the set up of the discussion area in WebCT for one unit of study at the end of the semester in 2003.

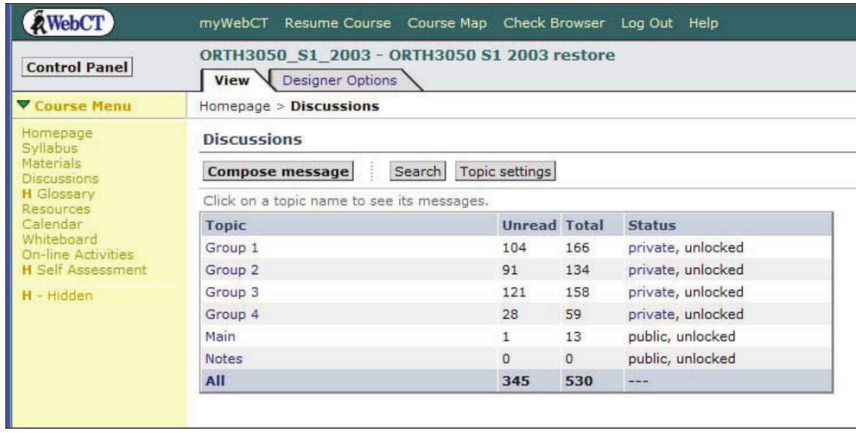

Figure 15.2. Discussion area appearance in 2003

The role of the e-moderator in the discussions was also explained. Students were shown the instructors' view of the WebCT site which showed data for each student's access (first and last access of site), and participation (number of messages read and messages posted). This surprised many students and demonstrated the overall presence of the e-moderator to track participation.

From the beginning of the semester, work in online discussion groups began with groups that completed tasks being rewarded with feedback from the e-moderators at predetermined dates. The authors participated as e-moderators during this time, frequently joining online student discussion, resisting the temptation to 'teach' but rather letting discussions evolve and be student-led. There are various styles of e-moderation (Mazzolini & Maddison, 2003), of which our styles most closely resembled that of a 'guide on the side'. Table 15.1 outlines the format for one of the cases that was discussed by the students, the marking criteria used and an example of feedback provided by the e-moderator.

Table 15.1. Sample instructions, case materials and feedback for one case used in 2003

Instructions given to students for discussion case
The aim of this activity is for you to discuss the clinical findings and reach an appropriate diagnosis and management for your case. You can request further clinical findings from the e-moderator, and if these are available these will be given to your group.
You will then need to decide as a group the diagnosis, differentiate it from other similar conditions, and write a short and long term management plan.
Using the patient details presented in the WebCT discussion section, you should as a group, do the following:

Instructions given to students for discussion case

Part A: Due by 8th April

Review the patient details, discuss the case and then request any additional clinical information.

After 8th April no additional information will be provided and the discussion will be closed off for Part A.

Part B: Due by 30th April

Decide as a group, post a suitable diagnosis and construct short and long term management plans, in a step-by-step way.

By 30th April the group should have discussed and posted your entire group's information, which will then be marked.

Your discussions will be tracked. You should make sure you input into the group discussions and decisions at least three times before each deadline.

Allocation of marks (group responses)	Allocation of Marks (Individual Responses)
Diagnosis including differential diagnosis (2)	Individual postings (8)
Insight into additional tests & relevance (2)	
Short term management (4)	
Long term management (4)	

Patient data and clinical findings for discussion case

(provided at the commencement of the discussion as a posting by the e-moderator)

Background history information

Orthoptic and Ophthalmic clinical testing results for patient's 1st visit

Clinical test results for patient's 2nd visit 2 months later

Sample of feedback provided by e-moderator for one group

General feedback:

Overall, you tackled this case well. The diagnosis was well justified…..

Instructions given to students for discussion case
You had good ideas …
Beware of drawing too many conclusions from …
Your ideas for divergence training were interesting …I would agree much more with….
Your comment about …
I wasn't quite sure why…
Approach to group work online:
I think you worked fairly well as a group, although it was obvious that some people posted a lot more of the information than others. Remember, even if you come into the site to read, post a message to let the others know if you agreed/disagreed etc. That way, everyone is aware of your presence in the discussion area and students doing a lot of posting and discussion don't get frustrated with the ones not posting. Please try to do this for your ophthalmic case to make it fairer to everyone in the group.
Lastly, I was happy with how you threaded your messages. Maybe have definite headings for your next case, it might make it easier for people to post into the relevant area.

Observation

During the first year of implementing structured online discussion activities students enthusiastically embraced the opportunities that were provided to offer their insights about the cases being discussed. They stated that 'the feedback (is) excellent', it is 'enjoyable conferring with peers', and it 'helped thinking outside square'. Tracking data available from WebCT indicated that students were reading the discussion board regularly and posting their ideas; although in the early years participation was limited by lack of access to computers outside the university (students without computers at home would not travel to the university from their distant clinical placements to access the materials).

As 2003 drew to a close the authors examined the discussion data more closely by developing research questions as part of the observation phase of the action research cycle. We were interested to determine if students were sharing ideas, debating opinions and building knowledge and whether their final grades were influenced by the online learning activities.

The content of 756 postings from 2003 were analysed using Salmon's (2000) nine conference analysis categories which consisted of five categories that classified content as indicating individual thinking and four categories which demonstrated interactive thinking. It was found that the content of 93% of students postings were indicative of individual thinking where students tended to post their

ideas as single messages rarely responding to contributions of other students by threading and building an online dialogue (Wozniak & Silveira, 2004). Examples of these types of postings are as follows with the category of individual thinking shown in brackets:

> After working through the information I came up with the following… have I got this right? *(Offering up ideas or resources and inviting a critique of them)*
>
> I agree that…, this is backed up by the reasons in previous messages, yes that's what I got… *(Articulating, explaining and supporting positions on issues)*

The appearance of the discussion board supported this analysis, its appearance indicative of a long series of single messages with very few extended threads (Figure 15.3).

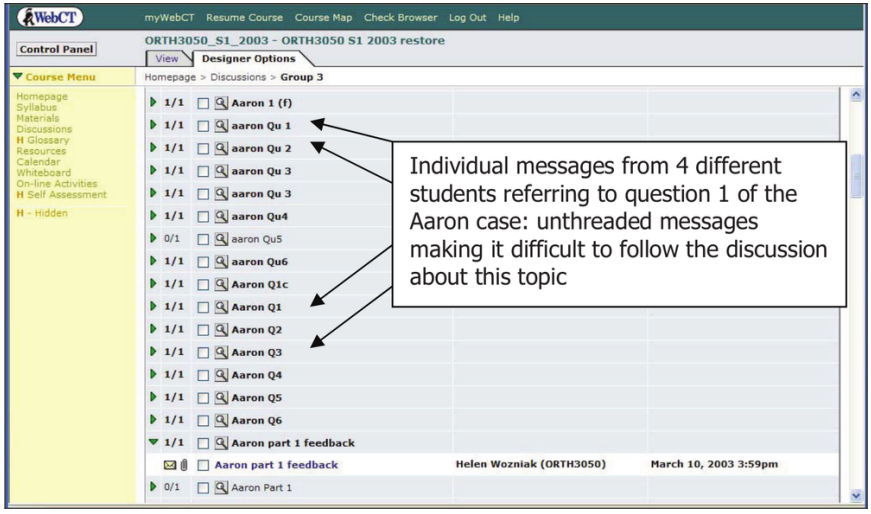

Figure 15.3. Appearance of discussion board in 2003

The influence of the online activities on other assessment results showed variable results. When the individual students' mark for their online activities was compared with a final summative assessment in similar content areas there was a significant correlation in two out of the three comparisons. The first correlation of r_S=0.474 ($p<0.05$) was found when an online case study mark was compared with a written exam-based case study mark where both assessments were evaluating a student's understanding and interpretation of a clinically-based case. The second

correlation showed a strong relationship between a mark derived from an analysis of a student's online discussions about an orthoptic case and the mark that the same student gained in a practical, clinic-based examination of a patient with a similar type of ocular condition (r_S=0.735 $p<0.001$, Wozniak & Silveira 2003). Clearly only limited conclusions can be drawn from such data considering the many influences that affect achievement in assessment activities. However these results did support a relationship between active participation online and student performance.

Reflection

Simply providing an online discussion space does not necessarily mean that it will be populated by lively discourse. The data collected above clearly demonstrated that students will not collaborate unless collaboration is structured into the activity, they tended to merely present their information without building on the thoughts of others. Other researchers have noted that full potential of the online discussion activities to promote greater collaboration and interaction between students was not often achieved (Dysthe, 2002).

To more carefully consider these aspects we drew upon other research investigating interaction between learners, teachers and content in both distance education and e-learning contexts. Garrison (1989) argued that an essential element for learning at a distance is dialogue and debate as these elements enable learners to negotiate and formulate their own meaningful knowledge. This has more recently been applied to online learning where Garrison, Anderson & Archer (2000) developed a conceptual framework that describes mechanisms for effective learning with computer mediated communication tools. They argue that a quality e-learning experience occurs when an environment is created that supports a community of inquiry through three essential elements; cognitive presence, social presence and teaching presence. We felt that our discussion activities had achieved the latter two attributes through the provision of a comfortable online environment with effective e-moderation. Further development was needed to address cognitive presence and promote collaborative higher order thinking and learning among our students.

This has been borne out in recent literature describing networked learning practices, showing that both the design of the task and the role of the moderator are critical to the success of the asynchronous discussion activity (Dennen, 2005). Goodyear, Laat & Lally (2006) highlight that providing ground rules, clear expectations about the purpose and role of the student and teacher in the activity will increase the likelihood of an active discussion board with relevant contributions made by all members of the group.

We were also influenced by the work of Salmon (2000), who using her experiences in moderating online discussion forums in the United Kingdom, de-

veloped a model of online learning and teaching. It describes five stages that the student moves through to become autonomous learners. Learners move through a process of initially accessing the online communication tools, socialising and sharing ideas, to constructing knowledge and finally self regulation and critical appraisal of their online learning. The model also details how the e-moderator should support the student as they move through each stage. It was with this background that we moved to planning our modifications to the discussion activities.

ACTION RESEARCH CONDUCTED FROM 2004 ONWARDS

Plan

Prior to the commencement of the 2004 academic year we redesigned the preparation activities to incorporate the ideas and reflections noted above. Salmon's model was redesigned for an undergraduate student's perspective and orientation activities were structured to scaffold effective online group participation. A reflection activity was also designed whereby students were surveyed early in the semester about their readiness for online learning which was reviewed and commented on later in the semester. The criteria for assessment of participation were also modified to mirror attributes of effective group collaboration. It included a student reflective report based on self analysis of their development as an online learner using Salmon's model.

Implementation

In 2004 and 2005 three short orientation sessions were provided to the year 3 students who were new to the online discussion activities (see Wozniak, 2007 for full details). A modified form was also presented to year 4 students. These sessions outlined:

- an introduction to Salmon's model of e-learning which we modified to show how students could scaffold their process of learning online in a collaborative group
- clarification of the purpose of the asynchronous discussions
- the role and moderation style of the e-moderator, and data available to them to track student participation
- the impact that 'lurkers' can have on group collaboration
- practice activities where students posted their ideas about a trial case which were then analysed by the students for timing, threading and cognitive level of their postings
- a reflection activity where students were asked to consider their previous on-

line experiences and rate their current level of proficiency on Salmon's model
- research results from the 2003 cohort showing the correlations between online assessment and exam marks.

Observation

Since 2004 the discussion board appearance has dramatically changed. The 949 postings made in the first 6 weeks of semester of 2004 were analysed as described earlier and compared to those made in 2003 prior to the changes in preparation activities. Messages now appeared under clearly labeled subject headings with long threads showing multiple contributions from several students (see figure 15.4). A statistically significant difference was noted with 47% of the 2004 postings (as opposed to 7% of the 2003 postings) showing 'interactive thinking' where students critique, expand, negotiate meanings, summarise contributions or develop ideas based on their interactions ($p<0.001$). Examples of messages that illustrate these aspects of interactive thinking are:

> Another point to consider is…; I thought Q1 was actually asking for…so maybe you could ask… I agree with your comments so far giving… *(Offering a critique, challenging, discussing and expanding ideas of others),*
>
> Ok here is the group answers…gathered from what everyone has said and agreed upon, so the general consensus is that we'd use…because… *(Summarising and modeling previous contributions).*

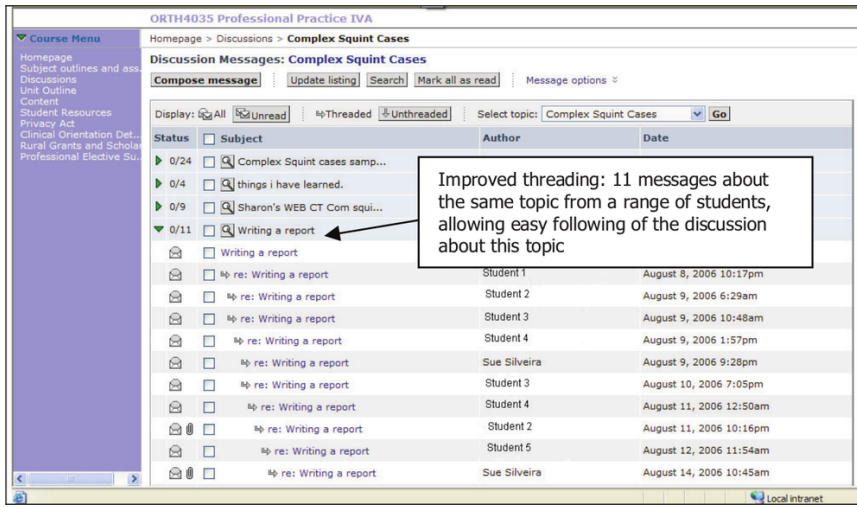

Figure 15.4. Discussion board appearance in 2006

With this distinct change in interactivity we decided to look more closely at whether there was a relationship between increased interactivity and other assessment results. Table 15.2 outlines the differences that were noted when the online case marks were analysed and correlated with the level of interaction noted after content analysis of the postings (Silveira, Wozniak & Heard, 2004).

Table 15.2. Changes to the assessment results after modified orientation sessions

Assessment	Type of change	Significance
Online case 1	Mean Mark increased from 2.25/6 in 2003 to 5.19/6 in 2004	$t=5.1$, $p<0.001$
	Higher marks associated with more interactive postings	$r_S=0.76$, $p<0.01$
Online case 2	Mean Mark increased from 3.75/6 in 2003 to 5.81/6 in 2004	$t=3.5$, $p=0.001$
	Higher marks associated with more interactive postings	$r_S=0.69$, $p<0.01$
	Lower marks associated with less interactive postings	$r_S= -0.47$, $p<0.01$

When analysing the student's reflections about their participation and readiness for online learning using Salmon's model, it was not surprising that the students' development as online learners improved significantly over the duration of the semester. There was also a significant correlation between their self reported stage of development and individual online participation mark ($r_S=0.411$, $p<0.01$; Wozniak, 2006). Students consistently reported that the online discussions were a positive experience encouraged by the timely feedback provided by their peers and e-moderators. A number of other factors may have influenced the changes that were observed in the students' discussion patterns such as our increased experience in moderating online discourse, the introduction of other communication devices in the students' daily lives such as SMS, and the fact that the student cohorts were different. Our research results do however, support the notion that online discussion activities have the capacity to improve the learning outcomes of undergraduate students.

We also noted that processes developed as a year 3 student, assisted their approach to online discussion activities in year 4. Students were able to drive the discussions, engage in peer teaching and self correcting behaviours. Another observation was that students who tended not to participate in the face-to-face situation were often the students who posted most frequently online. This behaviour has been noted by others and has been found anecdotally to transfer back to improved confidence in the face-to-face environment (O'Hara, 2004).

Reflection and planning for the future

Action research continues to influence our approach to online learning by revealing new issues and areas ripe for inquiry. Computer access constraints no longer influence student participation in line with overseas experiences (Kirkwood & Price, 2005). Over time we have spent much less time on these issues as a computer culture of online communication pervades the current generation of higher education students.

Whenever a new pedagogical strategy is introduced there is natural caution and perhaps a need to control on the teacher's part. As our students became more exposed to online learning through our units and other units in their course they display willingness to take control, to lead discussions and express concern to the non-participators.

Recently an invitation was extended to clinical educators to join the online discussions, to showcase the environment to those members of the orthoptic profession who were largely responsible for clinical supervision of students. The value of additional professional opinion and experience was recognised and welcomed by the e-moderators. Interesting patterns emerged ranging from clinical educators who declined the offer to those who accessed the site but 'lurked' and did not participate, to those who embraced the experience and provided valuable input. This is similar to patterns described by Knowlton (2005) from passive participation to dialogic participation. Clinical educator participation continues and is recognised by students in comments such as:

> it's great for them to see how hard we work at our academic as well as clinical learning. (Year 3 student, 2006)
>
> it really helps to continue my discussion with my clinical educator after hours when we have had an interesting case and we have run out of time to talk about them due to the next patient waiting. My friends also get the benefit of coming in on our discussion online as well. (Year 4 student, 2005)

Encouraging students to share their patient experiences in online discussion provides all students exposure at a more enriched level than purely accessing textbook cases. It can also enable students to express their fears and resolve their feelings through personal reflection about their patient encounters.

CONCLUSION

Over the past 6 years our journey into online teaching and learning has been challenging and enlightening, moving away from a technology focus to understanding the underlying pedagogy of e-learning. We have left behind the need to ensure student computer literacy and the need to control the learning environment. Our

experience has shown that with careful consideration of both the preparation and structure of asynchronous discussion activities student group leaders emerge naturally and the focus of the discussion can reflect higher order learning and team work. We have learned to trust our students, to value and acknowledge their contribution. We now perhaps enter another action research cycle with the focus on how best to manage the information overload generated online in the time available to both our students and ourselves.

Levy (2006) reinforces this notion by stating that:

> a key challenge in the networked learning context is the question of how to empower learners to engage actively and productively with the range of pedagogical, social, informational and technological resources that are at their disposal, as well as with a learning approach that may well be unfamiliar to them (p. 227).

Chapter 16
Informing eLearning software development processes with the student experience of learning

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The opportunities provided by eLearning technologies to enhance the student experience are encouraging universities to systematically invest into new eLearning projects. The implications of this trend for ensuring the quality of the student learning experience are serious and complex. One important aspect is how educational software being developed and used is related to the quality and effectiveness of the students' learning, and for software engineers, how the software can be developed to produce the most productive experiences.

Software engineering is a comparatively young discipline in universities, but it has already had a significant influence on modern experiences of education. As with other engineering specialisations, the maturity of software engineering is recognised only when it has established recognisable methodologies supported by solid evidence. Software engineering, outside the educational domain, employs numerous, well supported and recognisable methodologies (Pressman, 2005). For the purposes of education, however, this evidence is not sufficiently illuminative as it does not concern itself with the needs of students in relation to learning outcomes, the way they approach the use of the technologies to support their learning or their conceptions of how learning is supported by technologies.

There are significant challenges for software engineering research focusing on learning technologies. While the success of a business software system can be measured in ways such as a reduction of costs, or time, or increase of business efficiency, in education such quantitative assessments are less useful. The benefits from education are often ephemeral, realised in the medium or long-term and hard to capture. To address these challenges, current software development methodologies for learning technologies try to break down the development problem into smaller parts, each with its own quantitative measure. This often does not work as the smaller parts do not necessarily cohere to create a meaningful whole. Consequently, there is considerable room for learning software development processes to be improved, especially if the processes can be shaped by the nature of educational experiences they are designed to support. Unfortunately, this is no easy matter as it requires the collaboration of teams of people

from different disciplines, most notably software engineers and educational researchers. This chapter addresses the question of how software engineers and educational researchers can productively collaborate to improve software development processes for learning technologies so that the technologies are more likely to help students learn effectively.

Studies into associations amongst learners and their use of technology influencing its design is an important research focus in the field of learning. One area of research related to this focus is computer supported collaborative learning (CSCL). A particular focus of research into CSCL has investigated associations amongst software tools and learners (Lehtinen, Hakkarainen, Lipponen, Rahikainen & Muukkonen, 2002). Some studies have investigated students' use of mathematical software programs for collaborative learning (Derry, 1990; Reusser, 1996). Some have investigated students' use of collaborative software aiding experimental research methodology and statistical inferences (Lehtinen, Hämäläinen & Mälkönen, 1998). Others have investigated probability inquiry and use graphical representations to encourage collaboration amongst learners. (Enyedy, Vahey & Gifford, 1997). The emphasis in these studies is more about how the technologies support the interaction, rather than how the student experience influences the design of the technologies.

The research discussed in this chapter distinguishes itself from CSCL research in its focus. Rather than investigating mainly how software technologies may support collaborative learning, it investigates how students experience technologies that are developed to support different learning experiences, and then uses that experience to inform the subsequent software development processes to improve their design and underlying intentions related to improving learning. This focus of the research is essential if we are to help educationalists and educational software engineers who are innovating with learning technologies to improve student experiences of learning.

To clarify how educational concerns can be practically and sustainably integrated into software development processes, we look at software engineering projects at the University of Sydney where we developed eLearning applications using evidence of the relationship they have to our students' learning experience. We use the outcomes of our own previous research studies (Carroll & Markauskaite, 2006; Ellis & Calvo, 2006; Ellis, Calvo, Levy & Tan, 2004; Turani, Calvo & Goodyear, 2005) to produce a variant of the spiral methodologies that is informed by the student experience. The model we use to describe students' experience of learning is next described. Then the *spiral-Ed* methodology we propose is described. This is followed by a description of the projects for which we have been using it. Finally, the teaching context and results are described.

PRIOR RESEARCH

The research reported on in this chapter draws together ideas from the current literature in software engineering, particularly on the spiral model development methodologies (Boehm, 1988; Pressman, 2005) and on research into student learning in higher education (Biggs, 2003; Entwistle & Ramsden, 1983; Laurillard, 2002; Prosser & Trigwell, 1999).

In software engineering, several methodologies have been developed over the last three decades. Amongst these, the spiral models, studied since the 1980's, have two common features: an iterative approach for incrementally growing a system's degree of definition and implementation and a set of milestones for ensuring stakeholder commitment to feasible and mutually satisfactory system solutions (Boehm, 1988). The advantage of the spiral model for software engineering is its principle of committing resources incrementally to researching and defining the problem, and then developing the software, instead of a large commitment of resources before its prospects for success are understood.

Normally engineers decide what to build after analysing the requirements through 'understanding what the customer wants, analysing need, assessing feasibility, negotiating a reasonable solution, specifying the solution unambiguously, validating the specification, and managing the requirements as they are transformed into an operational system' (Pressman, 2005, p. 144; Thayer & Dorfman, 1997). The challenges of doing this analysis are well known, particularly on industrial and business systems. When eLearning systems are developed the analysis becomes more complicated. On one level, engineers look at what students and teachers will do with the system, but at a second level, educational research has shown that the picture is much more complex, and a complete analysis must include other aspects of the learning experience and students' perceptions.

PRINCIPLES OF DESIGN INFORMED BY THE STUDENT EXPERIENCE OF LEARNING

One of the challenges of developing software systems for learning is that software engineers do not yet have efficient ways of including the student experience of the technologies into their design. What we are proposing are a few simple questions which, if systematically used by software engineers, will go some way to providing input directly from students, into design processes.

In several research projects (Ellis et al., 2004; Ellis & Calvo, 2006) we have used a phenomenographic model of learning to investigate the quality of learning through the use of specific software. This model investigates the student learning experience by dividing it into key aspects: the *how* or its structural aspect,

and the *what*, its referential aspect. The *what* is often referred to as the direct object of learning. The *how* aspect can be subdivided into two further parts: the act of learning and the indirect object of learning. Related to these key aspects of learning, we have also investigated student perceptions of aspects of their learning context (Ramsden, 2003).

In our studies, we have found that the quality of what students' think they are learning has been logically and positively related to the quality of their approach to using the technologies in their experiences of learning. This research has found that students, who tend to adopt more meaningful approaches to the use of learning technologies, often perform relatively better than other students who adopt poorer approaches to the use of learning technologies. Significantly, the quality of student experiences of learning using technologies has also been logically related to their perceptions. Higher quality experiences tend to be associated with positive perceptions of the learning context.

From these studies, we have adapted the key research questions more generally to apply to software development processes. We seek to identify associations amongst the learners' *conceptions* and *perceptions* of, and *approaches* to using the software, to the way the functionalities of the software are developed. In software engineering, these are unusual questions as student conceptions, perceptions and approaches are variables not normally included in the engineering processes simply because they are not applicable to non-educational systems.

A METHODOLOGY FOR ELEARNING SOFTWARE DEVELOPMENT

Software development processes, influenced by the student learning experience, have been adopted by the Web Engineering Group at the University of Sydney. The group has developed a number of eLearning applications and activities which have been shaped by feedback from students using them for coursework. What we have learned from these projects is offered here as the spiral-Ed methodology which can be used by other developers. The purpose of this methodology is to allow those involved in developing software, (software engineers, instructional designers, interface designers and teachers), to be informed as to the particular student-related needs and goals of learning technology. The methodology proposed suggests that a software development team needs to incorporate these educationally orientated roles.

For example, let us consider a project in which a discussion tool is being developed. The engineer will come to the project with a number of skills and a tradition of evaluating software systems that include a requirement analysis process. If the development team were evaluating the discussion tool, they would inquire as to the functional and non-functional requirements. These requirements

describe what the students do with the system (for example, post or read a text document), and how the tool behaves (for example, how much time it takes the system to respond). For business software applications, it is often self-evident why people use the software the way they do, because their use is often motivated by a pragmatic goal, such as accessing some particular information or automating a task. In contrast, for learning technologies, the reason students do things, and how they do them, can often be more important than the actual completion of the task using the software. Table 1 shows examples of the 'metafunctional' dimension, or characteristics of the software which should improve the learnability of the student user experience.

Table 16.1: Example of functional and metafunctional requirements of discussion tools

Functional/Usability Requirements	**Metafunctional/Learnability Characteristics**
Time for posting	What have you learned through the discussions?
Time for assessing the postings	How do you approach using the discussion tool?
Number of postings	Why do you use the discussion tool in the way you do?
Organisation of fora	What aspects of your experience of using the discussion tool prevented you from learning?
Search functions within fora	

Traditional software development approaches would normally only consider the requirements listed in the first column in Table 16.1. In the approach argued for here, the questions in the second column are considered of equal importance. Figure 16.1 below illustrates a methodology with four additional phases that would take into account these and other requirements of educational software.

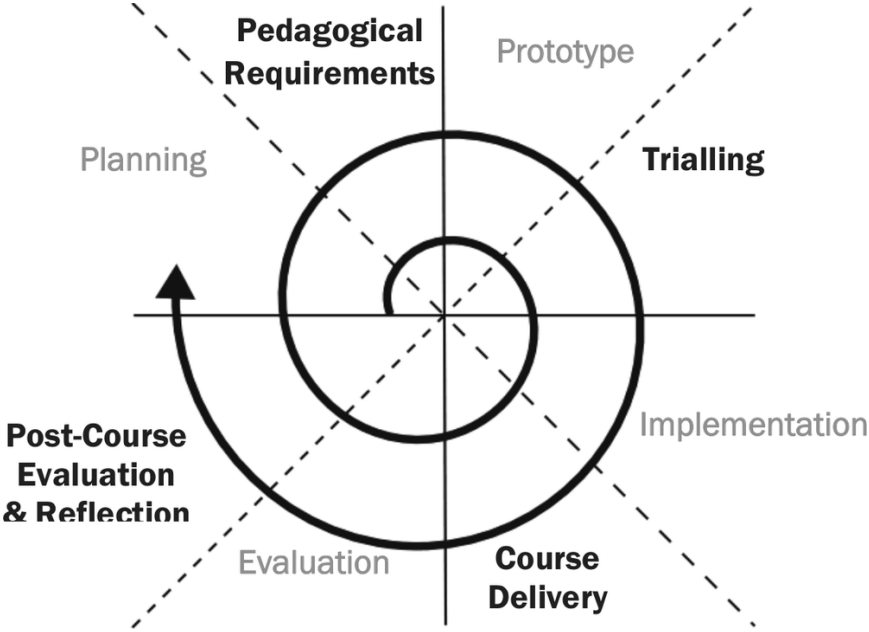

Figure 16.1: The spiral-Ed eLearning software development methodology

Figure 16.1 visually represents the proposed spiral-Ed software development methodology. It can be read as a spiral of activity traversing four stages, each of which has two parts. Each iteration of the spiral may take a year or more since some of its milestones have long user cycles, particularly in formal education environments where courses are only taught once a year. Our methodology provides guidelines for the project team to follow throughout the software development life cycle of the eLearning application. It can be integrated into software development methodologies for large projects, especially where there are greater resources at hand, or it can be used on its own for smaller projects. The fact that it is based on extensions to the industry-standard spiral methodologies, means it can be incorporated more smoothly and easily by engineers into the development process.

Figure 16.1 presents an overview of the methodology. The spiral conveys that it is an iterative process, made up of engineering and educationally driven stages. The engineering stages are: planning, developing a prototype, implementation and evaluation. Mirroring each of these stages, are the proposed educational stages: assessing the pedagogical requirements, trialling, course delivery and post-course evaluation and reflection.

The four stages in the methodology each have two parts, the first of which is standard to traditional spiral models and the second of which is specific to spiral-

Ed:

Planning. During this phase, planning for the project commences, software requirements are gathered, and a design for the system is produced.

Pedagogical requirements: Pedagogical requirements must also be gathered. These are obtained from the teacher and include the nature of the learning activity, the underlying pedagogy, how the activity will be assessed and any previous feedback from students about the learning activity which might help inform the software developers. The project team must clarify with the teacher what the students are expected to learn, and how. At this stage, the post-course evaluation of the student experience must also be planned.

Developing a prototype. This is a mandatory step in any engineering project. A prototype is normally built and used for testing and is accompanied by a risk analysis of the project meeting its outcomes.

Trialling: The outcome of this stage is to test the prototype with a focus group of students. Trialling can include both teaching staff and students. Students' perceptions of the software and their approaches to the learning activity should be evaluated. The prototype must provide the core functionality that is required to facilitate a learning activity.

Implementation. The system design is fully implemented to produce a functional system. The software is also tested for quality assurance.

Course delivery: At the end of the implementation and testing phase, the software is used within a course, where students are expected to use the software to achieve specific learning outcomes on which they will be assessed. During this phase, information about how students approach their use of the software should be obtained, where possible.

Evaluation. This phase evaluates the software application outcomes of the project to date before the project continues to the next iteration.

Post-course evaluation and reflection: Our methodology requires a post-cycle evaluation and reflection to be included. During this phase the data collected for the student's experience is analysed, and recommendations from the results are reported.

The inclusion of a course delivery testing phase in the model has proven particularly useful for the projects in which it was included. Evaluating the software within a real course allows for the project team to understand the students' perceptions and experience of the software, and how it is actually being used to shape their attitudes towards learning. The main advantage for testing the soft-

ware within a course is that learning generally takes time, and several weeks are required to test whether or not the software has had a positive impact on student learning. For example, pedagogy such as reflective learning strategies, requires the learner to first understand the knowledge content, and then spend time reflecting on what they have learned. It is unrealistic to believe that this can be achieved in a short time frame, or in an inauthentic lab testing environment.

Furthermore, testing the software within a course for the duration of a semester will uncover social phenomena over time. For example, in Project 2 discussed below, it was discovered that a few isolated students used a collaborative feature of an eLearning system to submit plagiarised work. The act of plagiarism would rarely occur in a focus group environment, as test subjects would be aware that their responses and actions would be closely monitored. Therefore, our methodology includes a trial period of the eLearning software within a real-time course environment to ensure the project team can observe how students use the software, (and sometimes may abuse the software) in ways that can only unravel within an authentic space.

APPLICATION AND EVALUATION

The methodology described here has been used for two educational software development projects: *Beehive*, a system which allows teachers to use educational design patterns to build on-line activities for groups of students; and *dotFolio*, an electronic portfolio used to develop students' reflective and writing skills. The emphasis in this section is to demonstrate the spiral-Ed methodology as it might be used by describing how each phase was carried out and how resulting information about the student experience influenced the development process. The software applications are currently in different stages of development.

Project 1 – Beehive: Enabling teachers to design on-line group work activities

Beehive is an educational software application that enables teachers to design and build collaborative learning activities on-line (Turani & Calvo, 2006; Turani et al., 2005). Teachers are able to use the eLearning tools provided by Beehive to design synchronous collaborative learning activities. For example, if we take the topic 'Making your backyard pool more sustainable', a teacher could:

- identify the purpose of the task and its desired outcome;
- identify a sequence of learning activities leading to the outcome;
- choose eLearning tools in Beehive to support these activities;
- develop the sequence of activities using the tools and help students understand the topic through them.

In the example of 'Sustainability', the eLearning tools chosen could include an instruction tool to explain the purpose of the task, a brainstorming tool which requires groups of 4-5 students to share their ideas about sustainability on-line, a voting tool, which requires the students to rank their shared ideas in terms of their effectiveness for the topic of sustainability, a discursive tool which requires the best two or three ideas to be more fully described by the students and a plenary tool which enables students and the teacher to provide conclusions and closure to the activity. Each of these tools has the potential to include audio and video resources to increase the richness of the experience.

During the development of Beehive, the following four educationally-focused phases were used to inform the software development process, as described below.

Pedagogical requirements. The goal of Beehive is to provide teachers with a tool that helps them to design collaborative learning experiences, and support them in the design task with research-based scaffolding in the form of educational 'patterns'. The functional requirements were based on other pattern-based systems (McAndrew, Goodyear & Dalziel, in press).

Trialling. A prototype of the application was developed using a combination of technologies, including the dotLRN Learning Management System and Flash Communication Server. The prototype was trialled with a group of seven users (tutors and postgraduate students). The participants were explained the purpose of Beehive, given a mock activity, organised into three groups, and allocated to different computers in separate rooms. After the mock activity, all participants were asked about how they had used the tool, what advantages and difficulties they found, and how they would use it in tutoring situations. The results revealed certain usability problems that were addressed at this stage.

Course delivery. The Beehive software program was used by a group of postgraduate students enrolled in the teacher training course 'EDPC5021, Introduction to the Learning Sciences', part of an Education Masters program.

Post-course evaluation. To evaluate their experience of using the software, the trainee teachers were asked what they thought the purpose of Beehive was, how they went about using it to design student learning activities and why they approached using Beehive in the way they did. This phase in the development process proved essential as it revealed that the software was falling short of meeting some of its educational goals. For example, when asked what they thought the purpose of Beehive was, some trainee teachers responded like this:

> Beehive is for developing the skills of students in the group, and allowing teachers to capture reusable learning objects.

To provide patterns for on-line teaching in an accessible way and to automate processes of student group work.

Model and structure face to face learning activities in an on-line way and provide a tool to manage on-line classes.

When asked the same question, other trainee teachers in the same class said:

To enable students to work collaboratively over the internet. To share ideas and come up with group decisions.

To facilitate on-line collaborative learning sessions to promote student understanding.

While the first group of quotations are not necessarily inaccurate (although the concept of trying to transfer a face-to-face activity to the on-line context suggests an undeveloped understanding about the way on-line learning can help student learning), they all share a focus that is on something other than students. The designers of Beehive first and foremost wanted a tool to improve the effectiveness of student learning. Additional benefits such as reusable objects, ease of design and managing the on-line environment are secondary. In contrast, the second group of quotations showed an awareness that the main purpose of Beehive was to enable students to share ideas, and to 'promote student understanding'.

When asked how they approached using Beehive, the same first group of trainee teachers responded:

As a trainee teacher, I sit, watch, and do what I am told with the tools in Beehive.

I just pick the tasks I'll need, set the scenario and information and slides and sequence the rest of the tasks.

The second group of trainee teachers said things like:

I prefer to do some preparation about student needs before I use the program. I like to have the script written before I go to Beehive.

I like to design learning activities in relation to student learning outcomes, especially when selecting the pedagogical techniques and selecting the tasks.

The software developers noticed a consistent theme in the comments made by the trainee teachers in relation to their approach to using Beehive. Comments such as those in the first group tended to focus more on the software itself, 'the tools in Beehive' or 'set the scenario and information and slides'. They did not tend to display any awareness of the learning context in which the on-line

tools would be used. In contrast, the second group of comments about teacher approaches to using Beehive foregrounded the educational context. In the first comment, emphasising 'student needs' and in the second quotation, 'student learning outcomes'.

We were then able to take the trainee teachers experience into account for the next development cycle. New ways to engage them in the development process as a flexible, student-centred activity were added. The changes included adding the possibility of students and teachers being able to co-design the activities, and a multimedia animation that demonstrates how Beehive affects students' learning, to help the users better realise potential student-centred benefits of the tool. The co-design feature allows students to engage better in the activity, and increase awareness of their own learning process as they understand better how the activity structure affects them. Including the educationally driven phases into our development process, was essential in truly understanding whether the software was not just usable or technically stable, but whether it was meeting its learning goals.

Project 2 – DotFolio: Enabling students to reflect on their learning

Portfolios of student work have often been used to indicate the quality of what students have learnt to interested parties and to facilitate student learning through reflection. When portfolios are enabled electronically, the effectiveness of retrieval and presentation of student work encourages a broader usage of e-portfolios as a part of students' everyday learning experience (Roberts, Newble & O'Rourke, 2002). Within higher education a growing body of research is identifying the value of e-portfolios for developing students' reflective learning practice (Roberts et al., 2002).

The goal of the dotFolio project is to investigate how students can use electronic portfolios for the purpose of learning, particularly through reflection (Carroll & Markauskaite, 2006). To facilitate this research goal, an open-source e-portfolio application - called 'dotFolio'- has been developed, based in part on investigation into the student experience of the software.

Undergraduate engineering students have been using dotFolio to reflect on current issues of engineering interest. For example, on the topic of Occupational Health and Safety, students would:

- select a news story from a source such as the *Sydney Morning Herald*;
- link it or upload it in dotFolio;
- summarise their understanding of the significance of the issue and its importance to the engineering profession and write their reflections in the online log ('blog').

The four education-centred phases used to inform the development process included:

Planning. The system was first used by engineering students enrolled in the first-year unit of study Professional Engineering. The first development iteration of the dotFolio project was based on the basic requirement of replacing a paper-based report writing activity with an online version, with the intention that this would improve the benefits of the activity for students. The students were to develop their reflective practice skills (as in the similar paper-based activity) as well as other generic graduate attributes.

Trialling. A prototype was built and then shown to a group of tutors and students. Based on the test results of the first prototype, the team decided to limit the functionalities available, so they would be more clear to users. In this way, the tool became more transparent and simple to both academics and students. Other usability issues became evident in this phase, as did issues around how to reinforce the idea to students that no copyrighted materials should be uploaded. Tutors who were going to grade assignments submitted through the system required a grouping functionality that would allow them to mark more efficiently.

Course delivery. About 260 first-year engineering students used dotFolio during one semester (16% female, 84% male).

Post-course evaluation. To investigate the students' experience of dotFolio and of reflective learning, an evaluation questionnaire was developed and a two-phase survey was conducted (Carroll & Markauskaite, 2006). The questionnaire was administered at the beginning and end of the semester. The first group of items interrogates student perceptions of the technology in their learning experience. The second group of items interrogates their approaches to using the technology. The last item investigates student conceptions of reflection. Data was collected twice in order to see how attitudes changed. Then, the significance of changes in students' attitudes were analysed using the paired-samples t-test (and marginal homogeneity tests).

The study showed how, by the end of the semester, students had a more positive view of the technology, but more negative view of collaboration with peers. No significant changes were observed in students' attitudes towards reflective learning in engineering.

Students strongly disagreed with some closed-ended questionnaire items they were asked to complete about the value of collaboration, 'My classmates feedback on my entries in the logbook will help/helped me to achieve the learning outcomes' and 'Reading and commenting on my classmates' entries in their logbooks will improve/improved my understanding of current professional engi-

neering issues'. In addition, the open-ended responses of some students indicated that they felt inherent conflict between collaboration with peers and the privacy of their reflection. This aspect of the students' experience revealed in this stage of the development process, prompted changes in the software, such as the addition of a functionality allowing students to make their postings private (not visible to anyone else except the tutors).

In addition, when students were asked in an open-ended question to write their concerns about the dotFolio tool, 12.7% at the beginning of the semester and 25.3% at the end of the semester indicated that plagiarism was an important one. This result provided insight into reasons for the students' dissatisfaction with collaboration. The plagiarism issue was also addressed by changes in the software. A plagiarism detection system that allows teachers to do a 'collusion' analysis and checks for submission similarities was implemented in dotFolio (Garcia Adeva, Carroll & Calvo, 2006).

By the end of the course, students were the most positive about the functional features of dotFolio. Some student comments indicated that they appreciated practical benefits: 'the ability to store files in a central site. This also helps with the transfer of data from home to university, as well as sharing of files between group members in group work'; 'much potential, system that I believe would reduce workload and streamline some assignments.' Other students described the benefits as being closer to their learning experiences: 'get to be exposed to real engineering projects'; 'it's different. I'll learn new aspects of computing…'

However, the students' answers to the items about reflective learning in engineering, and the lack of significant changes in their attitudes during the semester indicated that students did not relate the work they had done in dotFolio to their engineering practice. As a way of addressing this issue with the software, a new feature integrating the e-portfolio system with the faculty unit of study database, was added to dotFolio (Calvo, Ellis & Carroll, 2006). This function now allows students to link the description of the graduate attributes being developed, with their entries in dotFolio. The results of these changes may be tested during another iteration of the spiral.

CONCLUSIONS

In this chapter, we have sought to present a software engineering methodology that is informed by the learning experiences of students in higher education. The methodology is an adaptation of recognisable engineering methodologies referred to as spiral approaches to development, but extended for educational software to include stages for obtaining an understanding of how students think about, perceive and approach using the software for learning.

The spiral-Ed methodology proposed has been discussed in the context of

two learning software development projects: Beehive, a synchronous learning design tool and dotFolio, an electronic portfolio tool. These projects have provided a way of discussing how the students' experience of learning using these technologies can be fed back into the software development process to improve the quality of knowledge upon which the software systems are developed.

It is clear from the experience of the authors, that supporting students' learning experiences effectively with learning technologies is a complex goal. To do so in an informed and principled way, specialist knowledge from different disciplines is required and significant effort is necessary if the knowledge is to be synthesised and applied in a useful manner. Although the methodology described here is in its early days of development and application, our experience so far has been very positive, and has been valuable from the perspective of both the software engineers and the educational researchers. We argue that truly effective and supportive learning software can only be developed if some understanding of the experience of learning supported by the software itself is included in the development process. We anticipate that if software development teams increasingly employ a development methodology (such as the one proposed here) that is informed by the essential educational aspects of the software being produced, that the effectiveness of eLearning technologies overall will be significantly improved.

Chapter 17
www.theglobalstudio.com: Towards a new design education paradigm?

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Contemporary theory on teaching and research argues for inclusive scholarly knowledge–building communities. By this it is meant,

> a vision of higher education institutions as places where academics work collaboratively in partnership with students as members of inclusive scholarly knowledge building communities; where teaching and research are integrated, and where both students and academics are engaged in the challenging process of coming to understand the world through systematic investigation and collaborative decision making in the light of evidence (Brew, 2006, p. 3).

Thus begins Angela Brew's recent book on research and teaching. Her rationale for this position has various threads to it. Here I focus on two of those threads, and weave these into a narrative about teaching and learning in an international setting. Both threads rely on the capacity for critical thinking that the integration of research and teaching enables, and promote an argument for research to be intrinsic to tertiary education at all levels. The first thread is that an educated (or thinking) population is essential to a well functioning participatory democracy. Second, the contemporary world is 'super-complex' (Barnett, 2003a) and ever changing; thus it is impossible to prepare students for a future that is yet to take shape. Students, therefore, need to be equipped with the skills of critical and imaginative thinking that research affords and that will allow them to engage with this super complex world. To Brew the binary split between teaching (knowledge transmission- to students) and research (knowledge generation- to peers) is anathema, and grounded in now antiquated models of teacher rather than student focused approaches to learning (Brew, 2006, p. 18). She argues that research led teaching and the building of inclusive scholarly communities must be part of undergraduate as well as graduate education.

In this chapter I recount an attempt to create an inclusive scholarly knowledge building community of undergraduate and graduate students in fields related

to the built environment. The term city building professionals is used to denote the necessary interdisciplinarity implied by the many components to city building. The approach involves an intensive research and design experience for city building students with academics and professionals, and aims to promote participatory democracy (and social justice) and the development of critical and imaginative thinking. The vehicle described here is an international community-based action research project called Global Studio, now in its third year of operation. What distinguishes Global Studio from other forms of international design education is its interdisciplinary approach, its multi-university participants, and its commitment to serving the redistributive social policy ends of the United Nations Millennium Project and the Millennium Development Goals (MDGs) (http://www.un.org/millenniumgoals and http://www.unmillenniumproject.org).

Global Studio builds on the concept of the design professional as enabler (one who works 'with' rather than 'for'), and communities as active agents of change. The Global Studio educational strategy is a situated approach based on dialogue and 'learning by doing.' Its focus is site specific, involves participatory planning and design processes with socially excluded or disadvantaged communities, and the creation of useful outcomes. Results from two case studies described below indicate that Global Studio offers a powerful paradigm for the education of professional global citizens through mutual learning and best practice knowledge transfer, as well as the opportunity to create international networks of academics, professionals and students. In turn, these approaches can be applied in participants' own educational or professional practices.

BACKGROUND

Global Studio brings together teaching and research in a form of problematisation (and praxis) theorised by educators Paulo Freire (1974) and Henry Giroux (1983, 1988). It is enriched by Schön's 'reflection in action' (1983, 1988) and Snodgrass and Coyne's (1997, 2006) theories of design as a hermeneutical practice. Global Studio draws on the work and experience of various built environment theorists and practitioners, and NGO's, as it seeks to build a design education and research paradigm suited to contemporary urban challenges. These include Dutton (1991), Friedman (1995) Serageldin (1997), Groat and Ahrentzen (1996, 1997), Hamdi and Goethert (1997), Sandercock (1998) Sanoff (2000), Wampler, (2001), Bell (2004), Palleroni & Eichbaum Merkelbach (2004), Sinclair and Stohr (2006) but also Rural Studio at Auburn University (Dean, 2002), Assai (http://www.assai.com.au), Architecture for Humanity http://www.architectureforhumanity.org), the Design Collaborative at Detroit Mercy College (http://architecture.udmercy.edu/dcdc.htm) and Slum Dwellers International (http://wwwsdinet.org). Global Studio heeds the critique of archi-

tectural education by Boyer and Mittgang (1996), which argues that education needs to be more connected with society, and acknowledges the successful practices of community design academics and practitioners.

Global Studio's philosophical position also draws on debates about the internationalisation of tertiary education in a post 9/11 climate (Kennedy and Weiner, 2003; Kritz, 2006) and the very practical objectives of the Millennium Development Goals to end poverty by 2015 (Sachs, 2005). While Kritz broadly outlines a future landscape for international education, Kennedy and Weiner pose challenging questions about the new attitudes needed in educating for sustainable globalisation post 9/11. That most institutions want their students to have an international experience could, in their view, reproduce the problems of itself.

> We need education about 'real-world perceptions, perceptions that we would not like to hear,' That means our engagements in the professions, and in higher education more generally, cannot focus on those who most resemble us, or those who most apparently share our values, interests, and professional expectations. …. While China might be on the top of most professional school lists, some critical world regions rarely leap to the top of any profession's list of priorities, and are therefore unlikely to shape their global awareness. ….. We need to assure the diversity of higher education's internationalism. …. While there have been many important projects in the health sciences and in other professions dedicated to the address of needs in publics abroad, this identification with publics abroad has not been a core element organising curricula, research priorities, or institutional visions. This is the next challenge. As one university leader has said, the new internationalism for the twenty-first century will certainly have to consider the extent to which we are going to take on identification with people outside our own borders. (Kennedy and Weiner, 2003)

Effective identification with people 'unlike us' and outside our borders can only take place where there is open and equal dialogue. Thus any philosophical position must be firmly embedded in participatory, capacity and capability building processes. This approach is central to the Millennium Project Task Force for Improving the Lives of Slum Dwellers' report, *A Home in the City* (Garau, Sclar & Carolini, 2005) and informs Global Studio. Thus, Global Studio might be said to be reactive and proactive - reactive in that it joins academic work to the globally endorsed agenda to implement the Millennium Development Goals, and proactive in that it seeks to influence the education of city building professionals in local, national and international settings.

The role of participation in design and planning deserves special mention as it raises basic issues of knowledge and power. Arnstein's ladder of participation (1969) identified the possible modes of citizen involvement in decision making,

ranging from tokenistic in-puts through to true empowerment of citizen participants. Participation often falls short of empowerment, nowhere more graphically and succinctly represented than in slogans painted on walls in Paris in May 1968 – the year before Arnstein's article: *je participe, tu participes, il participe, nous participons, vous participez, ils profitent*. (I, you, he/she, you, we participate, they profit). In contrast, Martha Nussbaum's capabilities approach (2000) shifts the emphasis in the participation discourse firmly into the concept of participation as empowerment. Global Studio is a work in progress, and the intention is that it continues to grow through 2020 (the implementation period of the MDGs) building capability and capacity in universities, the professions and communities. Global Studio has been innovative in its insistence that people must be at the centre of their own development, and this applies equally to the 'researchers' (students, academics, practitioners, case study communities) as it does to the global urban poor. In other words it takes up Nussbaum's concept of building capability, and asks, 'what are participants capable of doing?'

THE ORIGINS OF GLOBAL STUDIO

Global Studio emerged out of my involvement in a UN Millennium Project Task Force from 2002-2004, and previous research on educating architects for globalisation. This in turn evolved from concerns in research and teaching about the importance of cross-cultural understanding involving issues such as gender, identity, class and ethnicity as well as the politics of space in the discipline of architecture. Conceptually, Global Studio fills a perceived research and teaching gap, and the perceived need for an international community of city building students, academics and professionals to make their skills available to improving the lives of the urban poor.

In 2002 I was researching globalisation and architectural education. The project was prompted by 9/11, and complemented previous research on values in architectural education (Rubbo, 2001). In the aftermath of 9/11 the challenge, or so it seemed to me, was to think about how education could provide graduates with a global perspective that would help them participate in the making of a safer and more informed world - regardless of the area of specialisation. Cultural understanding in the broadest sense would be a vital component, as would be a grasp of the phenomenon of globalisation.

Thus, the project posed the following questions:

- What opportunities exist in architecture schools to gain a global perspective, or to learn about globalisation? (internet search)
- What do today's architecture students need to learn to be tomorrow's global citizens, and how might they best acquire the knowledge? (focus groups and email)

Around equal numbers of male and female students at the University of Michigan and the University of Sydney responded to the latter question, and a focus group was also held with academic staff (or faculty) at the University of Michigan. With regard to question one, school mission statements around the world generally did not emphasise a global perspective in their curricula, although many wanted their students to have an international experience. With regard to question two, students were unanimous in their desire to learn about the processes of globalisation. 'We want to know the good and the bad'. Put another way, they wanted to know about 'globalisation from below' (often referred to as sustainable globalisation) and 'globalisation from above' (often referred to as neo liberal globalisation) (Falk, 2000). At the Universities of Michigan and Sydney, the majority of students in the focus groups said they would prefer to learn experientially, but acknowledged the need for formal study (seminars and lecture courses) as well. With respect to cross-cultural understanding, they did not think that cultural knowledge necessarily had to be gained overseas; it could also be gained through greater appreciation of the diversity in the student body (currently insufficiently appreciated in their view) and the diversity that was present in local communities. Many were interested in becoming 'citizen scholars' as Grund et al put it and wanted to 'discover their scholarly identity and decide where and how to contribute their expertise to the community in which they live' (Grund, Chertwitz & Darwin, 2001).

The conclusions of this research were that architectural education needed to better connect with its own diverse community, and that the university needed to be more open to local, national and international (non-academic) communities. What is new about these findings is the degree of interest and the importance that students attached to contact with external communities and the desire for their own difference to be recognised. Among the many virtues of architectural education Boyer and Mittgang (1996) also identified its hermetic nature in their important study commissioned by the Carnegie Institute:

> Architecture education is really about fostering the learning habits needed for the discovery, integration and application and sharing of knowledge over a lifetime. *Along with the vast potential, however, what this also points up is the architecture community's long history of failure to* connect *itself firmly to the larger concerns confronting families businesses, schools, communities and societies*…Unless those connections can be more clearly established in schools and public discourse architecture will remain omnipresent yet under appreciated and shrouded in mystery. *Architecture students and faculty at many schools seem isolated, socially and intellectually, from the mainstream of campus life* (Boyer & Mittgang, 1996, p. xv, xvi italics added).

Thus, the objectives of the Millennium Development Goals and the work of the Task Force provided an opportunity to address professional education and sustainable globalisation, and to consider how an effective, inclusive scholarly knowledge building community with intellectual, policy, professional and practical benefits could be constructed.

By and large, and relative to the scope of the need, architect and planners tended to be inadequately prepared or unable to work effectively with the urban poor in urban development. This was a message delivered to the Task Force by its urban poor representatives, which is not a surprising one. It is no secret that architects participate in only creating about 1% of the world's building culture (Davis, 1999), and that architecture has in the main been an elite profession serving an elite (Stevens, 1998). Nor is the rate of urban population growth and the increase in the numbers of the urban poor a secret. At present one billion people live in slums including 56 million in developed countries and if nothing is done this number is likely to grow to two billion by 2020. Indeed the world is at an historic tipping point as cities are where most people will soon live. Income disparities and social tensions encourage the growth of the 'divided city' a phenomenon that is not limited to developing countries and which can be identified in many Western, including Australian, cities. There are, therefore, pressing challenges and opportunities for the city building professions.

City building and improving people's lives are complex cross-sectoral and political issues, and require a multi-sectoral and interdisciplinary approach. One aspect that can be addressed by universities is the development of capable, reflective and effective design and planning professionals. Garau et al write in the Task Force's report, *A Home in the City*,

> The physical form of cities and the value added through the design of public space, community public buildings, and the landscape in cities and transport corridors is a concern in realising target 11…. Professionals must come down from the veranda as Bronislaw Malinowski famously urged of anthropologists and into the hut, the tent and the slum to find ways in which their own skills can be of assistance…. Many students and young professionals have a genuine interest in helping address the challenges facing the urban poor, not only because of the architectural or planning challenges but also because the cities of low-income countries are some of the most dynamic and interesting sites for new thinking and ideas. Confronting these complexities calls for the most creative minds (Garau et al. 2005, p. 94-96; Rubbo, Gurran, Taussig & Hall, 2003, p. 21-42)

Garau *et al* (2005, p. 94) also advocate that 'architects, engineers and other professionals need to be trained to help find solutions' and propose that educational and professional development in support of new forms of partnerships

between communities, local governments, and professionals may benefit from a range of initiatives including: learning from communities; encouraging information exchanges by professionals, students and communities in multidisciplinary settings; liaising with organisations and institutions dedicated to improving the lives of the urban poor and to realising alternative professional visions.

In late 2004 I proposed the action research project Global Studio and the forum People Building Better Cities to the Task Force. It was adopted and has been developed by Task Force members with the University of Sydney (Rubbo), Columbia University (Sclar and Carolini) and the University of Rome (Garau) taking the lead. While Global Studio grew out of the Slum Dwellers taskforce it has dropped the term 'slum' and now uses the (still less than) adequate term, 'the bottom 20%', which acknowledges that in any city there is disadvantage and this is not limited to the developing world. The case studies described below work with the 'bottom 20%' in Istanbul and Vancouver. In 2007 Global Studio will work in Johannesburg with township communities in Alexandra and Diepsloot.

FROM ISSUES TO APPLICATION

Case Study 1: Global Studio Istanbul (GSI) 2005

Global Studio Istanbul brought together more than 100 architecture and planning students, teachers and professionals from over 20 countries to take part in an international design studio and forum for three weeks in mid 2005. Hosted by the Istanbul Technical University, partners included the Universities of Sydney, Rome, Columbia, Middle East Technical and Mimar Sinan Fine Arts. Approximately half of the student participants were from less developed countries. GSI sought to implement some of the Task Force recommendations via an action research studio in Zeyrek, a poor neighbourhood in Istanbul. The projects were presented in a public square outside the local mosque. A short film documented the Global Studio process, including building a playing field with the children as well as the development of architectural and planning ideas for income generation, community gardens and ways in which the neighbourhood could be better integrated into the city. The film was shown in 20 countries by Global Studio participants who gave talks in their universities and communities when they returned home. Three months later and in collaboration with UN Habitat New York, GSI was exhibited in the delegates' area at the UN World Summit on the Millennium Development Goals in September 2005, thus disseminating the results of the project to politicians and policy makers.

An electronic survey of GSI participants indicated high levels of satisfaction with Global Studio. With more than a 95% return rate, 87% of students and 89% of teachers agreed or strongly agreed (the top two in a five-band scale) they were

satisfied with Global Studio. The qualitative feedback from students and academics was positive, but also constructive. For an Australian professor/practitioner one of the notable outcomes was 'Linking students from around the world and giving them time and reason to interact'. For an Indian student 'it was an amazing experience that I will cherish all my life'. Some comments about Global Studio Istanbul follow.

> One of the best things was meeting remarkable people and talking to them about their work and different cultural situations in their home countries, and the PBBC lecture series. (Student, Australia)
>
> I came back really inspired by the Global Studio, so I went back to the slum that I was working with, and I found out that they have a lot of problems now because they are in a real threat of eviction. So the Global Studio spirit is starting to flourish around here; another thing that I took from our experience was the idea of working together with the community in a small scale but full of meaning and urban action, so I had told the people in the slum about Zeyrek experience, (Student, Argentina)
>
> I have had the wonderful opportunity of sharing Global Studio with the University of Pretoria and to a smaller group in Johannesburg. I put together a wonderful school talk that surpassed even my closest friends' expectations. A lot of this maturity I owe to Global Studio. It is only when we are put under pressurised conditions that accelerated growth takes place. (Student, South Africa)
>
> I shared my experience with my professors and classmates and of course everyone was amazed about this incredible journey. I asked and was given permission to create my own studio for this summer in alignment to what we learned in Zeyrek. So hooray on our behalf, I will be expanding on what we learned to other students, faculty and staff through presentations, etc. (Student, USA)
>
> …I have been trying to advance the ideas some of which were presented on the research on community participation, etc. …should be brought into the mainstream of our planning and conduct of the architecture education programmes rather [than] being left as a side-line.. This has already begun with changes to the first year course. I spent three weeks in Botswana immediately after Istanbul designing the first year design studio and will be going back tomorrow to look at the work and take it further. Also, formulating further ideas and a programme of co-operative research about sustainable urbanisation in Southern Africa. (Professor, Hong Kong)

Case Study 2: Global Studio Vancouver (GSV) 2006

Global Studio Vancouver was held in June 2006. Hosted by the University

of British Columbia, partners included the founding partners plus the Chinese University of Hong Kong, Universidad de Buenos Aires, Witwatersrand University, University of Austin, Texas, and Rizvi College, Mumbai. GSV brought together over 80 city building professionals, educators and students from 21 countries to participate in the United Nations World Urban Forum (Sustainable Cities: Turning Ideas into Action) and the Global Studio. The disciplines of architecture, planning, landscape architecture, industrial design and international relations were represented. Working in Vancouver's disadvantaged downtown eastside with five distinct communities, Global Studio participants engaged in participatory planning and design approaches with residents, planners, designers, professionals, and civil society to develop strategies to improve people's lives. The outcomes were a series of multimedia events, and reports that were delivered to the community groups outlining possible futures developed in collaboration with local people, and ways of achieving these futures. GSV outcomes are posted on www.theglobalstudio.com > Johannesburg > PowerPoint.

GLOBAL STUDIO RESEARCH AND TEACHING APPROACH

Global Studio relies on collaboration and aims to build new partnerships, knowledge and capacity in all participants. Locations have been selected because they offered opportunities to add value to the studio experience. Istanbul was selected because it was the site for the 2005 Union of International Architects Congress at which Global Studio mounted a special session of 25 speakers on People Building Better Cities. Vancouver was selected because it was host to the UN World Urban Forum and GSV participants took part in this.

The Global Studio approach has the following research and learning steps: understand/read place; listen/learn from community; work with community; generate propositions and discuss with community; create an event; provide a report to the community; suggest how the work may be continued by other; reflect. The following questions are a way to begin to listen/learn from the community.

- What do people like/ dislike about where they live?
- What would improve their lives?
- What physical changes would help improve their lives?
- What is the political, planning and historical context?
- Does the community have a vision for the future?

These questions provide the framework for the participatory process and project research. The questions focus first on non-environmental issues and respond to the MDG's objective of improving people's lives. Answers to the first question often have little to do with the environment. For example, a person's life might be

improved if she could get a sewing machine and take in work or cultivate a garden to supplement the household's food (Istanbul), or public toilets and a place where she could meet friends out of the weather (Vancouver). A physical change might be a space where she could use the machine with sufficient light not to damage her eyes in the company of others, a community garden (Istanbul); a new pocket park with plants, toilets and shade structures, or a de-tox facility (Vancouver). For the children in Zeyrek, Istanbul, a playing field was their answer, and over the period of a week children, students, academics, professionals and local government worked together to make one. In this collective endeavour ethnic rivalries were forgotten as land was prepared and the children painted a fifty metre long mural of their vision for Zeyrek. Thus, the approach leads back to the issue of cultural understanding noted above and the involvement of 'people unlike us' that Kennedy and Weiner as well as the MDGs bring to our attention.

GSI revealed the importance of the 'bottom 20%' concept when a Kenyan student commented that what was poor in Istanbul would have not been poor in Nairobi, and an Argentine student asked 'what type of poverty are we talking about?' Other factors came into play in Vancouver's downtown eastside, the poorest postcode in Canada. The 20% embrace opens up areas for systematic design investigation and research in all cities, and enables the long-term educational objectives for the global and local studio concept. Focusing on people's lives allows a holistic approach, requiring across discipline responses. The 20% will vary from place to place but may be related to disadvantage that is social, cultural, economic, environmental, or pertain to gender, ethnicity, special interest groups, natural or man made disasters. This conceptual shift assists in the development of cosmopolitan citizen professionals and scholarly communities equipped with knowledge to work more inclusively at home or abroad. In this both participatory democracy and social justice objectives are served.

The research described here has been introduced into a graduate level course on Globalisation and Architecture at the University of Sydney. As work on the Millennium Project advanced and Global Studios have taken place, relevant knowledge has been incorporated into the course, and efforts made to take advantage of the experience and knowledge international students have. Further, the research methods have been introduced in a disadvantaged High School in Western Sydney where the first stage has been completed. The high school students were asked the same questions as were used in Vancouver and Istanbul. Using a research design appropriate to the setting, undergraduate students developed guided walks and group activities, including responding to the suggestion 'If I were principal for a day'. The activities yielded useful and often surprising insights into environmental values, and what students think might make the school a better place. The results were presented at the school to teachers and students. The next stage, as with previous Global Studios, is to work with the school community to translate the results to design. Just as in the 20% communities in

Istanbul and Vancouver, there are Western Sydney high school students capable of being agents of their own environmental design development.

CONCLUSION

Global Studio has a number of short and long-term goals, as well as some strengths and weaknesses. The goals of Global Studio are to promote and facilitate:

- New and transforming knowledge about participatory planning and design
- Interdisciplinary knowledge networks over the life of the project, and knowledge and skills that will be transferred between generations, across borders and cultures, and between universities, professions and communities.
- The normalisation of high quality design and planning for and with the urban poor and the less advantaged.
- A high degree of cultural learning and exchange due to the intensive 'learning by doing' of the studio, and a mix of students and teachers from less developed and developed countries.
- The use and development of increasingly sophisticated information and communication technologies to compliment the face-to-face work of Global Studio.
- The adoption of the Global Studio model by others and the development of local, national and regional global or glocal studios.
- The organic development of research projects and new teaching approaches, generated through participants and the communities they represent.
- An effective contribution by design teaching, research and practice to the Millennium Development Goal, 'ensure environmental sustainability'.
- The introduction of more interdisciplinary seminar and lecture courses in areas of significance to the MDGs.
- The development of the 'citizen scholar' or 'citizen professional'.

A strength and a weakness of the Global Studio model is that no university will have more than a few participants. It is strength in that it permits the formation of extensive international networks for those that attend, and a weakness in that it is hard to argue its cost effectiveness to heads of schools and deans. Thus 'ownership' or institutional buy-in are difficult to harness although the 'trickle down' effect at the University of Sydney has been significant: traveling exhibitions set up by students (see Blanchett & van den Bussche, 2006); the establishment of a Sydney chapter of Architecture for Humanity; well attended public lectures; student and staff professional awards; thesis research projects; successful student grant applications on related topics to professional funding

bodies; and a greater interest in architecture as a social art. There is the question of the long-term impact on participants. Will the Global Studio model produce any lasting change? Only longitudinal research will provide the answer. There is also the issue of falsely raising expectations in communities, and the lack of follow through, matters which can be addressed if carefully planned.

Global Studio has taken up the liberatory philosophies of educators such as Freire and Giroux, learned from the reflection in action and hermeneutic analyses of Schön, Snodgrass and Coyne and combined this with a 'globalisation from below' approach in an attempt to create an inclusive knowledge building community that can make a positive contribution to the realisation of the Millennium Development Goals. All cities have their bottom 20% for whom design and planning skills are most often out of reach. Issues of migration and refugees challenge many cities, and globalisation's social, cultural, technological and economic flows are changing our urban landscapes. Its essential components are a research and curricula commitment to interdisciplinarity, the promotion of cultural understanding, participatory processes and the inclusion of social justice objectives.

Global Studio itself is a reflective practice, and an evolving project. Lessons learned in Istanbul were applied in Vancouver, and further changes will be made in Johannesburg. It will continue to build scholarly and inclusive communities, where teaching, research, action and reflection constitute the project's praxis. While fragile in the ways mentioned and especially with regard to funding there has been no shortage of contenders wanting to host Global Studio, or a regional glocal studio. At time of writing this includes Brazil, Argentina, Papua New Guinea, India and Australia. Planning is presently underway for GS Johannesburg in June 2007. That Global Studio is making some headway in the difficult terrain of international education is indicated by the Rockefeller Foundation invitation to profile the GS model and the South African outcomes at their July 2007 Global Urban Innovation Summit in Bellagio, Italy.

ACKNOWLEDGEMENTS

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Chapter 18

Research-led curriculum development in time and organisational management skills at the Faculty of Health Sciences

Barbara Adamson, Lynne Harris, Adrienne Hunt, Robert Heard
Faculty of Health Sciences

This chapter describes and discusses the approach taken by a group of researchers in the Faculty of Health Sciences to improving the learning outcomes of health science graduates. In so doing, we highlight a process and a model that could be used by other groups of researchers wishing to develop and strengthen graduate skills and attributes during university education. A key feature of the model is participation by key stakeholders: employers of new graduates, graduates and academics. Whilst consulting relevant stakeholders has been the cornerstone of improvements to teaching and learning (Foskett, 2005) our approach with this consultation process is unique. We discuss why we believe our approach is unique and the developments in research and curricula spanning over a decade (1993-2004). The original piece of work consisted of a follow-up of graduates to determine what skills and attributes are necessary in order to be well-equipped for working in a rapidly changing health care environment. The subsequent research and developments in teaching and learning were guided by this research and consist of in depth investigations into organisational and time management skills necessary for effective functioning in the workplace. Whilst this research has been published as a sequence of studies, no previous publication has discussed the complete series of studies and the many and varied applications that have resulted. Throughout the chapter, the reader will be referred to more detailed presentations of our research and subsequent applications of the findings.

MEETING WORKPLACE REQUIREMENTS: CHALLENGES IN HIGHER EDUCATION

In 1993 a group of researchers in the Faculty of Health Sciences led by Barbara Adamson (from the Discipline of Psychology), Lynne Harris (from the Discipline of Psychology), Adrienne Hunt (from the Discipline of Physiotherapy) and Robert Heard (Discipline of Psychology) was charged with the responsibility of assessing the adequacy of undergraduate preparation in health information man-

agement, occupational therapy, orthoptics, physiotherapy and speech pathology in meeting the needs of a changing health care environment. It should be noted that all allied health students complete practical components known as clinical placements or fieldwork during their undergraduate or graduate degrees as well as academic components. Clinical education or fieldwork may involve spending short (a few days) or relatively long periods (6-10 weeks) working in health or education settings with clients or patients. Typically these placements are supervised by an experienced practitioner ('employer') in the student's discipline. This practical aspect is similar to the requirements of other health science programs (e.g., dentistry, medicine, nursing, pharmacy). Additionally, graduates are expected to be 'workplace ready' at the point of graduation. Hence health science curricula have traditionally been influenced by their respective professional bodies and workplace demands.

At the time of designing our research, very few studies had been conducted in allied health to assess graduates' perceptions of their university education. This situation contrasted with the many studies conducted in the disciplines of medicine and nursing which focused on the impact of structural course changes to programs (Bottorff, 1986; Geffen, Saunders & Sefton, 1994) and the relationship with graduate preparation for the workforce. Furthermore, available research tended to address single disciplines or particular workplace settings (Huebler, 1994).

EVALUATING QUALITY IN HIGHER EDUCATION: FOLLOW-UP OF GRADUATES

While there may be dispute over how quality in higher education should be defined, it is difficult to argue against the inclusion of a process of defining quality based on current and future workplace requirements. Hence a workplace driven approach to curriculum evaluation was selected. This approach is top-down since one group of stakeholders, that is, employers are given the opportunity to determine the direction of the curriculum development process. This contrasts to a bottom-up approach (Oye-Adeniran, Adewole, Iwere & Mahmoud, 2004) where academic teaching staff (at the ground level or 'bottom') in the first instance are given the opportunity to frame the direction of the process.

The three sections below describe the original piece of research consisting of a follow-up of graduates and the research process involved in our workplace driven methodology including consultation with key stakeholders. A model of the process is depicted and summarised in Figure 17.1. In addition, Figure 17.1 displays the subsequent developments in research stemming from the original study.

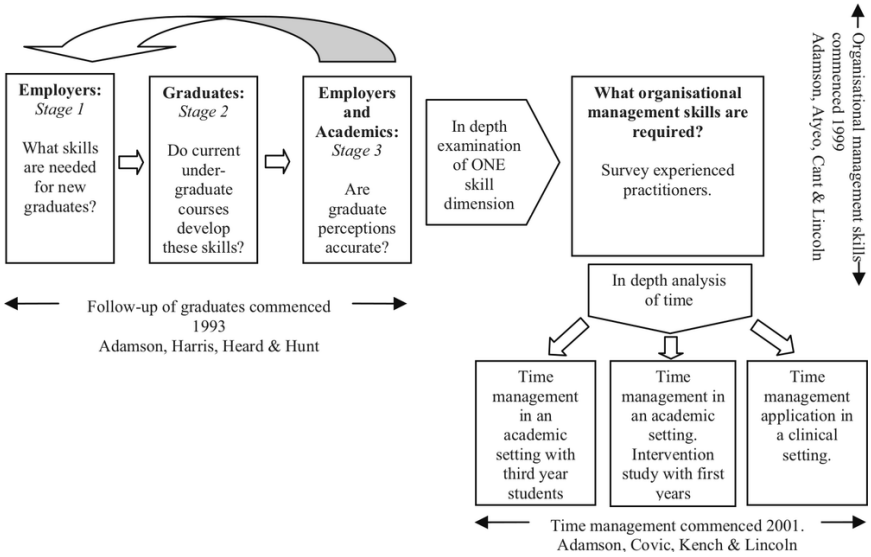

Figure 18.1. Workplace-driven curricular development

Survey of employers

In order to establish the attributes and skills that are necessary and desirable to equip graduates for the challenges of the workplace, a survey of employers (experienced practitioners who work closely with new health science graduates in the 5 disciplines mentioned above) was conducted. Employers (n=67) endorsed the need for the skills and attributes specified by the Academic Board (1993) of the University of Sydney, which included knowledge skills, thinking skills, personal skills, personal attributes (e.g., strive for tolerance and integrity, ethical practice) and practical skills. In addition, they identified a suite of skills that they perceived necessary in order for new graduates to function effectively in the current and future health care environment. These included: knowledge of the health care system, organisational management skills (e.g., budgeting, time management), and client management (e.g., knowledge of when to discontinue client treatment).

It is important to note the design characteristics of the survey we used with employers. Whilst closed ended questions asked them to make ratings of the importance of skills and attributes specified by the University of Sydney (a finite set) it was the open ended questions that allowed employers the flexibility to nominate other skills and attributes they perceived necessary in a rapidly changing health care environment. Moreover, the commonality of the suite of skills recommended as desirable for new graduates by employers across five distinct health science disciplines was noteworthy. This was a significant finding that

hitherto had not been available in the literature since as discussed above, previous research had conducted single discipline studies (e.g., nursing or medicine). It is noteworthy that a current literature search of studies in the area indicates that this trend is still evident (Spratt & Walls, 2003) with few exceptions (Humphreys & Davenport, 2005).

Survey of graduates

The commonality of the employers' responses across the five professional groups allowed us to devise a questionnaire for use by graduates from these five discipline groups. That is, the graduate survey was devised to reflect the skills and attributes perceived by employers to be necessary for new graduates to meet the demands of the workplace. The survey consisted of 52 items that were written in the form of questions asking graduates whether their undergraduate course had prepared or equipped them with the skills necessary to perform the tasks specified by employers. A seven-point rating scale was used to obtain this information. An example of a survey item is 'Did the course equip you to produce written records and reports?'

A total of 527 health science graduates completed the questionnaire. Using a statistical technique called factor analysis eleven workplace dimensions (factors) were identified. We named these workplace dimensions by identifying the type of items that loaded on each factor. The eleven workplace dimensions were: communication with clients, communication with health professionals and the general public, knowledge of the health industry, confidence in clinical role, realistic expectation of workplace role, pursuit and application of knowledge, workplace management, applying an evaluative approach, essential tasks and ethical practice. By examining the means of each workplace dimension we were able to determine the strengths and weaknesses of current undergraduate courses in terms of their adequacy in meeting the demands of the workplace (Adamson, Harris, Heard & Hunt, 1996; Adamson, Harris & Hunt, 1997).

Survey of academics and employers

In order to assess the validity of the findings related to graduates, a very similar version of the graduate questionnaire was mailed to employers and academics who taught in the designated health professional disciplines. The results pertaining to the perceptions of these two latter groups of stakeholders (n=84 and n=41 respectively) were consistent with each other and with the perceptions of health science graduates, thereby substantiating the validity of the graduates' findings.

A RIGOROUS METHODOLOGICAL APPROACH TO

The concurrence of perceptions between these three groups, that is employers, academics and graduates allowed us to feel confident regarding curriculum development to better match the skills and attributes that graduates acquire as a result of their university education, with the skills and attributes required of them in the workplace. The results of the survey of graduates, employers and academics indicated that on several workplace dimensions, undergraduate courses were not equipping graduates adequately. Specifically, graduates perceived themselves to be ill-equipped on dimensions concerned with workplace management, knowledge of the health industry and coping in the workplace. On other dimensions such as essential tasks (e.g., writing written records and reports, effective communication with clients), confidence in clinical role and ethical practice, graduates perceived themselves to be better equipped. These results and the rigorous statistical procedures adhered to in the design and data analysis of our research are discussed elsewhere (Adamson, Harris, Heard & Hunt, 1996; Adamson, Harris & Hunt, 1997). Subsequent to the research the challenge was now for educators to consider how best to accommodate the requisite attributes and skills identified by employers.

As discussed above, we believe our research has distinguishing and unique features not always present in the research conducted to assess the adequacy of undergraduate education (Harris, Adamson & Hunt, 1998). However, it is important to note two of these features since we believe it is these features that have contributed to a sustainable series of applications in researching and developing graduate attributes and skills.

First, the inclusion of open ended questions in the initial survey to employers proved valuable since without these questions the suite of skills and attributes they identified may not have been uncovered. Whilst this methodological approach was novel at the time our study was conducted current literature searches indicate that this is still the case (Foskett, 2005). Our approach contrasts to studies in the area where typically the focus is on employers and other key stakeholders commenting on the strengths and weaknesses of existing course content and structure. Hence the qualitative aspect of our research design with employers made possible the exposure to skills and attributes perceived to be necessary for effective functioning in the current and future health care environment. It is only at the next stage of the research process when graduates, academics and employers were asked to rate whether the current undergraduate course covered the skills and attributes specified by the initial group of employers that curricula issues became relevant.

Second, the employers who responded to our survey were from a range of workplace settings (e.g., hospitals, community settings) and five distinct allied health science disciplines. Despite the differences in demographic characteristics

the commonality of the suite of skills and attributes that they identified was striking. This gave us confidence in the robustness of our data. Additionally, the graduates who responded to our survey were themselves working in diverse settings (e.g., public/private hospitals, community and educational settings). A statistical analysis indicated that their perceptions of the adequacy of their courses did not differ markedly across workplace settings (Adamson, Harris, Heard & Hunt, 1996).

THE IMPACT OF OUR FOLLOW-UP OF GRADUATES RESEARCH ON TEACHING AND LEARNING PROGRAMS

The findings of this large scale study had a significant impact both within the Faculty of Health Sciences, the broader University of Sydney community, and beyond. In the first instance, the commonality of the findings across the five disciplines had a major influence on curriculum planning in the faculty, in that course content specifically designed for a single discipline rather than groups of disciplines became hard to sustain particularly in an era of shrinking budgets in the tertiary sector. This resulted in curriculum development involving inter-disciplinary teams of teachers, teaching to cross-disciplinary groups of students (Harris & Viney, 2003). The findings of our study were also incorporated in undergraduate course reviews and consultations with relevant professional bodies and in graduate entry programs being developed at the time (e.g., Masters of Occupational Therapy) particularly in terms of addressing the skills and attributes specified by employers. The details of these developments have been published elsewhere (Adamson, Hunt, Harris & Reid, 1999; Adamson, Hunt, Harris & Hummel, 1998; Harris, Adamson, Reed & Hunt, 1998; Hunt, Adamson & Harris, 1998; Hunt, Adamson, Higgs & Harris, 1998).

In addition, the questionnaires developed in our study have been used and adapted by other academics and researchers across different contexts. For example, the Faculty of Dentistry at the University of Sydney used our original employer questionnaire to determine what skills are necessary for dental practice in a changing global market (Gonsalkorale, Dean & Sefton, 2003). The graduate questionnaire has been used to collect data for course reviews and the accreditation process for the Singapore Nursing Board through the Singapore Institute of Management (SIM) (Personal communication with the Director, Dr K O'Loughlin in the Faculty of Health Sciences). After publication of our research there were numerous requests from colleagues both within Australia and overseas to use the questionnaires developed from our research. Hence the impact of our large scale study whilst difficult to quantify is clearly far-reaching.

TARGETING SPECIFIC AREAS FOR CHANGE

Workplace management

Workplace management and knowledge of the health industry were two of the main dimensions that key stakeholders perceived to be covered inadequately in undergraduate curricula. Whilst it may be debatable as to whether these two dimensions should be covered in undergraduate degree programs in allied health, it was considered pertinent to further explore how one of these dimensions could be enhanced and strengthened.

In order to obtain an in-depth understanding of what underlying knowledge and skills to foster in relation to workplace management in undergraduate and postgraduate students, as with our previous research, we adhered to an evidence-based approach and surveyed experienced practitioners in allied health fields. Five hundred and three experienced practitioners with managerial duties from medical radiation sciences, occupational therapy, physiotherapy and speech pathology participated in our study. We used a survey with both open ended and closed ended questions to elucidate what managerial skills and tasks they perceived as necessary both for managers in the health care environment and for new graduates.

It is beyond the scope of this chapter to discuss the findings of this research in detail and the implications for fostering workplace management skills in both undergraduate and graduate courses. Nonetheless, one specific aim with this research was to build these skills and knowledge base into an existing postgraduate unit of study called Organisational Management. This unit is available to graduate students across the faculty. Eight managerial dimensions were uncovered using factor analysis (staff relations management, management of future planning, prioritising work tasks, quality assurance, implementation and change, career path management, legislative knowledge and running a department) and these were used to inform curricula development with this postgraduate unit of study (Organisational Management). Furthermore, to ground this unit in a health care industry managerial context, 10 experienced practitioners who agreed to be contacted were asked to write a case scenario from their everyday work experiences. These case scenarios represented the underlying managerial dimensions identified above and required critical thinking and problem solving skills necessary for effective functioning in management. The students' responses to the case studies formed the assessment for the unit of study.

Although our intention with this study was to further our understanding of the skills and attributes underlying workplace management as with the follow-up of graduate research this research also had far reaching implications and applications (Adamson, Ateyo & Cant 2000; Adamson, Cant & Hummel, 2001; Adamson, Lincoln & Cant 2000; Atyeo, Adamson & Cant, 2001; Lincoln, Adam-

son & Cant, 2001). Apart from informing curricula development there were other positive outcomes. For example, Lincoln, Adamson and Cant (2001) conducted a separate analysis of the responses from speech pathology participants. This information was used by the Speech Pathology Association of Australia during a review of their Competency Based Occupational Standards for Speech Pathologists (CBOS, 2001) to change expected competencies in the area of management. CBOS defines the expected competencies of new graduates nationally and is an integral tool of the accreditation process for university programs. Hence the results of this piece of research were incorporated into Australia-wide competency based standards in speech pathology.

Time and organisational management skills

Another relevant finding from the research into managerial skills was the importance placed by experienced practitioners on new graduates possessing sound time management skills upon entering the workforce (Adamson, Ateyo & Cant, 2000). This finding echoed the importance attached to this skill in the follow-up of graduates' research. Twenty-five percent of graduates felt inadequately trained in time management skills upon entry to the workplace (Adamson, Harris, Heard & Hunt, 1996). Consistent with these findings is the importance that students themselves place on time management skills (Humphreys & Davenport, 2005).

Poor time management has been reported to result in stress for both health science students and graduates (DiGiacomo & Adamson, 2001) and has been identified as contributing to less than optimal outcomes in therapy (Adamson, Hand, Heard & Nordholm, 1999). While the link between time management and academic performance appears to be more tenuous (Mace & Tira, 1999), the inconsistency in findings may be due to inadequate measurements of time management abilities and skills. Notwithstanding, the role of time management has been identified as one particularly significant point of weakness in students who are academically struggling (Proctor, Prevatt, Adams, Reaser & Petscher, 2006).

In order to further develop graduate attributes, specifically in relation to time organisational management skills we embarked on three research studies. Two of these studies were carried out in an academic environment with undergraduate students and the third in a clinical setting.

Time management studies conducted in an academic environment. The first study consisted of 154 final year undergraduate students from the disciplines of medical radiation sciences, speech pathology and physiotherapy (Covic, Adamson, Lincoln & Kench, 2003). The second study was conducted with 478 first year students and consisted of a brief time management intervention program with a five week follow-up (Adamson, Covic & Lincoln, 2004). In both of these studies we utilised a time management scale specifically developed for the Australian

student population. The Australian Time Organisation and Management Scale (ATOMS) was developed by colleagues in the School of Psychology, the University of Sydney (Roberts, Krause & Suk-Lee, 1999) and it consists of 62 items that measure six dimensions of time-management behaviours and attitudes, namely: sense of purpose, meeting deadlines, mechanics of time management, effective organisation, propensity to plan and coping with temporal flow.

In our study of final year students we found that students had better skills in some dimensions of time and organisational management skills, such as a strong sense of purpose, a high level of focus and goal-setting, but not so in the area that specifically reflects time management, that is, the mechanics of time management. Interestingly, the mechanics of time management is quite amenable to improvement as it requires simple behavioural strategies such as the use of diaries and to-do lists. The majority of students we identified as at risk were deficient on only one dimension. These findings motivated us to develop an intervention program to target specific components of the time and organisation management skills construct.

Given that we identified a need to improve time management skills in final year undergraduate students, our intervention study targeted first year students in order to enhance their time and organisational management skills early in their academic careers. Initially, in week 3 of an academic semester, we surveyed 478 first year students' time management skills using the ATOMS scale as in Covic et al's study (2003). Then, in week 7 we provided students with their scores on each of the 6 dimensions and an intervention manual which reflected the six time and organisation management skills in Roberts, Krause and Suk-Lee's (1999) scale. The students were instructed to carry out the prescribed exercises and to focus on areas of identified weakness. Students then had 5 weeks to work through the intervention manual and were then surveyed again in week 12.

The time and organisational management skills of the first year students were similar to the final year students surveyed in our previous study. However, while the majority of students found the intervention manual useful (63%) only a small minority of students completed all the exercises (3%) or focused on their weakest areas (29%). Subsequently, 59% did not feel that their time management skills had improved. Our findings suggest that a time management intervention with students needs to be considered in relation to the following issues: time management skills may be influenced by personality traits and therefore resistant to change; intervention delivery needs to be framed within the principles of adult learning; compliance with intervention requires attention; and simple intervention procedures may not have an impact on time and organisational management skills. It may be that a gradual but progressive inclusion of time and organisational management skills within academic programs could be a more effective intervention approach (Adamson, Covic & Lincoln, 2004).

Time management studies conducted in a clinical placement environment. Clinical placements are perceived by educators and students as 'high stakes' learning activities. Patient or clients need to be provided with high quality services that are delivered efficiently, professionally and ethically by students even though they are learning and inexperienced. Students perceive placements as high stakes because they occur 'in view' of their future colleagues and potential employers. Clinical placements are the most obvious and salient place that students learn about how to function in their future workplaces. Hence we moved our research on to focus on student performance on clinical placements.

Our previous work identified that time management skills was an issue for new graduates in the workplace, so we hypothesised that this may also be the case for students when on clinical placement. We also thought that clinical placements were perhaps a key learning experience that could be used to improve time management abilities before graduation. In order to explore this further Lincoln, Adamson and Covic (2004) studied the time management abilities of speech pathology students on clinical placements. This study found that students reported improved ability in the area of the mechanics of time management e.g., using a diary, making lists, timetables when placed full-time in health care settings compared to their peers who continued to attend university classes and simultaneously have clinical experiences in an on-campus clinic. Students also reported improvement on this dimension over a one year period. Interestingly, students' abilities on other dimensions of time management such as sense of purpose, meeting deadlines, effective organisation, propensity to plan and coping with temporal flow did not change (Roberts, Krause & Suk-Lee, 1999). Consistent with other research findings, these time management factors may relate more closely to personality and hence be more resistant to change.

As with our previous work we sought to validate these findings with the other stakeholders in clinical placements, the clinical supervisors. In our study we asked clinical supervisors to also rate students' time management abilities. Clinical supervisors agreed closely with students in their ratings of time management abilities on three out of the six time management dimensions. Clinical supervisors perceived students to be better at meeting deadlines than the students perceived themselves to be and poorer at propensity to plan and coping with temporal flow than students. In general clinical supervisors rated the speech pathology students as having good time management skills.

As a direct result of this work, objectives and learning activities were modified or included in the speech pathology curriculum. A developmental approach to the acquisition of time management skills in the clinical setting was developed. Beginning students are now expected to manage time well in clinical sessions with clients, intermediate students are expected to manage their time and responsibilities across a week and advanced students are expected to manage their clinical responsibilities across a semester or a block clinical placement. Profes-

sional development units of study in the academic stream in the final year also address management of services and caseloads, prioritorisation and health care service delivery models. Clinical supervisors receive training in how to facilitate the development of time management skills in students and also the importance of modelling good time management.

This work has also been influential in our work with students who exhibit chronic difficulties with time management, particularly in clinical settings. The knowledge that some aspects of time management can readily be taught and changed, e.g., the mechanics of time management and others are more resistant to change e.g., propensity to plan, has helped in understanding the individual strengths and weaknesses of students. Identifying the students' strengths and weaknesses allows us to tailor learning support and intervention more effectively than previously. It remains now for us to evaluate whether these changes have had a positive effect on our students' time management abilities in clinical placements and eventually as new graduates in the workforce.

REFLECTIONS ON THE PROCESS

The research and teaching and learning developments described above resulted from cross disciplinary collaboration. This collaboration has continued and broadened to include other workplace issues such as retention of the allied health workforce. The collaboration has also fostered and mentored academics in research and teaching and learning. Table 17.1 summarises the outcomes from the research process for organisations, the university and individual staff.

Table 18.1. Number of publications and conference papers resulting from the research

Topic	**No. of refereed international journal articles**	**No. of conference presentations**
Follow-up of graduates	7	1
Organisational management	6	2
Time management	3	2
Other publications resulting from the process	8	3

Additionally, the inclusion of stakeholders, particularly employers and clinical educators has improved reciprocal relations between stakeholders. Stakeholders are aware that faculty programs are striving to match graduate knowledge, skills and attributes to a rapidly changing workplace. A productive dialogue con-

tinues regularly between groups. Students have also benefited by having their curricula more closely aligned with the needs of the current health care system. Importantly, professional associations have also noted the research findings. As discussed above The Speech Pathology Association of Australia responded to our work on management competencies. This research has also opened the door to the successful submission of collaborative grants with professional associations. The collaborative grants to date have focused on related issues such as retention of health professionals in the workplace and their professions.

The current body of knowledge demonstrates that research into teaching and learning in health sciences can be evaluated in the traditional metrics used to measure academic research outputs and impacts. This work was supported by several competitive grants and resulted in international peer reviewed publications and conference papers. The work also established track records for the individual researchers in this field which subsequently assisted them to win external competitive grants and to attract doctoral students. The development and application of a rigorous research method also in turn developed the research skills of team members.

The dissemination of the results showcase a scholarly, evidence-based approach to curriculum development and have enhanced the faculty's reputation as a leading education provider in the health sciences. Finally, the process highlighted the need for regular and sustained programs of research that continually evaluate the match between graduate skills, knowledge and attributes and workplace requirements. The implementation of an iterative approach will ensure that health sciences courses remain evidence-based and relevant into the future.

WHERE TO FROM HERE?

The follow-up of graduates study commenced in 1993. It is now time to repeat the process because health care services, workplaces and allied health curricula have changed. Some of the significant changes in health care services relate to a focus on prevention in health, an increased use of technology, and implementation of evidence based practice. Changing directions in delivery of health care services have been accompanied by managing an increased need for services, larger case loads, increased legal, security and safety requirements and interprofessional collaboration between health professionals. Whilst some of the skills and attributes required to meet the new challenges faced by health professionals today were identified and anticipated for the future by employers in our follow-up of graduates study, the mix, the emphasis and changing demands within the health sector warrants further research.

Additionally, current changes within the Faculty in terms of health science education are substantial. For example, masters level professional entry programs

which will be the norm for allied health professional education at the University of Sydney, open up a new era in terms of the challenge of building onto the existing skills and attributes of graduate entry students. How best to match the skills and attributes of this new cohort of students with the changing health care sector is a challenge now facing educators. Given the diverse nature of the education, work and personal experiences of graduate students it will be important for future research to determine how these contribute to the competent professional as well as their university academic and clinical experiences. It will also be necessary to investigate the strengths and weaknesses of the different pedagogies used in graduate education, for example problem based learning and case based learning and determine whether these approaches assist graduates to meet the needs of the current workplace. Another important question to be addressed is what clinical experiences best promote the skills and attributes needed for the current workplace. Graduate students generally spend less time in workplace clinical placements so it is imperative that their learning is optimised during their placements. Finally, what skills and attributes will be most highly valued in the next decade and how best to enhance them in a changing educational sector remains to be determined. If we were to look in our crystal ball we would predict that future graduates will need skills in managing support staff such as therapy aides, high level technology skills, research skills and project management skills. This in turn will require curriculum revision and the commencement of the next research cycle.

Chapter 19
Competency-based curriculum: Permanent transition in dentistry

Tania Gerzina

Faculty of Dentistry

THE LEARNING ENVIRONMENT OF THE CLINIC

Dentistry is a field of human health care where education principally trains students for the independent and proficient care of patients with oral and dental diseases and disorders. The learning environment is the dental clinic which is often housed within a tertiary medical hospital. Much learning, of course, is completed in traditional lecture theatres and seminars rooms, online and face-to-face but the clear understanding of student and educator is the goal of clinical performance. It has been suggested that 'the clinic is the learning environment to which all our students aspire' requiring the assiduous 'transfer of knowledge from the basic sciences to the clinic by tuning and restructuring of knowledge' (Rumelhart & Norman, 1978; Mullins, Wetherill & Robbe, 2003). How teaching best occurs in this environment, for the preparation of students to advance to independently provide patient clinical care, is an important and central field of enquiry for educators and clinicians alike.

Students, as trainee clinicians, are introduced to the learning environment of the clinic early in their careers. This aims to provide authentic, contextual learning and facilitate integration of knowledge from basic to clinical sciences uniquely afforded by the environment (Mullins, *et al*., 2003). In providing strong contextual learning, the environment is an example of a 'community of practice' featuring 'mutual engagement' of a number of participants (Lave & Wenger, 1991). Other important participants are regional Health Care Systems supporting the vast majority of patient care in accommodating the clinical environment and statutory national bodies, such as the Australian Dental Council, who are tasked with standard maintenance and recurrent accreditation of dental programs. Other participants are the professional associations, such as the Australian Dental Association representing a unified community of practitioners. In this setting, students are expected to simultaneously demonstrate diverse competencies, including a range of skills, broad knowledge-base, professionalism and empathic, ethical behaviour, supervised by clinical educators.

In many professions, clinical educators are themselves practicing clinicians, and share responsibility for patient care provided by student clinicians, with those students. The clinical educator often employs a range of teaching modes and their supervision, at its best, may be defined as the 'provision of monitoring, guidance and feedback on matters of personal, professional and educational development in the context of patient care' (Hirons & Velleman, 1993; Irby, 1995; Kilminister, Jolly & van der Vleuten, 2002). The student/clinical educator relationship has also been suggested to mirror the *therapeutic* alliance that exists between patient and physician, in representing an educational alliance (Tiberius, Sinai & Flak, 2002). Whilst the relationship can benefit both student and educator, Fallon and co-workers found that effective clinical teaching in medicine also has an impact on patient outcome which can improve when direct supervision of the student clinician is combined with focused feedback. (Fallon, Wears & Tepas, 1993).

Clinical teaching in a dental education context has been less extensively examined and is different from that of medical clinical teaching. (Romberg, 1984; Chambers, Geissberger & Leknius; 2004). Technical competence in the fine motor skills required in dental procedures is an important characteristic of dental education. Unlike clinical teaching in undergraduate medicine, undergraduate dental clinical teaching must facilitate the development of competence that enables a student to autonomously engage in the privilege of patient care at graduation guided by reflective practice (Greenwood, Lewis & Burgess, 1998). Reflective practice is a way for beginners in a discipline to recognise consonance between their own individual practices and those of successful practitioners. (Schön, 1996).

Whilst in business and industry the competence-model is reported to benefit a broad and large range of stakeholders in, for example, articulating workforce needs, focusing training, activating development efforts and planning future trajectories, it is not clear if this is also so in dental education. There is little organised research that can point to the long-term value and impact of competency-based curricula on student development of clinical competence and patient outcome. (Hager & Gonzi, 1991; Gonzi, 1993). Similarly, there is little organised research that clarifies how students learn clinical competence. Chambers has argued, however, that competency-based education has raised these matters to conscious discussion. (Chambers, 2001). This attests to the sense of a curriculum in transition.

DRIVERS OF CHANGE: THE MOVE TO COMPETENCY-BASED CURRICULA IN DENTISTRY

The need to consider the merits of a competency-based curricula has been faced

by many professions. Probably the earliest driver of this for the Faculty of Dentistry was the issue of a report by the Institute of Medicine (IOM) in 1995; *Dental Education at the Crossroads: Challenges and Change* (Field, 1995). This report recommended significant curricular reforms relative to educational contact and presentation in dentistry. In 1998, the Commission on Dental Accreditation of the American Dental Association adopted predoctoral dental program accreditation standards requiring competency-based assessment. This was then placed in the light of the first ever US Surgeon General's report on oral health published in 2000: *Oral Health in America: A Report of the Surgeon General* (Satcher, 2000). This report detailed the most common oral health problems while highlighting the need to increase access and care for a range of underserved populations in the US. Implications of the reports gave rise to curriculum reforms which included 'redesigning curriculum to incorporate competence-based learning principles, decompression of the curriculum by eliminating irrelevant or duplicated material and revitalising underlying sciences via evidence-based approaches' (Hendricson & Cohen, 2001). The American Dental Education Association in a report, the *Competencies for the New Dentist* (2004) equated graduation (that is, with a first dental professional degree) with the attainment of professional competency through a continuous process of professional improvement divided into five stages: novice, beginner, competent, proficient and expert as described by Dreyfus and others (Dreyfus & Dreyfus, 1986; Bruer, 1993).

Political unifying changes in Europe also impacted on educational processes. With the signing of the Bologna Declaration in 1999 by the Ministers of Education of 29 European countries, an aim to establish a European Higher Education Area by 2010 achieved strong significance in advancing the importance of competency-based dental education. The groups tasked with facilitating convergence in the dental education area, the Association of Dental Education in Europe (ADEE) moved to organise competencies for the graduate dentist into a professional profile that would have applicability amongst all the nation members of the European Union. (Plasschaert, Holbrook, Delap, Martinez & Walmsley, 2005). This, together with similar initiatives in North America and the United Kingdom, provides an overview of competency-based curricular design available in dental education. (Boyd, Gerrow & Chambers 1996; American Association of Dental Schools, 1997; General Dental Council, 2002).

These reports caused strong resonance in the Australian dental educational community. In 1999 to 2000, the Faculty of Dentistry at the University of Sydney sought to respond to some of these strong external issues but also had pressing internal issues with which to contend. The internal imperative was the implications of an advanced curriculum reform already completed by a faculty with which dentistry had strong integration both educationally and professionally. The Faculty of Medicine had by now already implemented its new graduate-entry, four-year problem-based learning (PBL) curriculum, the Graduate Medical

Program, which had immediate logistical and philosophical implications for the provision of basic science teaching for the Faculty of Dentistry. In 2001, the Faculty of Dentistry therefore, introduced the BDent program, replacing the former five-year, undergraduate-entry and largely didactic Bachelor of Dental Surgery (BDS). The BDent PBL-based curriculum was designed to align with best practice in dental education identified in international standards in literature and by University of Sydney Academic Board policies whilst contributing to the objectives of the University Strategic Plan in the creation of a strong evidence-based scholarly environment. (Klineberg, Massey, Thomas & Cockrell, 2002). The reform had begun and it was soon recognised that a new curriculum required new and evidence-based educational modalities to be developed to support its objectives. Meeting these challenges became the driving energy of a number of faculty research projects in both scholarship of learning and research paradigms and these are described below.

SCHOLARSHIP OF LEARNING AND TEACHING PROJECTS

The faculty curriculum committee was tasked with the development and implementation of a competency-based curriculum. This was considered in terms of three broad phases: planning, implementation and evaluation. Each phase was characterised by a series of integrated projects in both the scholarship of learning and teaching, and in educational research. The results of these projects were presented throughout the timeline of the curriculum development, at dental and medical educational conferences, nationally and internationally, and published in refereed journals, to seek the benefit of critical review and reinvest that benefit into the phases. The curriculum committee had final oversight of developments providing broader comment. An added challenge to the committee was the need to maintain the integrity of the exiting BDS degree program whilst simultaneously developing and implementing the BDent program.

Planning the curriculum

Development of the dental clinical competencies. An aim was defined as the design of the competency-based structure of the new dental program. The method featured aspects of project management often used in business: organising the team, defining the project, planning the stages and activities, activating goals, reporting the results, reviewing the process. The team consisted of a cross-section of discipline experts and educators led by a senior academic with strong educational experience. Firstly, a literature search was completed on competency-based education. This yielded a working definition of competency as a broadly stated

general description of an essential patient care skill or professional role that an entry-level general practitioner must be able to perform unassisted and unsupervised. In addition, it was considered that maintenance of competence required reflective practice and was a professional and ethical responsibility (Willis & Dubin, 1990). Secondly, a search and critical review of online competency statements and resources published by dental schools and dental educational associations nationally and internationally was completed. Thirdly, the various lists were reviewed by the project group by determining the behavioural objectives comprising the competency, the direct applicability to dental practice and the relevance of the competency to the program mission. A example for the competencies was that adopted by the Association for Canadian Faculties of Dentistry. The competencies for the BDent program was rationalised to a final list of 50 items set out in one of a series of five curriculum planning papers. The team reiteratively reviewed the competencies in terms of discipline emphasis and balance in order to safeguard overall integrity and to facilitate the networking of new knowledge patterns. This networking was preliminarily completed by grouping competencies into multi-disciplinary domains of knowledge. The final stage of the project was the determination of the following components for each competency: educational outcome, specific knowledge, pre-clinical skills and clinical skills. Outcomes of this published project were the identification of the competencies and their operational components, acceptance by consensus in the faculty of the competency-based structure and a recognition of the imperative of review of the competencies in the future (Klineberg et al., 2002).

Development of a new dental competency-based unit of study. An aim for this project was the operationalising of the competencies into units of study, the basic packets of academic programs. Utilising a similar method already establish above, the curriculum team critically adapted units of study from the Faculty of Medicine Graduate Medical Program in the three themes of Life Sciences, Personal and Professional Development and Dentist and the Community. These three themes provide the framework for the goals of the program, for the development of the curriculum and for assessment. Uniquely dental units of study where developed to integrate those competencies encompassing the necessary communication, reasoning and clinical skills required to provide accurate oral health diagnosis as well as the clinical understanding and technical skills needed to treat dental patients. This occurred by the consolidation of about sixteen individual dental disciplines into two new dental themes, Total Patient Care, for senior years, and Foundations of Total Patient Care, for junior years, of the BDent program. Each of these new themes required the scholarly development of a number of new learning strategies and modalities which were addressed in the implementation phase (Daly, Groenlund & Moran, 2002).

The BDent website for the dental program at the University of Sydney. An aim in this project was to develop a program website that supported learning by providing staff and students with access to curriculum in a timed, controlled way. The curriculum team employed an information technology specialist to develop the website. Technical advice suggested that the website needed to be password protected, feature a bulletin board to announce news, feature customised online lecture timetables, allow timed release of resources, enable users to submit feedback through a forum, allow 'staff only' access to certain resources and provide multimedia 'triggers' to enhance learning. Student response to the website has been monitored consistently with unsolicited and solicited student and teacher feedback and focus group sessions. Outcomes have been excellent utility by students and educators but ongoing maintenance of the website has been imperfect. This project and the website were presented in 2002 at the American Dental Education Association Annual Conference in San Diego, USA and the presentation was rewarded with an international award (Gerzina, Lester & Sefton, 2002; Reynolds & Gerzina, 2002)

Establishing benchmarking in the Faculty of Dentistry. This funded research project aimed to develop a method for benchmarking teaching and learning in response to an institutional need to validate the new BDent program. A qualitative method was used. A collaborative institutional partner, University of Adelaide, was identified, and the partners negotiated on the areas of teaching and learning to be benchmarked. Problem-based-learning approach and assessment were nominated as those areas. A list of quality indicators for these aspects of teaching and learning were first developed conceptually and then validated by the literature. Then, using a quality enhancement framework, levels of achievement for each indicator were developed (Kember, 2000). The project yielded a strong, evidence-based charting of performance indicators which were mutually developed with the benchmarking partner and which represented an agreed model for a benchmarking project to progress to the next stages of implementation and evaluation. It was perceived that the model could be readily adapted for any benchmarking project in all levels of education; primary, secondary, tertiary and continuing. Another significant outcome of the project has been the commendation by accreditation bodies of the dental program in Sydney for the benchmarking initiative and the expansion of the project to include another partner, the Faculty of Dentistry at the University of Toronto, Canada (Henderson-Smart, Winning, Gerzina, King & Hyde, 2006). This project has been presented in several forums including national and international conferences (Dempster, Grad & Gerzina, 2005a).

Implementing the curriculum

Development of dental clinical competency logbook. An aim was to develop,

and evaluate effectiveness of, a learning resource to organise and track the completion of competencies by students, promote self-reflective practice and enable criterion-referenced assessment. The curriculum team used a method including a database literature search for clinical log books in the professions of dentistry, nursing and surgery. Desired characteristics for learning and assessment in the logbook were defined and enabled a stepwise development of the logbook. Student evaluation of the logbook was completed by questionnaire using a six-point Likert scale and using 20 items. These items were drawn from statements articulated by students during informal focus group sessions about the logbook. An open-ended comment section was included. Several results and outcomes have occurred. Student evaluation (response rate 73%) of the logbook has been favourable with strong support, particularly, for the self-assessment section. The Clinical Competency Logbook has now been in place for junior years in the BDent program for the last seven years (with annual refinement). The logbook has been viewed favourably by accreditation teams (Australian Dental Council Accreditation Report, 2005). Currently, a new Scholarly Project is advancing the modality into an electronic version, the eLogbook, and extending its use into all years of the program. (Moran & Gerzina, 2001).

Assessing the development of clinical competence. This project aimed to assess student development of specific clinical competencies which are considered essential for independent high quality provision of dental care for patients in a dental surgery. To achieve this aim, the working group utilised a qualitative method. Data derived from websites of dental schools throughout the North America, Europe and UK were systematically searched for detail on assessment tools and an extensive literature search through ERIC and MEDLINE were presented to the working group for discussion and critical review. In addition, current faculty assessment practices and University of Sydney Academic Board Policy on assessment completed a data set for elaborate discussion. Methods included consolidation in the working group, of the understanding of sound assessment practice. Practically, the competencies were arranged in interdependent groups enabling the competencies to be directly linked to areas of the curriculum. There were several outcomes. A scheme of integrated clinical assessments was developed that could measure the acquisition and mastering of the dental clinical competencies. The new assessment tools were criterion-referenced, authentic, fair, realistic and meaningful, recognising the development of student clinical competence as proceeding from the cognitive to the behavioural with increasing dependence on the provision of dental care as the assessment focus. Sessional assessment and self-assessment are used in all years of the program, embodied in the clinical competency log-book. In the largely pre-clinical early years, further formal clinical assessment also includes both integrated and discipline specific clinical assessments. In the predominately clinical years 3 and 4, competency

assessment is founded on sessional clinical assessment, completion of clinical thresholds, case presentations and in clinical mentor reports. Assessment of student completion of clinical competencies is now completed in several ways in the program, aiming to authentically present an accurate overview of a student's clinical development.

Evaluating the curriculum

Effectiveness of assessment in integrated clinical competencies. This research project aimed to qualitatively assess the effectiveness of the newly formulated clinical assessment in the junior years of the program (BDent 1 and 2). In this project methodology, a questionnaire was designed that explored the value of the assessment format in accurately reflecting student performance, enabling valuable feedback and enhancing student self-evaluation. Both students and assessors were provided with the opportunity to provide feedback. The questionnaires were constructed based on responses to a six-point Likert scale with responses ranging from 1 (strongly agree) to 6 (strongly disagree). Data were entered into SPSS (Statistical Package for Social Sciences) and analysed. Open-ended questions were also included. Results from the questionnaires were valuable. Differences in perceptions of the value of the assessment grades varied between the student groups and between the assessors. Tentativeness in the use of the full range of the grades characterised students and assessors with less familiarity with assessment goals. Criteria for the grades and guidelines were found to be meaningful by all groups and simplification of logistical issues was seen as a requirement for compliance by students and assessors. The current study highlighted the value of a robust and sensitive grading scale in clinical and pre-clinical assessment in dentistry. Some data from this project are shown in Figure 19.1. An outcome of the project has been that clinical sessional grading using non-numerical grade descriptors is now completed by both the student (in a reflective self-assessment) and by the clinical educator for every clinical session. The grades are able to be summatively processed supporting progression decision but remain the primary source of feedback to students on their development of clinical proficiency. (Hyde & Gerzina, 2002; Russell, Reynolds, Fairley, Hyde, McInerney & Gerzina, 2005)

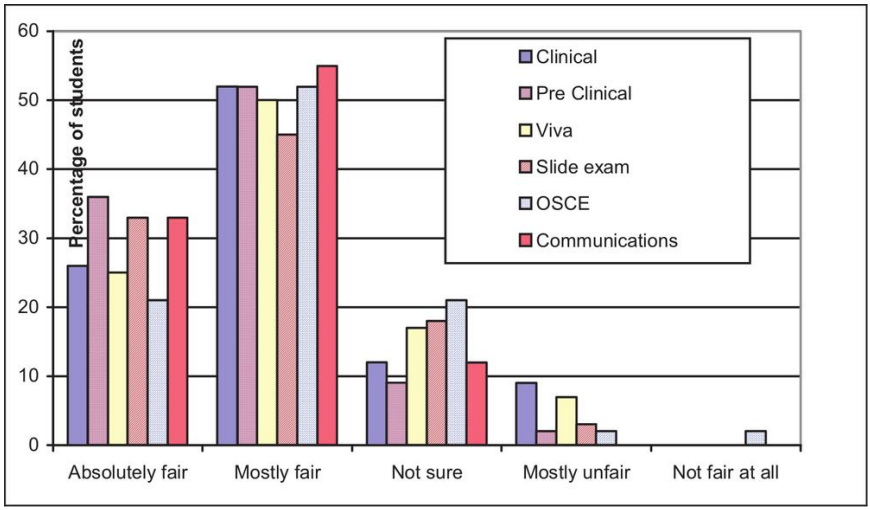

Figure 19.1. Students' ratings of the perceived fairness of each component of the Clinical Assessment (n=44, RR 65%)

Student use and perceptions of different learning aids in relation to formative assessment, and to becoming a clinician. This research project aimed to determine student perceptions of a recent written formative assessment in terms of the usefulness of various learning aids both in preparing for the assessment and in preparing to be a dental clinician. The project also aimed to establish correlations between approach to learning and perceptions of assessment and learning aids. The Study Process Questionnaire (SPQ) (Biggs, 1987) and two specifically designed questionnaires were used featuring a six-point Likert scale. Correlations between student approach to learning as assessed by the SPQ and perceptions of assessment and learning aids were evaluated. The SPQ yields three factor scores 'deep', 'surface' and 'achievement'. Relationships between approach to learning and perception of the written formative assessment were examined in the first instance. Correlations between approach to learning and student perception of the usefulness of learning aids in preparing for assessment and preparing to be a clinician were examined in the second instance using Spearman correlation coefficient and a significance level of $p<0.05$. Theoretically expected associations were seen, in that surface learning was associated with students' concerns regarding whether assessment items reflected curriculum content, a valuing of lectures as a learning aid and low scores for group seminars, called theme sessions.

Table 19.1. Significant (and trend to significant) correlations between approach to learning and perceptions of assessment and learning aids

Approach	Question	Correlation
Surface	The MEQ questions were representative of	r = -.307
	the curriculum content*	p = .07
	I find theme sessions a useful learning aid in	r = -.512; r = -.387
	preparing for assessment/clinical wo	p = .002; p = .024
	I find lectures a useful learning aid in preparing	r = .415
	to be a clinician	p =.015
Deep	The MEQ paper tested clinical application of	r = .374
	basic and clinical sciences	p = .03
	I don't find independent study groups a useful	r = -.296; r = -.275
	learning aid in preparing for assessment/ to be a clinician **	p = .08, p = .11
	I find clinical days a useful learning aid in	r = .303
	preparing to be a clinician	p = .08
	I don't find learning topics a useful learning aid in	r = - . 277; r =-.330
	preparing for assessment/ to be a clinician **	p = .09, p = .06
Achievement	Written formative assessment helped to clarify the	r = .392
	level of knowledge and understanding required	p = .02
	I will change my approach to study as a result of	r = .323
	my experience with the first formative assessment	p = .06
	Formative assessment failed to give me a clearer	r = -.287
	understanding of my strengths and weaknesses **	p = .10
	I don't find learning topics a useful learning aid	r = -.390; r = -

Approach	Question	Correlation
		.317
	in preparing for assessment/to be a clinician**	p = .02; p = .07
	I don't find independent study groups a useful	r = -.346
	learning aid in preparing for assessment**	p = .04
	I don't find on-line assessments a useful learning	r = -.332
	aid in preparing for assessment **	p = .05
	I don't find written formative assessments a	r = -.424
	useful learning aid in preparing for subsequent assessments **	p = .01

** negative correlation, positively framed item; ** negative correlation, negatively framed item r = correlation coefficient comparing paired responses; the first r value refers to correlations with assessment while the second refers to correlations with preparing to be a clinician*
p < 0.05 considered significant; p < 0.1 considered to be a trend to significance; where two values are given, the first r and p values refer to correlations with assessment while the second refers to correlations with preparing to be a clinician
(Source: Gerzina, Worthington, Byrne & McMahon, 2003)

Deep learning was associated with a perception that the assessment tested application of basic and clinical sciences and a valuing of both independent study groups and learning topics as learning aids. An achievement orientation to learning was associated with a valuing of formative assessment as a learning aid and an intention to modify study habits as a result of participating in formative assessment. Some data from this project are shown in Table 19.1. The findings provided insight into student learning in a PBL context which will meaningfully inform both educators and curriculum developers (Gerzina, Worthington, Byrne & McMahon, 2003).

Competency-based dental clinical teaching: perceptions of students and educators. This research project aimed to explore perceptions of dental student clinicians and clinical educators about dental clinical teaching to provide primary data for dental researchers and educators. Student focus group data provided

background for development of a questionnaire which explored three themes related to clinical teaching. Twenty-one educators and 45 student respondents completed the 25-item questionnaire. In the theme of the educator/student relationship no statistically significant differences were seen between educator and student group perceptions. In the theme of educational theory applied in dental clinical teaching, a statistically significant difference was seen between educator and student groups in perceptions of the value of pre-clinical instruction in senior clinical years and in perceptions of the value of a clinical log book. In the theme of skills required for clinical dental practice, a statistically significant difference was seen between educator and student groups in the perceived value of a critical appreciation of evidence-based practice as one of the skills. Some data from this project are shown in Table 19.2. The study overall indicated that the dental clinical learning environment supports close perceptual conformity between students and clinical educators in regard to what each group considers to be 'good practice' in clinical teaching. The findings of this study indicate that some techniques that have been advocated to enhance clinical learning, such as evidence-based teaching methods, require further investigation (Dempster, Grad & Gerzina, 2005b).

Table 19.2. Comparison of educator and student perceptions in regard to the application of educational theory in dental clinical teaching

Questionnaire Statement	Educators			Students			
	Median	Mean	S.D.	Median	Mean	S.D.	S
The PBL form of teaching has supported the development of the ability to provide dental clinical care of patients	3	3.4	0.5	4	4.2	0.5	NS
Small group teaching, such as tutorials, are valuable to the development of dental clinical skills.	2	2.2	0.6	2	2.5	0.4	NS
There is a clear link between the theory and the clinical practice of dentistry in the dental program.	3	3.3	0.3	2	2.3	0.2	S P<0.003
Formal lectures are valuable to the development of dental clinical skills.	3	2.6	0.9	2	2.3	0.5	NS
Grading student performance in clinical sessions should use a	3	3.2	0.7	3	3.4	1.5	NS

'pass', 'credit' etc system to best support student development as dental practitioners							
A student record of their completed patient care, such as a clinical log book, assists student preparation for independent practice.	3	2.9	0.3	4	3.7	0.2	S P<0.004

Rating scale: 1=always agree, 2=agree, 5=disagree, 6=strongly disagree. (Source: Gerzina, McLean, Fairley, 2005)

Preparedness of dental clinical educators to supervise student clinical competence. The aim of this research project was to provide data on the clinical educators' perceptions of clinical teaching and their degree of confidence to clinically supervise student clinicians during student care of patients. A mixed qualitative/quantitative method was used. A questionnaire was developed for all clinical educators containing both open- and closed-structured items reflecting all the Clinical Competencies of the program. The closed-items section used a 5-point Likert scale to ascertain educator perceptions of, firstly, their degree of confidence to supervise students completing each of the clinical competencies and secondly, their perception of their own teaching characteristics compared with a list of characteristics associated with effective educators in the literature. An open item section queried educator ideas about aspects of educator development in dental clinical teaching. Chi square ($p<0.05$) was used to compare results between participant educators (general dentists, specialist dentists) and Pearsons product-moment coefficient was used to determine correlations between years of teaching or gender and perceptions reported. Results were as follows. A response rate of 67% to the questionnaire was seen amongst the educator participants (63% male, 30% specialist or possessing a higher degree) and these participants had an average of 9 years clinical teaching experience. A majority of educators (greater than 70%) felt well prepared to supervise student clinicians completing 60% of the listed clinical competencies, such as 'conducting a dental clinical examination'. Educators reported feeling unprepared to supervise students in 17% of listed competencies, such as 'performing periodontal surgery'. They reported being uncertain about their confidence in supervising students completing another 17% of the competencies such as 'managing needs of physically challenged patients'. Educators rated themselves as possessing a large number of the characteristics of effective educators but were unsure about some characteristics, such as 'gauging a student's need for independence' and 'linking theory to practice'. Specialist dental educators considered themselves confident to supervise in a significantly larger number ($p<0.05$) of the clinical competencies than general dental specialists; no significant differences were seen in comparing edu-

cators of more or less than 10 years teaching experience; some significant gender differences were seen in educators confidence supervising specialist-level competencies (Gerzina & Down, 2006).

CONCLUSIONS

The competencies present, in a comprehensive and convenient list, the ingredient skills and capabilities that the entry-level clinical practitioner needs in order to conduct independent practice. Typically, curriculum designers attempt to realise the vision of curriculum planners in choosing an educational approach that serves the educational mission. Curriculum development and implementation is most usefully approached in a structured strategic way, aiming to take value from the benefits of faculty positioning in a research-intensive learning environment of a university. A 'traditional' way to design a curriculum is a linear process starting with a needs assessment, goal development, design of the objectives, teaching strategies and finally evaluation methods (Harden, 1986). However, the challenging issues emerging for professional educators and curriculum designers relate to the translation and adaptation of these skills and capabilities into learning interactions and events that are simultaneously authentic, stimulating, valid and practical and align to the expectation of the health care setting in which most clinical training programs are conducted.

The current chapter has aimed to present the perspective and a sample of the endeavours of a clinical faculty in a large research-focused university as it engages with the enormous challenge and promise of competency-based curricula and the slow turning of the faculty ship onto that course. Competence of the graduate and then of the graduate clinician were discussed in the light of the clinical learning environment and the issues of multiple stakeholders in clinician training. Our own faculty has made some tentative but exciting inroads into understanding the educational power of a competency-based approach to curriculum design, development and implementation through a broad and growing number of projects in the scholarship of learning and teaching and in research enquiries. Presentations on the endeavours and findings have been shared in the educational community nationally and internationally and critically reviewed. Current new initiatives in the faculty have commenced in patient care teams, utilising interprofessional learning in elaborating the dental team with other oral health practitioners and with other practitioners. An abiding reality remains in the sustainability of the curriculum in transition.

The growing educational emphasis on competence at graduation will continue to affect educational business. International consideration of the value and costs of competency-based curricula as applied in higher education continues to be elaborated by discussion and publication. Growing evidence and research

analysing the effects of the approach almost guarantee an ongoing exciting future. But perhaps, the final analysis of the value and effectiveness of the approach may lie in the ability of the students and the educators alike to recognise a curriculum in transition and acknowledge the keen sensitivity of that curriculum to emergent evidence.

PART V

THE CHALLENGES AND TRIUMPHS OF TRANSFORMATION

Chapter 20

Encouraging the scholarship of learning and teaching in an institutional context

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The chapters in this book have demonstrated what happens when individuals, course teams, faculties and the university as a whole systematically ask questions about teaching and students' learning and then set up ways to investigate them. Chapter 1 set out a number of institutional strategies for the development of scholarly activities in teaching and learning, and this has been followed by a series of chapters demonstrating how academics have been investigating their teaching and their students' learning. The book has also explored actions taken to develop courses and curricula and improve students' learning as a result of these investigations. Institutional strategies have been reflected in the various responses of individuals, teams and faculties throughout this book, and continue to be a key influence on the development of teaching and learning and the enhancement of students' course experiences within the university. Indeed, the success of targeted funding and strategic initiatives to develop a scholarly approach to teaching and learning has been largely due to the variety of ways in which disciplinary communities, academics, together with their leaders and managers, have embraced the integration of research and teaching as integral to a research-intensive institution.

We are a group of academic developers, located in the Institute for Teaching and Learning (ITL), a central academic department reporting directly to the Pro-Vice Chancellor (Learning and Teaching). We are charged with an institutional responsibility to encourage and support the development of the scholarship of teaching and learning. We are, then, a key element in the university's strategy. Beginning with Paul Ramsden's (2003, p.5) internationally recognisable epithet that 'the purpose of teaching is to make student learning possible,' our overall remit as developers is to help the university community to improve teaching and learning.

The scholarship of teaching and learning is, in our view, about infusing pedagogical work with a new spirit; perhaps even a new moral spirit. On the one hand it works to develop the status of teaching and learning through recognising its capacity for scholarship. It seeks to revalue teaching and learning through promoting its intellectual character. It is also a movement that feeds a

distinctly performative agenda (Ball, 2000) allowing a university to make claims about teaching performance and teaching quality. As mentioned in Chapter 1, the scholarship of teaching and learning goes beyond encounters between individual teachers and learners. At its best, a focus on the scholarship of teaching and learning encourages both a critical questioning and a conceptual re-organisation of the ways that teaching and learning are considered. It is a movement that asks: what is the university for and how is teaching and learning to enact that purpose? This raises challenging questions about the identities of teachers and the sort of learners the university desires its students to be. Yet this suggests changes in how academics are to think and enact themselves as teachers; how they are to respond to the expectations of their students and the ways they might work together. To be engaged in the scholarship of teaching and learning demands a renewal of the professional identities of teachers. If our responsibility as institutional facilitators of the scholarship of teaching and learning is to provide fresh insight or new ways of working, then we must exercise care in doing so, for it is also our responsibility to challenge existing views.

As facilitators of this institutional change process, our work with the university community to progress the scholarship of teaching and learning travels across a range of contexts–often at very different levels, and with different kinds of outcomes. In some cases, we work to engage academics in the scholarship of teaching and learning within the suite of graduate programs we offer (from our Foundational Program to Doctoral level study). At other times we work through our Strategic Working Groups structured around Research-enhanced Learning and Teaching, e-Learning, Evaluation and Quality Assurance, or Generic Graduate Attributes, to provide opportunities for sustained conversation about how to advance teaching and learning in more scholarly ways. At other times we work in collaborative projects alongside individuals perhaps to implement tutor training programs, or within course teams, or faculty teaching and learning committees, to help introduce a scholarly approach. The scholarship of teaching and learning also has resonance in our own everyday corridor conversations about how to improve aspects of student learning. University teaching and learning in each of these contexts is often the subject of intellectual contest and scholarly debate. As in any robust academic community, we argue about what it is and what it can be because we are invested in its success.

In this chapter, we aim to give voice to some key challenges that emerge in our work as institutional facilitators of the scholarship of teaching and learning. We seek to make visible some of the ethical and conceptual tensions that arise for us in making decisions about shaping, responding to, and then supporting a program of institutional change such as the scholarship of teaching and learning. We focus on three dimensions in particular. The first of our challenges results from an explicit focus on academics' learning; specifically, their learning about university teaching and student learning within our graduate programs. The second

relates to the state and status of educational research as a context for developing the scholarship of teaching and learning itself. In encouraging academics to consider their teaching and students' learning as potential sites for research, there is often a shift in the terrain of what it means to inquire, how to go about it, together with the proper ethics and values involved in an educational inquiry process. The third challenge for us in developing the scholarship of teaching and learning is about the ethics of change and the politics of transformation; both individually and institutionally. How far should we push an agenda of change when we see our academic colleagues under pressure? How far should we encourage them to question the structural and organisation arrangements of teaching and learning in their departmental or disciplinary contexts; ones which may have made putting scholarly teaching practice in place difficult?

WHEN ACADEMICS BECOME LEARNERS AGAIN

Engaging in the scholarship of teaching and learning may require the academic teacher to become a learner; to see learning quite differently and to see oneself as a different sort of learner to the one who successfully negotiated university study in the past. In many disciplines, the democratic practices of problem-based learning and group-based, collaborative learning, for example, are managed carefully in adult learning contexts that depend on respect, trust and openness. Many of our colleagues are in fact already developing and managing student-centred, democratic curricula, but without necessarily understanding in any critical sense why what they are doing is truly worthwhile from a student learning stand-point. For the academics comfortable with a traditional lecture-based unit or course, patterns of control and authority are well established. Regardless of their practices, university teachers frequently come to our programs with unchallenged ideas about teaching. Each semester they may present themselves to their students as highly respected international researchers, as knowledgeable didacts, as experienced tutors and lecturers, and as facilitators and managers of student learning. Their authority as teachers is recognised as a consequence of their scholarly reputations and publications, their disciplinary research profiles, and/or their years of experience in university teaching. Authority is also invested in them by the university management and its statutory bodies, which rely on teachers to make judgments on, and report back the results of, their students' learning.

Yet, a good many of our colleagues want to learn how to teach better. They may seek a set of tips, techniques and strategies that will help to alleviate a problem immediately. They may see the relation between teaching and learning as relatively straightforward; as cause and effect or input and output. In order to extend ideas of the scholarship of teaching and learning we may first challenge academics' conceptions of teaching and learning. This can be quite demanding.

It can sometimes result in difficult learning, particularly when one must confront years of practice. While graduate programs in higher education ought to provide opportunities for academics to engage anew in different kinds of learning experiences where they are challenged to see its application and possibility within their own teaching contexts, and with their own students, the question of how these programs are 'relevant' suggests that their success depends largely on the extent to which academics bring themselves to their learning as teachers. In the learning contexts that we have designed to develop the scholarship of teaching and learning, we sometimes observe that academics themselves can appear to opt for quite passive modes of learning. They do not always take responsibility for their own learning, even when there are opportunities to do so. Sometimes we experience initial resistance to our efforts to engage in cross disciplinary group-based inquiry, or to our suggestions to try out new forms of assessment. Perhaps this is not altogether surprising. As participants learning in a course such as the Graduate Certificate, they are subject to the same sorts of pressures that we know strike any learning situation.

In our courses and programs, the focus of our efforts in developing the scholarship of teaching and learning is on students. Our emphasis is about making an argument that demonstrates why it is important to understand the way students experience and perceive their learning. A student-focused conceptual change approach (Prosser & Trigwell, 1999) puts the student's learning rather than the teacher's teaching at the centre of the pedagogical encounter. As the chapters in this book have shown, understanding the students' perspectives in order to better focus teaching to student needs and ideas appears to be central to engaging with the possibilities afforded by the scholarship of teaching and learning. Changing a person's conception of teaching and learning can involve a shift in power relations and a subsequent shift in their world view. We are of the view that unless a person has had their own conceptions challenged and changed, it is difficult, perhaps impossible for them to imagine what this might be like for their students and how much of a revelation it can be. In other words, we suspect that before anyone can think about changing students' perceptions or approaches to learning, they themselves need to have experienced the sort of learning being implemented. Yet this can be troubling. It can take a long time to come to terms with such ideas. This raises a range of dilemmas for our work as facilitators of the scholarship of teaching and learning, inasmuch as it also presents us with an ethical responsibility to attend to the effects of changing conceptions.

Further, in the context of encouraging the scholarship of teaching and learning, the pedagogical relationship is such that we are teaching our academic colleagues. In a different way, they are also teaching us. We learn about how their departmental discourses position the scholarship of teaching and learning. It is a relationship that requires a great deal of thoughtfulness, particularly when we are expected to model good practice. Since we are teaching about the scholar-

ship of teaching and learning, we endeavour to become the living embodiment of what scholarly teachers are meant to do. Yet like them and many teachers, there are times when we falter. There are moments of sheer exhaustion that affect our capacities as teachers to teach according to the ideals we espouse. Teaching our academic colleagues means that they see that of us too. So there has to be a degree of care and trust involved in the way we go about negotiating the conditions for learning. It is sometimes expressed through the way we provide feedback, or through our invitation to academic participants to consider their peers in the course as part of a learning community. While they have both their own personal learning outcomes as well as the ones we set to work through, they also have commitments to each other; to give and receive challenge with honesty and to bring themselves fully to the contexts of their learning. Any or no previous experience of this kind of collegial activity, learning or responsibility, will tend to affect how academics see what kind of learning community is possible amongst their own students.

When academics become learners again, it is not just the encounter with students that is the subject of learning about teaching. Teachers bring longstanding traditions and habits of academic 'being' that emanate in part from the cultures of disciplines and departments. Whether we are disciplinary academics or academic developers we bring with us views about what can be changed, about what is both possible and impossible. We bring with us a set of ideas and understandings about how teaching and learning operates in our particular contexts, how decisions are made and their sometimes hazardous effects. We might even carry a view that we are at arms-length from processes of academic decision-making. When academics learn with us, they might even suggest that we developers have made things that way; that these are *our* pedagogical in(ter)ventions, that it is *our* agenda for teaching and learning change with which they are grappling. Whatever our offering, whatever our expertise, whatever our evidence-base, and whatever the contexts our academic colleagues come from, signals about what it means to be engaged in the scholarship of teaching and learning are interpreted. Academics read clues about its value. In the absence of evidence, they may engage in speculation about its worth, whether it is time well spent, whether it makes a difference when it comes to making a case for promotion, or in an application for a teaching award. In this book, we have witnessed a number of different ways that our colleagues from many different areas of our university have engaged with the scholarship of teaching and learning. These are colleagues who have fully embraced the possibilities offered by research on students' understanding and experiences for curriculum change. We have an important role in our graduate programs in persuading colleagues who have not yet taken on the scholarship of teaching and learning in this way of its value and purpose. We have a responsibility to demonstrate that student learning improves as a result of a teacher who cares about the scholarship of teaching and learning (Brew & Ginns, forthcom-

ing).

Responses to an invitation to revisit and replenish their work as teachers will depend largely on the extent to which academics engage systematically in critical reflection; not only on their roles as teachers, but also in the contexts that influence the sort of teachers they want to become. But in order to engage in critical reflection on practice, teachers need first of all to have an idea of critical reflection. Kreber, Castleden, Erfani and Wright (2005) have suggested that an individual's discipline might influence significantly the amount and type of self-regulated learning they do. So in areas where there is not a strong tradition of critical reflection or academic participation, one's ability to influence the organisational structures of teaching and learning so that they might be re-shaped to take account of the scholarship of teaching and learning may be limited. This poses particular challenges for those like us who have a role in facilitating academics to develop their teaching and learning scholarship. We encourage our academic colleagues to ask questions about the structural conditions that will allow the scholarship of teaching and learning to flourish at the same time as they are subject to mixed messages about its merit. Such mixed messages come for example, from university procedures that reward the scholarship of teaching and learning on the one hand, and pressures to concentrate on disciplinary research that may come from senior colleagues or faculty workload policies on the other. Such tensions are inevitable in an environment where research achievement is highly prized and teaching excellence is also expected.

Much of our work across the university tells us that it is challenging for our colleagues to think about teaching and learning in new ways. What seems really central is the realisation that academics' own learning as teachers appears to be mirrored in the way they teach their own students, and in turn, in the way their own students assume responsibility for their learning. For the teacher whose experience of university teaching and learning has been predominantly of a traditional lecture and tutorial type, engaging in the scholarship of teaching and learning provides new experiences of being a learner in uncertain territory. The pedagogy is unfamiliar. These experiences often problematise the sense of security that may have been inherent in previous teacher-learner relationships. They can be experiences which suggest new curriculum structures with innovative forms of collaboration and assessment. At their extreme, these experiences can trouble ideas of power, authority and responsibility precisely because they demand a new kind of teacher and a very different sort of learner. Our work in encouraging these more scholarly approaches is to be mindful of the consequence of engaging too much in this work without appropriate resourcing and collegial support.

THE MESSY BUSINESS OF EDUCATIONAL

RESEARCH

When an academic begins to inquire into their own teaching, the first thing with which they are confronted is the sort of questions they can ask. These can often be of a very different order to those in their own disciplinary area. One early challenge that our colleagues face is in recognising that there is a relationship between the sorts of questions asked and the resulting truth claims in respect of the outcomes. In educational research, the researcher needs to establish not only the findings of the research, but also to make a claim about the status of those findings as truths, facts or as knowledge. In order to be able to do educational research, teachers therefore need an appreciation of not only the methods of inquiry but also the particular methodological traditions in which those methods are situated. They also need to have developed some understanding of the epistemological assumptions of the particular methodology.

When a group of experienced academics from very different disciplinary areas engages in a new paradigm of inquiry, their identities as researchers may also come into question. What they know to be true about teaching and learning, and how to develop and improve it, may undergo transformation. Learning about the scholarship of teaching and learning raises methodological debates about epistemology and ontology, about how to locate an inquiry within a field, together with the constitution of data and evidence. And all this new learning happens at a time when the authenticity of evidence-based practice in education is increasingly under strain (Davies, 1999; Davies, 2003; Elliot, 2001). This process can also challenge those like us–academic developers–whose job it is to support academics to take up a desire to research their teaching and learning practice. As higher education researchers and scholars ourselves, schooled and often re-schooled in traditions of social science, the academics that learn with us test our expertise. And rightly so. They query the theoretical perspectives about teaching and learning that we bring from our field. They query the language we use to describe the scholarship of teaching and learning. It can be both too complex, but also, not complex enough.

The teacher who seeks to engage in the scholarship of teaching and learning has to come to terms with the idea that questions of methods and methodology are questions about the nature of knowledge within education. For many of the academics who hitherto have not had the opportunity to reflect on the contested nature of knowledge (Brew & Phillis, 1997), this can open up new ways of thinking. As a consequence of encouraging academics to engage in the scholarship of teaching and learning, a new space appears. Teachers are challenged to change their conceptions when they come to realise that there are different ways of looking at knowledge. Engaging in the scholarship of teaching and learning can challenge some colleagues' notions of a verifiable, correspondence view of truth. Indeed, the idea that there might be different truths can be confronting. Even if teachers

persist with the idea that, for example, the scientific method is the 'right' way to generate knowledge, the likelihood is that they can never return to the idea that it is the only way. For academics with backgrounds in disciplinary areas where theories about the nature of knowledge and reality are assumed rather than debated, these realisations can be unsettling. The flow-on effect is that engaging in the scholarship of teaching and learning can also challenge how an academic views their own discipline and their disciplinary research. As they begin to familiarise themselves with these intricacies, their reflections about what needs changing in their own teaching and their students' learning becomes richer, infinitely more interesting and challenging. Inquiring into approaches to teaching and learning can turn out to be far more complex than even the literature on the scholarship of teaching and learning acknowledges.

A key focus in discussions about the scholarship of teaching and learning in the North American context has been on how academics can be encouraged to adopt methods and approaches that arise from, and build on, the methodological traditions in their own disciplinary areas. Huber (2000), Diamond and Adam (1995) and others have argued that it is important for different disciplinary communities to define the scholarship of teaching and learning for themselves. In this book there are many examples where academics from different disciplines have done that.

Disciplines differ in the extent to which pedagogy is an integral part of disciplinary thinking or a distinct field of activity with its own specialist scholars (Healey, 2000). They also differ in the way that ideas about teaching and learning have built on existing research and practice in higher education or have developed in isolation. There are dangers in holding steadfastly to either of these approaches. The first may lead to the perception that the language of teaching and learning scholarship is too generic; the second suggests a disciplinary preoccupation with technique that is disconnected from broader theoretical issues. Weimar (1993) for example, following a review of disciplinary journals on pedagogy, concluded that these publications discussed issues which were transferable across fields, but that the journals included very little material from other disciplines. She also found that disciplinary journals were concerned mostly with teaching techniques rather than broader matters of education.

While it is a useful starting point, it is not enough to focus scholarly work in teaching and learning exclusively within a particular discipline, or on the questions and methods that arise from just one disciplinary context. In areas where views of the scholarship of teaching and learning are limited by teacher-focused conceptions of teaching or a conception of the scholarship of teaching focused on recognition or reward (Lueddeke, 2003), there is no necessary impetus to translate that work to an understanding of student learning. Furthermore, Huber and Morreale (2003) have argued teaching development can occur most readily at the borderland of the discipline, where cross-disciplinary exchange takes place.

So the discourses which support the scholarship of teaching and learning are coloured at all times by pre-existing notions of what constitutes research and scholarship and the nature of teaching within particular disciplines. The scholarship of teaching and learning is radical in part because it asks what needs to change in order for students' experiences of learning to be enhanced. In some instances, these are changes that disturb the very core of what is known and sacrosanct in the organisation of disciplinary communities. The challenge for individual disciplinary areas is to be able to communicate across disciplines to build up a shared understanding of teaching and learning practice building 'on the shoulders of giants' as it were, rather than 'rediscovering wheels' in local communities. Academics' ideas about the rigour of teaching and learning scholarship are likely to be read against what is valued in the discipline and the rewards it brings. They are also likely to be influenced by perceptions regarding the scholarly quality of pedagogical research. Sometimes work is only considered scholarly if it is quantitative, objective, and presented as if it is independent of the researchers who are studying it. The view that education research is waffly, vague, long-winded, subjective or unscholarly is not uncommon. If a strong and convincing tradition of the scholarship of teaching and learning is to continue, we need to think carefully about how to ensure its quality. We also need to test accepted wisdom regarding the authority of disciplinary ways of knowing. We need to continue to ask questions about the possibilities and limits in situating the scholarship of teaching and learning within disciplinary formations.

All these challenges manifest themselves in various ways in our work across the university community. As the academics that learn with us become increasingly conversant in the field of university teaching and learning, they learn there is a healthy but fractured literature around any one research question. They learn to locate the literature, and they are encouraged to evaluate it in terms of its claims, arguments, evidentiary bases and conclusions. They learn to position their research question within that literature. They wrestle with a new language; they question its relevance and applicability. They learn what it means to write convincingly about their teaching practice so that it moves on from description to theorising and problematising. They ask why inquiring into their own teaching and learning is so hard–why it often lacks the rules of clear definition and precise measurement. And they learn about themselves as teachers, their values, ethics and the sorts of relationships they have made with their students. Rowland (2000) argues that sooner or later, inquiring into teaching will lead to an examination of values, and specifically the values that underpin teaching. Our values are at the core of our teaching whether we recognise them or not. Yet realising that teaching is value-laden can be very challenging for teachers who assume that it is an objective, value-free, or even a values-neutral activity. What academics frequently learn from engaging in the scholarship of teaching and learning is that they hold a set of values and that sometimes these are inconsistent with what is

practised. This is another context for profound learning because its power goes far beyond a set of expectations that academics will merely become competent teachers. Engaging seriously in the scholarship of teaching and learning demands the articulation of a pedagogical framework, or a philosophy of teaching. Often, the necessity of this work can prove troubling.

THE ETHICS, POLITICS AND DIRECTION OF PEDAGOGICAL CHANGE

The scholarship of teaching and learning movement has appeared at a time when the autonomy of universities is being challenged and when academic freedom is more often than not framed in the context of discussions of academic responsibility or duty (Nixon, 2001; Nixon, 2003; Barnett, 2003b, 2004; Kennedy, 1997). Teaching, like research, is being made accountable. In doing so, teaching and learning is becoming increasingly visible. The emphasis on students' experience of learning, together with the professionalisation of university teaching has generated a momentum for treating the scholarship of teaching and learning seriously.

The notion of authenticity in teaching is one that concerns us in this context. It is one thing to bring the messy issues of teaching scholarship and educational research to the surface in our academic development interactions with our colleagues; however, the responsibility for teaching approaches will always rest with the individual teacher. Berci (2006) has argued convincingly for a linking of personal growth and development with pedagogic and professional development. Our work therefore must always be mindful of this interplay. More importantly, it must respect that individuals are at different places in their development – both as teachers and as people and that these places might not be congruent with institutional or our own perspectives and agendas.

As a group of academic developers, we are aware of the effects of encouraging our academic colleagues to think in new and unfamiliar ways about their work as teachers. Sometimes that challenge is welcomed, at other times it is considered a burden; the worst kind of encroachment. We are charged with a responsibility to help our colleagues understand the teaching and learning requirements of the university, but in doing so we harbour a desire for them to learn in ways that encourage them to go beyond the current university system, to ask difficult questions of it, armed with evidence and thoughtful deliberation (Nixon, 2004). Our job in part, is to present the evidence about the improvements generated by the scholarship of teaching and learning yet we know only too well that our colleagues are working in contexts and with time pressures that hinder its inherent possibilities. This raises questions about what responsibilities they have to teach well, and to whom they are responsible. Is it to themselves, students, the disciplinary community, or the university? What obligations have they to shape the

policy terrain which enables them to make the scholarship of teaching and learning part of their normal academic practice? These are easy questions to ask but difficult ones to answer.

CONCLUSION

The chapter authors in this book have successfully found ways through many of these challenging issues. This has taken time and persistence. We do not claim credit for their achievements. However, we have found supporting our academic colleagues to view university teaching and learning as scholarly work to be challenging and also rewarding. This is because teaching and learning change always entails a movement between personal learning and transformation, and between academic responsibility and institutional performativity. The focus on teaching and learning itself can often interrupt years of habitual and accepted academic practice. The scholarship of teaching and learning prises open both practice and theory, and the questions it raises can generate forms of disquiet and resistance. We hear it all the time: 'Yes, teaching and learning is important, but it is not what constitutes academic *gravitas*'. That kind of response is often the most difficult to contest, especially where there is a teacher-focused information transmission view of university teaching and learning (Prosser & Trigwell, 1999). Consistent with this view, a movement such as the scholarship of teaching and learning may be experienced as no more than an institutional imposition designed to make academics over into certain kinds of professionalised teachers (McWilliam, Hatcher & Meadmore, 1999); teachers who lose their academic freedom to decide how best to teach, or teachers who are told that the way they have taught is no longer enough. Yet in other instances, as we have seen throughout this book, the very notion of a scholarship of teaching and learning can act as an intellectual revelation. It can be experienced as a way of bringing research and teaching into closer alignment. It can provide a meta-framework in which to develop an evidentiary basis for teaching practice, development, improvement, reward and recognition. It can generate new ideas about how to solve curriculum challenges. It can raise questions about the methods and methodologies we employ to inquire, research and evaluate teaching and students' learning and it can provide a new community in which to support, discuss and contest the labour of university teaching and learning. Disciplinary based teaching and learning networks and pedagogical research groups have been flourishing across the university for some time. This book is a testament to that growth. The next logical step in the scholarship of teaching and learning movement will be to extend the opportunities within which students themselves can become practising scholars too.

Chapter 21

Learning to be a scholarly teaching faculty: Cultural change through shared leadership

Rosanne Taylor and Paul Canfield

Faculty of Veterinary Science

This is a story about a faculty faced with a disintegrating culture and lack of direction, which underwent adaptive change to become internationally competitive in veterinary education and research. It highlights the importance of establishing a sense of common purpose through an agreed culture, which can then be translated into action through shared leadership. Visionary leadership created a collective will to succeed, and so the way forward to improving teaching based on evidence became clear. The process of change was strengthened by engagement with the university, educational and leadership consultants, other veterinary schools, the veterinary profession, research stakeholders and the student body.

During the past decade student learning has increased in importance for research-led universities (Ramsden, 1998) with recognition that high quality outcomes are achieved through student-centred learning experiences. Students are more likely to develop advanced concepts and life-long learning commitment when teaching supports their active engagement in constructing personal meaning (Trigwell, Prosser & Waterhouse, 1999). A conducive climate for student-centred, conceptual-change focused learning can be created through application of the insights from student learning research. This scholarly teaching practice is most effective when inquiry stimulates reflection and continuous improvement. Effective leadership enables staff to create excellent learning environments for students and is particularly important in research intensive universities that traditionally prize research achievements (Knight & Trowler, 2000).

The concept of scholarship of teaching emerged from Boyer's *Scholarship Reconsidered* and has been a focus for initiatives to improve university teaching. Its aspects include: understanding the literature on teaching research; using well informed, effective approaches which engage students in appropriate learning to develop creative, critical thinking; systematically gathering and using evidence and reflecting on the literature to improve students' learning; and communicating findings. Scholarly teaching illuminates how teachers facilitate student learning, using the practices of research in planning, investigation, analysis, evaluation, reflection and communication to share the findings with colleagues (Trigwell,

Martin, Benjamin & Prosser, 2000). Healey (2000) argues that teachers should focus on how students learn in their discipline and disseminate this knowledge. Ongoing inquiry, reflection and discussion on instructional design, pedagogy and curriculum knowledge (Kreber, 1999) can create an unstoppable momentum to sustain continuing innovation and enhancement of student learning. Professionalism in teaching is guided by evidence and sustained by reflexive self-awareness. These skills can be developed through formal training in higher education and supported by reward and recognition systems.

THE HISTORY AND PROCESS OF CULTURAL CHANGE IN THE FACULTY

The Faculty of Veterinary Science is a relatively small professional school which has undergone substantial change in its culture, structure, teaching and research activities in response to external forces and a decline in government funding over the last decade. The threat of amalgamation in 1997 generated grass-roots momentum for rejuvenation of the faculty's identity, purpose, structure and ways of doing business. To effect change a process was needed whereby all staff, students and external stakeholders could obtain ownership and master adaptive change skills.

The process of reform commenced with appointment in 1998 of a visionary Dean who was the catalyst for change. He galvanised staff into action with a blunt, realistic appraisal of the serious difficulties facing a faculty of approximately 60 full time equivalent academic staff, 80 general staff and 500 students (it has since grown to 80 academic staff, 900 students with increased course offerings and research). He led workshops with stakeholders, including staff, students, the veterinary profession, industry, and key university personnel between 1998 and 2002. The faculty's staff had to listen carefully, and sometimes painfully, to stakeholders' needs, criticism and suggestions for improvement. As a consequence, staff accepted major changes made between 1999 and 2002. These were: building an agreed culture; adopting shared leadership with staff accepting personal responsibility for the faculty's success; a revised flatter structure; planning for financial sustainability through admission of fee paying students; assessment of current and future staffing needs; rejuvenation of the fundraising and alumni foundation; strengthened partnerships with government, industry and welfare groups to expand funded research; intensive reflection and strategic planning; staff development and a commitment to major curriculum and teaching renewal (Canfield & Taylor, 2005). The leadership of faculty-level change utilised a model of distributed leadership combined with strategic coordination, elements which have since been identified as the key to rapid, widespread and sustained change in school education (Leithwood, Jantzi, Earl, Watson, Levin & Fullan,

2004).

REFORM TO ESTABLISH SCHOLARLY TEACHING

At the time of appointment of the Dean, teaching quality was variable and lack of agreement on the factors that support quality learning hampered progress. Veterinary students are outstanding in their intellectual capability and career motivation so understanding the reasons for their dissatisfaction and correcting their concerns, were of crucial importance. Many graduates were disappointed with aspects of their education which were didactic and uninspiring. Some felt ill-prepared to cope with the stressful transition to professional practice. Students appreciated the small group, practical teaching modes of the latter years of curriculum but criticised the high workload and assessments. Student leaders helped staff understand the detrimental effects on learning of an overcrowded, content-laden curriculum which lacked alignment to veterinary practice needs. Staff struggled to understand and accept these views but recognised the need for change given the competitive international market for veterinary education.

Faculty sought to reinvent itself as an innovator and leader in training veterinary scientists and to attract support for teaching and facility development; a 'self-help' strategy. External funds were obtained for development of new postgraduate courses, establishment of a teaching innovation unit, clinic refurbishment and construction of a wildlife centre. International developments and online education were embraced with creation of a range of new resources such as the library without walls (Veterinary Education and Information Network), Library of Inherited Disease in Animals (McGreevy, Costa, Della Torre, Thomson & Nicholas, 2005) and the Online Library for Veterinary Images in Education and Research.

The university introduced initiatives in 2000 to promote student-centred learning (described in Chapter 1). These included use of evidence to improve practice, rewards for faculty achievement, support for innovation and quality enhancement systems. They were implemented through Learning and Teaching plans, Working Groups to support university teaching initiatives and Academic Board reviews of faculties (Barrie, Ginns & Prosser, 2005). University leaders explained the significance of the relationships between students' perceptions of their learning context and quality of outcomes. After sustained debate in the Veterinary faculty, and a small study confirming the relationship between our students' perceptions, approaches and their learning outcomes (Taylor & Hyde, 2000), staff agreed to adopt student-focused, conceptual change teaching practices (Trigwell & Prosser, 1996).

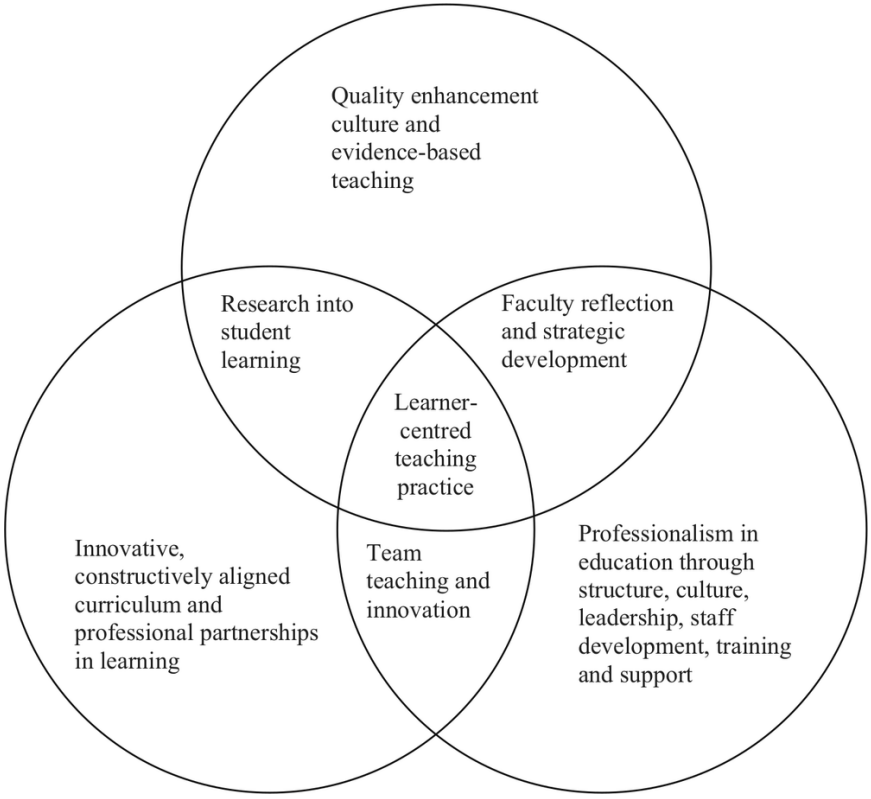

Figure 21.1. Relationships between the three key elements of scholarly teaching to support effective learning

The faculty embarked on changes to all aspects of its structure and function directed at achieving financial and cultural sustainability through enhanced performance in teaching, research and service. The new structure provided clear lines of responsibility and leadership for education quality enhancement to an Associate Dean assisted by a Learning and Teaching Committee. Planning sessions and a cultural change retreat were conducted to engage staff (academic and general) with the vision of establishing the faculty as an international leader in veterinary and animal science education. The first goal was: *'A shared culture of excellence and scholarship in teaching and learning'*. The following principles were used to guide implementation of the new curriculum, staff development and evaluation (Figure 21.1):

- Figure 21.1Ensure the teaching context supports a professional approach to education (shared leadership, restructured faculty, student-centred teaching,

staff development, rewards and support).
- Jointly develop an innovative, constructively aligned curriculum based on teaching scholarship (to support and encourage staff to invest in enhancing student learning).
- Understand, acknowledge, and address problems to enhance quality creating a culture of continuous improvement based on scholarship and research (evidence-based teaching).

Ensuring the teaching context supports a professional approach to education

The faculty context has a profound impact on staff views on the quality of their teaching environment, and approaches and enthusiasm for teaching. There is a direct, significant relationship between deep approaches to teaching practice and students' deep approaches to learning (Trigwell, Prosser & Waterhouse, 1999). In order to improve student learning experience, faculty constructively aligned the context for scholarly teaching and engaged staff in collaborative decision making.

Acknowledgement and ownership of problems was a first step in improving learning and teaching. Creating a receptive culture for change required clear goals, cohesive effort from academic and general staff and inclusion of students. As a consequence, staff showed increased willingness to listen, debate, act in different ways and make changes in teaching practice. Some senior academic staff that found it difficult to adapt, retired or left, and were replaced by incoming staff who embraced cultural change.

The Dean and Faculty Executive Committee ensured adoption of a distributed, inclusive model of leadership which emphasised all staff taking personal responsibility for educational change. This is known to be more sustainable than relying on a few enthusiastic teachers to create a climate of excellent teaching (Ramsden, 2003). Shared leadership helped to capture a diversity of good ideas and enthusiasm from general staff, as well as academics, with recognition of their skills and expertise. This required constant synthesis and application of wisdom, intelligence, creativity and a willingness to adapt and energise the change, which are all recognised as key elements of educational leadership (Sternberg, 2005).

The faculty's in-house leadership training program, run by external facilitators, was influential in empowering the culture change by enabling staff to exercise situational leadership to stretch their capability. The program helped staff understand themselves and their impact on colleagues, to experiment with new ways in working with others and developed skills in communication, teamwork and negotiating conflict. Staff were supported to continue to grow professionally and personally, to take risks, to enjoy, and be reflective within a secure 'safety net' of collegial support. This has been influential in increasing participation in

new teaching initiatives, such as e-learning, group activities, and experiential learning.

The faculty was restructured to enshrine good teaching practice and remove limitations to growth. An important step was removing the old Department boundaries. Teaching responsibilities were transferred from departmental Heads to the Associate Dean in the new Executive (Canfield & Taylor, 2005). This placed many existing decision making processes in the hands of staff, creating space for them to take initiative and form flexible task-focused teams. This focus on teaching that emphasises students' experience of learning, led by individual and collaborative empowerment of staff to make change within an agreed framework, are features of higher quality forms of academic leadership (Martin, Trigwell, Prosser & Ramsden, 2003), which creates the most favourable context for scholarly teaching. The changes experienced by staff also affected student-staff interactions, e.g., 'There is very little hierarchy - most staff treat one as an equal.' (Year 4 student, 2005).

Faculty adopted Biggs' (2003) model of constructive curriculum alignment and designed the curriculum to achieve graduate attributes (revised in partnership with the profession and other veterinary schools [Collins & Taylor, 2002]). The aim was to increase active, meaningful student learning experiences based on the 3P model of learning i.e. it was student-centred, considered students' perceptions of their learning context and evaluated learning outcomes (Prosser & Trigwell, 1999). The discipline boundaries were intentionally eroded by creation of units that required integration and application (Figure 21.2).

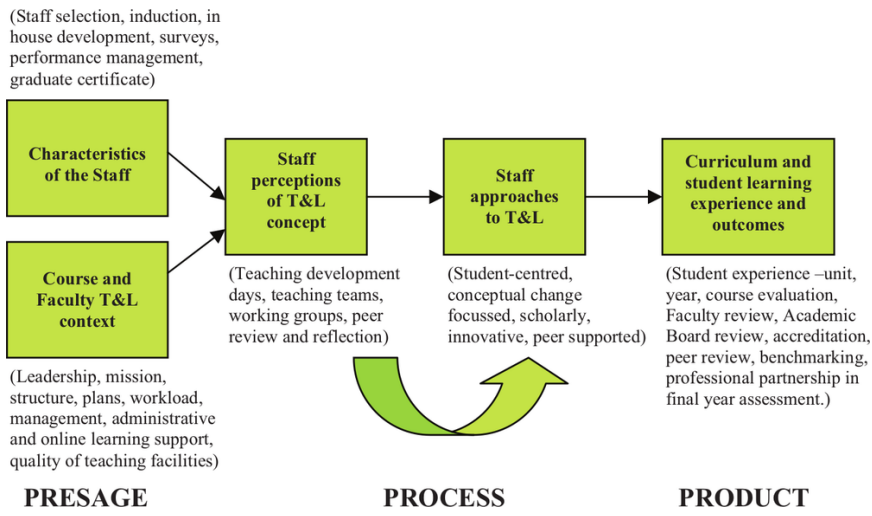

Figure 21.2. Strategies to support scholarly teaching based on the 3P model (adapted from Prosser & Trigwell, 1999)

The Learning and Teaching Committee was revitalised with new membership composed of year coordinators, student representatives from all years, staff with responsibility for student welfare, e-learning, and professional placements. Students also provided input through a revamped Liaison Committee. The new Learning and Teaching Committee included external stakeholders with expertise in higher education and continuing education, and an education consultant. It had responsibility for design and implementation of the new curriculum, advising on resources and staffing for teaching, establishing flexible teaching development teams, gathering and reflecting on the quality of outcomes including student evaluations and strategic planning. It was accountable for quality as well as curriculum, allocated funds to support teaching initiatives and scholarship, provided targeted staff development based on strategic need, and reported to external accrediting bodies.

University and external advice was sought to develop faculty expertise in teaching. This established a rich, continuing partnership with the Institute for Teaching and Learning and an external consultant. Timely, targeted development equipped staff to make curriculum change and helped to develop the skills required for reflexive critique of practice, which Brew (2006) suggests is the most important function of academic development. Faculty leaders avoided formulaic quick-fix approaches to improving teaching. Rather, staff were encouraged to work with peers to seek their own understanding of pedagogy and instructional design for their discipline using the teaching literature. They worked in teams, overcoming 'pedagogical solitude' to create approaches to teaching most suited to their context (Benjamin, 2000) and to build and strengthen the relationships between disciplines. This led to a profusion of initiatives and competing ideas with vigorous debate; an indicator of a vibrant scholarly culture.

A central aspect of the reorientation to become a scholarly teaching faculty was harmonising all activities to recognise, reward and support student-centred learning by changes in staff recruitment, development, evaluation, promotion, rewards and workload. Alignment of all the factors that impact on academics is necessary to convince staff that there is more than rhetoric in support of good teaching practice (Biggs, 2003). Important elements were: providing supported opportunities for staff to pursue their own creative ideas about improving student learning (small funds provided for teaching improvement projects); creation of flexible teams to implement new approaches; iterative development of new initiatives and a shared vision of alignment of the curriculum to graduate attributes.

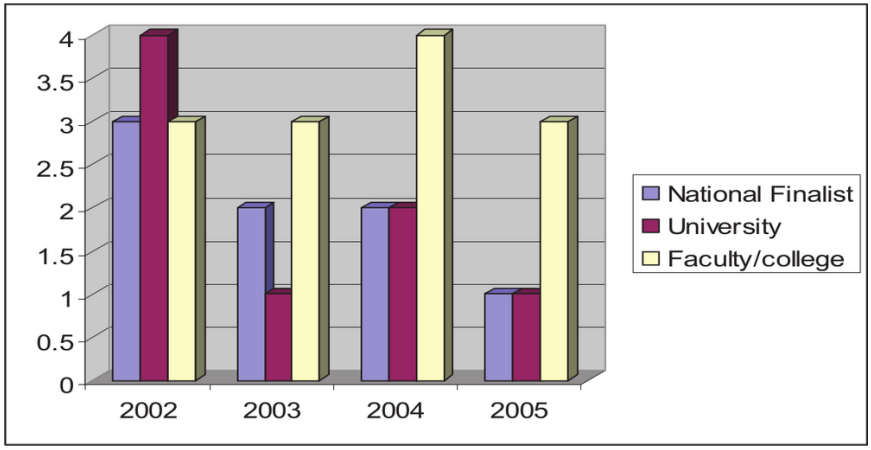

Figure 21.3. Number of faculty staff receiving teaching awards each year. Faculty and College of Science and Technology awards are grouped together. Team awards are counted as a single entry

Academic staff were recruited to the faculty partly on the basis of their interest in student-centred learning, willingness to undertake formal training and pursue teaching innovation. During induction, staff received formal training and informal mentorship to understand the expectations, roles and responsibilities of their new position. Effective coordination and leadership roles have a strong impact on student learning (Hazel, Prosser & Trigwell, 2002), so they are explicitly valued and rewarded in promotion and recognition. Our teachers' achievements have been recognised with university, state, national, professional, e-learning and teaching innovation awards (Figure 21.3). More than 25 staff were recipients of individual or group awards with 11 receiving multiple university and external awards between 2000-2006, whereas in the preceding 7 years no staff received any teaching awards.

Since 2002, all new faculty teachers have been assisted to complete the Graduate Certificate in Educational Studies (Higher Education) so they commence with a shared understanding of good teaching practice and scholarship of teaching. In 2006 more than 30% of staff have completed this qualification. This has had a powerful impact by providing teachers with the experience of being a learner again, managing workload, overcoming anxiety about their performance and completion of assessment tasks, and learning to communicate in a new discipline. One person commented: *'By revisiting the position of a learner, it allowed me to reflect on what was important in my teaching and to empathise with our students on the learning process.'*

Table 21.1. Impact of sustained focus in improving student learning experience in a unit

of study

Year	Good teaching#	Clear goals & standards#	Appropriate assessment#	Appropriate workload#	Generic skills#
1996	3.5	3.4	3.1	2.6	3.2
1997	3.6	3.3	2.9	2.6	3.3
1998	3.7	3.5	3.2	2.9	3.4
1999	3.8	3.8	3.5	2.9	3.5
2000	4.2	4.0	3.4	3.0	3.7
2001	4.4	4.1	4.1	3.6	3.7
2002	4.2	4.3	4.2	3.3	3.8
2004	4.4	4.3	4.4	3.6	4.1
Other units*	3.0	3.3	3.4	3.0	3.4

#Unit evaluation means on a 1-5 Likert scale, (1 strongly disagree, 2 disagree, 3 neutral, 4 agree, 5 strongly agree) 50-90 students enrolled in Animal Science 2, a compulsory unit for BScAgr and BAnSc

**Average evaluation of units offered by other faculties and taken by same student cohort in 2004*

Formal training prepared staff to lead change among colleagues beyond the immediate context of their own teaching. The familiarity with teaching research, good practice and the clarity of purpose that the Graduate Certificate training provide empowered staff to challenge existing practices and implement change, using the scholarly literature and small action research projects (e.g., research reported by Taylor and Hyde, 2000), led to sustained improvements (reported in Ramsden, 2003, and shown in Table 21.1). One person commented: *'The most powerful part has been the courage that comes from knowing the evidence, based on the scholarly literature in education, that you are on the right track. I would never have had the courage to contradict one of the senior staff (who taught me) over teaching matters in the past, but now I am happy to do so.'*

Additional, intensive, in house, development has been conducted to meet the learning needs of staff on a just-in-time basis, such as designing aligned learning outcomes, creating student-centred, online and case-based learning activities, aligning assessment, grading criteria and feedback, learning in profes-

sional placements, and research led teaching. Development of teaching expertise has extended to clinical, technical and administrative staff. Professional partners participate in an annual conference to enhance supervision of learning in professional placements.

A key to scholarly teaching has been creating a cultural shift so staff are aware of the impact they have on student learning in a social context. The faculty culture statement, staff shared leadership training and performance management and development process were used to encourage staff to make effective change through review, recognition and allocation of staff workload. As a consequence the faculty has undergone steady growth in scholarly teaching, in numbers of staff participating (Figure 21.4) and the intensity of participation. Faculty participation rates increased to the highest in the university in 2002-6. The university's Scholarship Index, described in Chapter 1, measures rates of teaching publications, awards and formal training. The faculty's rapid improvement to lead this index coincides with the cultural change in learning and teaching.

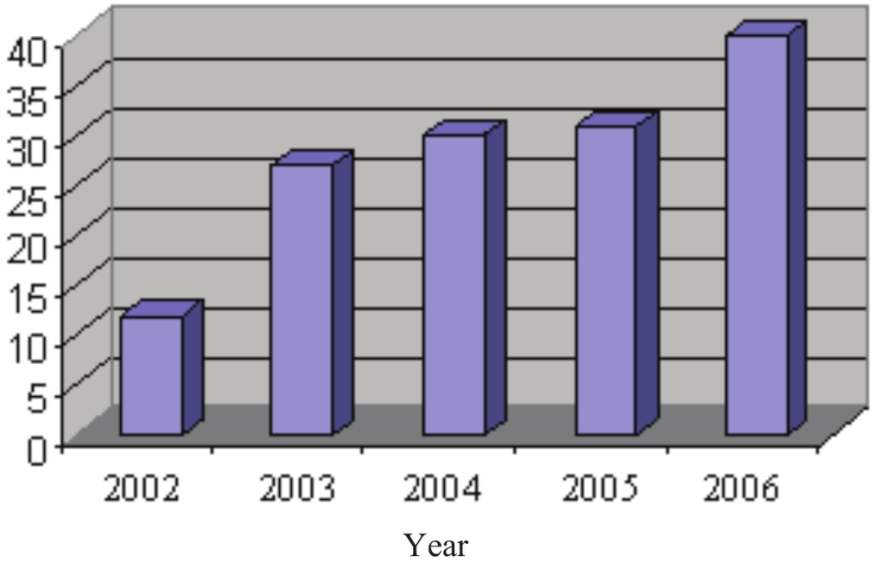

Figure 21.4. Number of staff involved in teaching scholarship (data from approximately 80 academics)

Developing an innovative, constructively aligned curriculum based on teaching scholarship

A major cultural shift for the Faculty of Veterinary Science was the acceptance that student learning was core business that deserved continual attention. Student-

centred learning through constructive curriculum alignment was adopted as the guiding principle for renewal. During curriculum implementation staff were stimulated to use the available teaching resources in different ways to achieve active engagement. Cross-disciplinary teams were empowered to be creative in encouraging active learners, achieving discipline outcomes and graduate attributes for the course. An emphasis on helping students to learn through clinical problems led to the creation of our own case-based learning pedagogy (Canfield, 2002; Canfield & Krockenberger, 2002).

In order to create time for active student learning faculty reduced timetabled teaching by 25%. This created 'space' for new topical, interdisciplinary units of study and the introduction of a stream called Professional Practice, which provided enhanced generic skill development, including leadership training. A lecture free final year of experiential learning in professional practice placements was introduced which further reduced classroom teaching time in the degree by 20%. This compression of traditional content teaching time challenged staff who were unable to continue with the existing teaching modes (lecture, tutorial and practical classes). Reform of curriculum and teaching methods was achieved by an integrated, collaborative approach to curriculum design, reduced repetition and replacement of transmission-modes with more active, self directed learning.

The graduate attributes provided a framework for 'big picture' redesign of the whole curriculum with outcomes sequentially aligned through vertical and horizontal integration. Teaching teams developed learning activities and aligned assessments designed to help students construct their own understandings, with large class teaching limited to 50% of teaching time. A greater range of learning activities, including online learning, professional placement learning and practical classes, was adopted to suit the variety of student learning styles. In essence, the aim was to develop critical, creative thinkers in the manner of a constructivist approach to learning.

The faculty has actively promoted greater sensitivity and responsiveness to students and their learning needs, seeing them as important partners in our education activities. Staff cultivated mutual trust and respect responding in a thoughtful way to feedback from students. This has created a shift in the power relationships towards more mature learning partnerships where students feel an important part of a learning community. As one student commented, *'A great sense of community. You feel welcome and invited to contribute to all aspects of the faculty and they seem genuinely pleased about feedback'* (Year 4 student, 2005).

Enhancing quality and continually improving student learning through evidence and scholarship

Frequent, ongoing collection of data and constructive reflection on its significance has been essential for improvement. It has sustained purposeful staff

discourse on teaching and commitment to enhancing learning quality in the face of recent challenges. A culture of scholarly teaching has been supported by allocation of staff resources to collect, analyze and communicate evidence. The impact of the findings of investigations into learning have been amplified by peer reflection, seeking advice from external expertise, application of ideas from the teaching literature, presentation of findings at faculty, university and national teaching conferences and in publications, all of which have increased from nearly zero prior to 2000 (Figure 21.4).

At the time of significant change, the units were not reviewed, evaluated or reported in a systematic way, so valuable information for improving learning was lost. Regular student evaluation and staff reflection on each unit was initiated to focus attention on students' learning and the whole teaching team were accountable for quality. Data was gathered from a range of sources including students, graduates, staff, profession and the university with reporting on progress against milestones. Agreed minimum levels of performance focused the faculty's support on struggling units, to ensure additional resources were used for greatest impact. Inquiry projects helped to illuminate issues, test solutions and disseminate findings. One student commented *'One of the best aspects was the staff's responsiveness to feedback and their ability to change'* (Year 5 student, 2005).

The course experience questionnaire data provided course level information on how graduates and future alumni view their education and was a major impetus for change. However, as a lagging indicator it did not provide the sensitivity necessary to evaluate the immediate impact of curriculum and teaching change. More current information was derived from the student course experience questionnaire data which provided information by year of enrolment. The Learning and Teaching Committee looked beyond the numerical data and commenced systematic analysis of the trends that emerge from student comments. These provided progressive, early indications of problems and staff were guided to understand their significance. Improving aspects of the student learning experience has since become a feature of every faculty learning plan and sustained improvements have been achieved (Table 21.2). For example, faculty implemented policies with a series of workshops on good assessment (Gibbs & Simpson, 2004) in 2001-3, improved marking and feedback practices and monitored the impact on learning, leading to marked improvements in students' perceptions of assessment (Table 21.2).

Table 21.2: Impact of scholarly teaching on undergraduate student learning experience

Undergraduate student course experience (% agreement)					
Year	00	01	02	03	05
Good Teaching Scale	44	41	50	55	54§

Clear Goals and Standards	48	44	41	50	46§
Appropriate Assessment	33	33	41	42	46
Appropriate Workload	17	17	13	13	16
Generic Skills	62	60	61	66	67§
Learning Community	-	61	61	63	63§
Overall Satisfaction	74	79	78	80	85*

** Highest in university*
§ Second highest in university
Data collected and reported by the university annually 2000-3 and biannually thereafter

A more detailed understanding of the variation in student learning experience was derived from unit of study evaluation questionnaires, conducted on a rolling three year cycle, or more frequently for units with problems. These provided crucial information on emerging trends which were addressed by the unit coordinator and teaching team in a systematic, collegial way, with closure of the loop to students on action taken. The faculty recognised the direct relationship between unit evaluation results and students' experience across the course. Student course evaluations are a leading indicator of performance in the university's teaching performance index and contribute to Teaching Dividend allocations for faculties, discussed in Chapter 1.

Individual staff in team-taught units can also undertake their own confidential evaluations in order to plan for improvement in their teaching, but the emphasis remains on the students' experience of learning in a unit, rather than an individual teacher. Other forms of feedback from students are used to investigate questions, including focus group discussions and targeted surveys. Staff provided critically useful perspectives and peer review of teaching in other units of study. This has been most effective in the many new units introduced since 2000 which depend on team teaching, situations that strengthen innovation, inquiry and communication about student learning (Benjamin, 2000).

The profession provides a critical perspective on veterinary and animal science education as employers of recent graduates and supervisors of work placements. Students spend their final undergraduate year as veterinary interns in professional placements. Supervisors' reports on student progress and achievement, collated across the whole year of final year students, are analyzed to identify strengths and weaknesses in student learning outcomes. These findings have been used to strengthen elements of training and assessment in the curriculum. Examples are inclusion of a series of barrier animal handling tests prior to

clinical placements and increased early assessment of oral communication skills.

The university and the veterinary profession help setting standards for education and in assessing outcomes. The university's Academic Board Reviews focused on benchmarking and establishing a common quality education culture across the university. The faculty, through necessity, has engaged in professional accreditation since its inception in Australia and in partnership with the United Kingdom. This accreditation process has been a driver for ensuring quality teaching facilities, curriculum design and the development of agreed graduate attributes. It facilitates collaborative teaching and direct benchmarking amongst the Australasian veterinary schools. Because of the growing international student base, and a developing global view of food production, animal diseases and public health, faculty decided to engage in North American accreditation. In a lengthy process, and through a shared leadership approach, the faculty finally achieved its goal of becoming an internationally recognised provider of veterinary education. This became a catalyst for transforming the local curriculum into one that had global acceptance and relevance, thereby increasing opportunities for attracting international educational and research collaboration. The external perspectives were also crucial in helping the faculty visualise what would be required to reach the university's goal of 1:5:40 ranking (first in Australia, fifth in the pacific region, 40th in the world).

CONCLUSIONS

Learning to be a scholarly teaching faculty, although initiated by inspirational leadership, was a process of discovery that required inclusiveness and shared effort. Establishing a 'buy in' of all stakeholders to the faculty culture was essential to provide an environment that nurtured 'deeper' approaches and inquiry into teaching rather than a compliance culture which can arise from enforced structural change (Knight & Trowler, 2000). Recognition of the urgent need for adaptive change, and provision of a framework of staff development and empowerment for change based on sound educational principles were important elements in sustaining the change to scholarly teaching (Figure 21.5). Creation of a consistently supportive and rewarding environment and quality enhancement practices that reinforced student-centred learning provided a buffer against consistent external pressures which had the potential to undermine staff commitment to continually improving learning and teaching.

Staff training in shared leadership was crucial to provide self-awareness of teaching practices, confidence to engage in adaptive change and continual self-improvement, and a capacity to understand the needs of the learner. By providing self-confidence and an understanding of the building blocks of inter-personal skills, the leadership program helped to promote productivity by motivating staff

to be active contributors in making and implementing decisions underpinned by teaching scholarship. Knight and Trowler (2000) have argued that transformational change can be superficial and imposed where it does not engage with the culture of academic departments. It was realised early in the faculty's process that sustainable educational change required leadership that enabled staff to make their own collective and collaborative contribution.

Creation of our own sense of identity and purpose as *'a world leader in veterinary education'* through a Culture Statement and collectively developed Strategic Plans was necessary to take ownership of our curriculum and embed more effective ways of helping students learn. We approached the task with a view to the long-term cultural and financial sustainability of the faculty's future, which, in part, was established on the premise that staff will continue to be innovative and committed if there is appropriate reward and recognition of effort. Staff perform best in the long term when they are confident through belonging to a trustworthy, productive and dynamic team driven by a shared purpose (Margerison, 1990). They appreciate the opportunity to be part of teams that share their enjoyment and interest in improving learning. Teaching and learning development that is timely and well focused on staff needs enables professional growth which is stimulating and enjoyable. It allows staff to have a sense of being connected to colleagues as part of a larger effort of excellence beyond the usual boundaries of small research teams. It also gives staff a chance to contribute to the understanding that the next generation of professionals have of good teaching and to influence their behaviour when these graduates take on informal teaching roles in their careers. The consistent inquiry, reflection, analysis and communication of investigations into the impact of teaching on learning play a vital role in the continuous improvement in quality. Progress is measured against key performance indicators developed for our Teaching and Learning Strategic and Operational Plans (Table 21.3). These plans integrated elements of the university's Plan, Working Group initiatives (described in Chapter 1) with aspects that were specific to our own context.

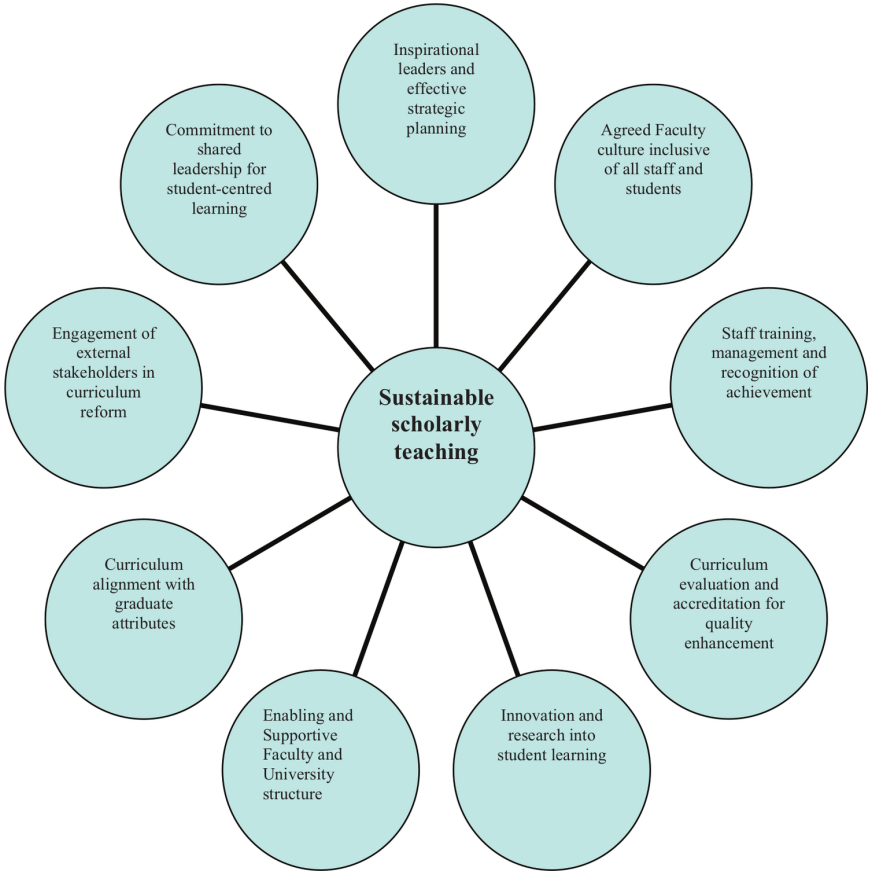

Figure 21.5. A synthesis of the factors which helped to establish and sustain scholarly teaching in the faculty

Table 21.3. Key performance indicators for a scholarly teaching culture

■ Enabling context for learning and teaching
○ Visionary leadership to transform learning and teaching
○ Shared, purposeful leadership in learning and teaching
○ Succession planning in learning and teaching roles
○ learning and teaching considerations a major force in Faculty of Veterinary Science planning

- Flat structure supportive of learning and teaching
- Students active participants in all learning and teaching groups
- Embedded teaching innovations group
- Strong links to ITL, external expertise in education

■ Staff development

- Recruitment on interest, capacity in teaching
- Induction, mentoring new staff on teaching roles
- Shared leadership program
- Supported completion of formal training
- In house teaching development
- Development for professional partners in education
- Support for researching education, further qualifications
- Recognition of scholarly activity in teaching

■ Curriculum

- Graduate attributes, curriculum alignment in all courses
- Commitment to student-centred learning
- Experiential and authentic learning
- Innovation, development of new courses
- Focus on improving assessment and feedback
- Development of new learning resources
- Leadership training for students

■ Quality in student learning experience

- Effective processes for ongoing quality enhancement
- Constructive use of evaluation for reflection

- Agreed benchmarks for performance
- Peer review and team teaching
- Strong links to accreditation bodies-national, international
- Benchmarking with other universities

■ Recognition/reward

- Competitive in gaining funds for teaching innovation, scholarship, performance
- Promotion based on teaching excellence
- faculty teaching awards for academic, general staff and professional partners
- External teaching awards

Finally, it was recognised early that for a truly long-living, sustainable culture of scholarly teaching in the Faculty of Veterinary Science, there was a necessity to influence others about the role of shared leadership for educational advancement. The first recipients have been our students and professional partners through leadership modules in Professional Practice and preparation for work placements. However, we do not intend to stop there, for it is absolutely imperative for sustainability that we obtain university-wide acceptance and support for the importance of shared leadership for scholarly teaching and educational advancement.

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Chapter 22

The scholarship of teaching in a research-intensive university: Some reflections and future possibilities

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This book has brought together a diverse range of activities which can best be described as reflecting the scholarship of teaching and learning at the University of Sydney. The papers in this monograph represent examples of practice from a wide range of disciplines, using a range of approaches and operating at a variety of levels. Importantly, they describe how this type of research can be used to change and improve practice. Through their publication they provide various examples of Hutchings and Schulman's (1999) conception of the scholarship of teaching as being public, open to critique and evaluation, in a form that others can build on. These examples clearly reflect question-asking, inquiry and investigation, particularly around issues of student learning. They contribute to improvement in teaching practices, institutional knowledge and intelligence and hopefully improvement in student learning.

In this chapter I draw together some common themes and identify some issues that have emerged over a period of time where the scholarship of teaching and learning has been used as a strategy to reward, recognise and develop teaching and learning at the University of Sydney. The book was commissioned at a time when I held the position of Pro-Vice Chancellor (Learning and Teaching). In this role I was responsible for developing a cross institutional strategy to enhance and improve learning and teaching. My predecessor Paul Ramsden initiated two major initiatives that were aimed at developing a performance culture across the university: the Scholarship Index and the Teaching Dividend as described in Chapter 1. After Paul left I had the challenge of implementing and embedding these into university practice. Both of these initiatives distribute funds from the centre as a means of recognising and rewarding improved practice in teaching and learning.

These initiatives indicate the commitment to achieving and rewarding quality teaching in a research intensive environment. At a time when the RQF has been stressing the importance of research, they are an important counterpoint to a preoccupation with research. The importance of teaching at Sydney is recognised in two ways: the allocation of resources through these initiatives, and the opportu-

nity to be promoted on the basis of outstanding teaching. These two activities are clear messages that the University recognises and rewards teaching.

SOME REFLECTIONS ON THE SCHOLARSHIP OF TEACHING AT SYDNEY

Clearly the papers in this monograph indicate that the scholarship of teaching is widespread, and embedded into the policies and practices of the institution. There are examples from the faculties of Health Sciences, Science, Arts, Business and Economics, Education and Social Work, Veterinary Science, Engineering, The Sydney College of Arts, the Sydney Conservatorium of Music, Architecture, Medicine, Pharmacy and Dentistry. It is pleasing to note that there are several contributions from academics in Science, an area that one might usually consider to be more focussed on more traditional and scientific research.

The papers all reflect the values for learning and teaching at the University of Sydney as presented in the Learning and Teaching Plan 2007-2010, in particular the values of excellence and intellectual inquiry. Moreover they operationalise the principles presented in the plan, especially to promote research-enhanced learning and teaching, to promote student centred learning and teaching, and to strive to continuously improve and enhance the quality of student learning and teaching.

The papers also indicate how the scholarship of teaching and learning can operate at the institutional, group/faculty and individual level. At the institutional level the papers have clearly demonstrated the existence of a culture of scholarship across the whole institution, supported through policies and rewarded through the allocation of funding. At the group/faculty level there are several examples of how research has been used to improve practice. Curriculum renewal and responding to student needs are two common themes which exemplify this. At the individual level measuring the ability of first year students to use skills and knowledge learned in mathematics courses is a case in point. So returning to Hutchings and Shulman's earlier quote, what then are the questions being asked, and what are the issues around student learning reflected in these chapters.

The following themes and issues are addressed in this volume: subject specific investigations, curriculum interventions and improvements, student learning strategies and experiences, learning in an information rich environment and cultural change.

Subject specific investigations

The extent to which students developed and used concepts which reflected the conventions of pharmacy is the focus of Sainsbury and Walker's research. They

identify a number of implications for enhancing student learning, including "the importance of collaboration in group work and of providing opportunities for students to discuss their understanding and approaches to problem solving".

Batmanian and Lingard in their research on learning and teaching of basic sciences in the health related professions pinpoint the difficulties of teaching and learning of compulsory basic science in professionally oriented faculties. On the basis of their investigations they came to the conclusion that academics teaching in this subject have varied their teaching methods to include only minimal necessary factual information so that students are overwhelmed by content which in turn would lead them to adopt a surface level approach to learning. A variety of delivery strategies were introduced to ensure that content and professional needs were accommodated. Most importantly though was the conclusion that "students need to be taught exactly what constitutes deep learning and to value it not only for their immediate learning but as a lifelong learning tool."

Assessment stands at the core of the teaching and learning process. In their chapter Manjula Sharma and Ian Sefton examine assessment practices in Physics. The original purpose of the research was to gain some understanding of students' thinking that would enable them and their colleagues to become more effective teachers. Trying to understand the variation in the distribution of marks which seemed to be unrelated to differences in students conceptual understanding was the trigger for this research. They believed that 'gaining some understanding of students' thinking would enable them and their colleagues to become more effective teachers. Sharma and Sefton take the view that doing research on students' understanding almost inevitable leads to a more learner focussed approach to teaching.

Interventions and interruptions

Finding ways to attract and support Indigenous students is a challenge for many institutions. In their chapter, Farrington, Page and Daniel di Gregorio under took research to elucidate the factors that promote Indigenous students' academic success. From this research they identified strategies to induct students into the university learning environment and suggest some changes in curriculum that would help students in their studies.

Many students in the science areas come to university with poorly developed writing skills. Charlotte Taylor and Helen Drury's research examined the integrated writing program within a first year biology course. In this program students improved their scientific writing skills. Their research confirmed the view that students need a structured and explicit approach to the teaching of writing; one which modelled good writing and provided students with systematic feedback on the quality of their scientific writing.

The Arts Network Mentoring Program was an initiative put in place in the

Faculty of Arts to foster a sense of identity and belonging for first year students. The importance of relationships, creativity and image emerged as clear factors in this program, The use of a participatory action research cycle with its collaborative and integrative dimensions provided Nerida Jarkey and her team with a clear understanding of the benefits and outcomes and enabled the faculty to put in place a strategy that has been positively received by new and 'old' students alike.

When we think of interventions and interruptions we usually think about these coming from academics or from central administration. Ann Elias describes a situation where students complained about 'the offensive nature of contemporary art while enrolled in a program that aims to develop contemporary artists.' This research led her to pose the question of 'how to facilitate discussions that are inclusive, but not stressful to students'. The research confirmed the importance of the ethics of teaching, attained through discussions that are sensitive to the social and intellectual anxieties of students and a curriculum that is transparent to the key philosophical underpinning of the discipline and profession".

Student learning strategies and experiences

Patricia Lyon writes about the operating theatre as a learning site. She identifies the learning strategies that students use to manage their learning across three domains; the physical environment and the emotional impact of surgery as work, educational tasks and the social relations of work. She advocates the need to develop specific curriculum initiatives to provide students with formal opportunities to actively prepare for the experience of being in the operating theatre in order to help them get the most out of the experience; one which is likely to be challenging and difficult.

Competence in mathematics is important for science and engineering students. Britton et al were interested in measuring the ability of first year science students to use skills and knowledge learned in mathematics courses, in other contexts – specifically science. To date most of their emphasis has been on the development of tests to measure transfer and to find ways to interpret their data. While for them their research unearths more questions than answers, it does provide the opportunity to build a community of practice across disciplines that might nor have occurred otherwise.

Group work is an integral learning and teaching strategy in higher education. As Fiona White and colleagues point out in their chapter on Evaluating Student Perceptions of Group work and Group Assessment, it can be a challenge to implement effectively-from both teacher and student points of view. Surprisingly, the research indicates that for her students group work is preferred above individual work irrespective of the method of assessment.

Academic honesty and plagiarism is challenging staff in universities in Australia and elsewhere. Mark Freeman and colleagues undertook a research project

aimed at improving academic honesty in the Faculty of Economics and Business. The approach developed in his faculty has been collaborative and has involved all staff in the design, implementation and research. The faculty efforts have facilitated a cultural change in academic honesty but also acknowledged and rewarded staff for their participation.

The Global Studio as described by Anna Rubbo weaves a narrative about teaching and learning in an international setting. The Global Studio demands that students develop critical thinking skills and brings together design teaching and research in a form of problematization. Importantly it also relies on the development of social participation and critical reflection. This project clearly is ongoing and has great potential to enhance students learning experiences moving them from local to global perspectives.

Learning in an information rich environment

eLearning has become ubiquitous as a mode of delivery in higher education. Several chapters investigated this as a tool to support student learning but from different perspectives.

Peter Goodyear and Robert Ellis are concerned with learning for the 21th century especially how it relates to the characteristics of knowledge work and the development of epistemic fluency. Their research indicates that many of those they interviewed are still looking for authentic ways of using ICT. Students expect it to be used, but don't have definitive views about how it is to be used. While this research is still in its early stages, it does point to the need for a better alignment between technological capability and educational purpose.

At a more specific and applied level Rafael Calvo and colleagues have focused on how evidence-based research into students' experience of eLearning has been used to inform software development process in a large number of eLearning projects. This chapter reports on students' experience of learning using two learning software approaches: Beehive – a software system to help trainee teachers design synchronous collaborative learning activities and dotFolio – an electronic portfolio tool for learning that promotes reflection. This project endorsed the need for the development of communities of practitioners to undertake cross-disciplinary work to search for approaches and tools to enhance the student learning experience.

Online discussions provide students with flexibility to learn in virtual environments. Wozniak, Silveira and Devonshire draw on their experiences in fostering online learning discussions in the blended learning environment of an undergraduate allied health science courses. Drawing on evidence from learning cycles from 2000 to 2006 they note the move away from a technology focus to an understanding of the underlying pedagogy of elearning. This research ascertained that through careful preparation and structure of asynchronous discussion

activities student group leaders emerge naturally and the focus of discussion can reflect higher order learning and team work.

Cultural change

Change is inevitable in the current climate and Faculties are responding to it in a variety of ways. Paul Canfield and Rosanne Taylor describe how the Faculty of Veterinary Science changed its direction to become a leader in veterinary education and research. They describe a change in culture brought about through the application of shared leadership, and a series of substantial structural and organisational initiatives. Improving the quality of teaching, the instigation of a culture of scholarly teaching, and a focus on student centred learning were at the centre of these changes. The impact of these changes has been substantial with a dramatic improvement in student satisfaction. In addition, a number of staff members have gained excellence in teaching awards.

SOME OBSERVATIONS AND LESSONS

It is clear that the above themes are indicative of the diverse areas in which the scholarship of teaching is enacted. In what follows I want to briefly reflect on two issues that need to be considered in order for the scholarship of teaching to be able to be embedded in institutional practice and then to flourish. The two issues are advocacy and sustainability. In some respects these represent two ends of a management continuum. Advocacy is fundamental for the Scholarship of Teaching to be accepted institutionally. Advocacy from the centre legitimates this as a valuable initiative and thus gives it status. It also gives out the clear message that teaching and the scholarship of teaching are rewarded and important in the university's set of priorities.

Consideration of sustainability is integral to thinking about the future of the Scholarship of Teaching at the institutional and individual level. Implementing change and new initiatives are relatively straightforward, sustaining them and keeping the momentum going is much more difficult. Much of the research detailed in this volume has been sustained by committed staff over a long period of time. How to sustain the effort and interest of staff, when there are competing demands, especially in a research intensive environment, needs to be considered at the individual and corporate level. Administrators and academics alike have to ask can we sustain interest, funds and effort in such activities. Interest can easily be redirected if other priorities emerge and there are reward structures in place for them; certainly the allocation of funds through the Scholarship Index and the opportunity for staff to give presentations at teaching and learning fora legitimated the effort of staff doing this kind of systematic investigation in student learning

and their teaching.

Developing the scholarship of teaching and learning at the University of Sydney has taken place alongside the implementation of systematic and sustained implementation of quality assurance processes designed to ascertain students' learning experiences. This information has been used to gauge the success of strategic teaching and learning interventions and to inform the processes of curriculum change. Also important has been policy renewal which has led to clear articulation of values and principles and coherent strategies that underpin them, including policies on generic graduate attributes and research-enhanced learning and teaching.

CONCLUSION

This volume and the critical work undertaken by the writers represents an institutional response to the development of an activist teacher professional (Sachs 2003). In various ways these projects are about a politics of transformation insofar as they are concerned with changing teachers' beliefs, perspectives and opinions regarding the importance of teaching in a research intensive environment. In its most obvious form the politics of transformation is rooted in everyday life, and this is its strength. In the examples in this volume, academics have looked behind some of their taken for granted assumptions about their practice and the design and pedagogy of that practice.

Activist teacher professionals work collectively and collaboratively which enables them to draw together a range of intellectual, social, cultural and other resources. At times when academics workload is intensified it also ensures the development of a sense of community which is important in sustaining high levels of energy and interest.

The development of trust and mutual respect is fundamental to developing the type of activist teachers I am suggesting. Activism requires trust in people and processes. When trust erodes, so too does the goodwill and energy that sustains an organization. Thus, it is important that strategies and processes to support and reaffirm trust are used to focus and mobilize action.

Clearly then activist teacher professionalism is not for the faint hearted. It requires risk-taking and working collectively and tactically with others. Like any form of action it demands conviction and strategy. However, the benefits outweigh the demands. Such a professional creates new spaces for debate about practice and an understanding of the conditions that shape practice. New cultures that recognise and reward quality teaching are institutionalized with improvements in student learning and the student experience their outcome.

The Scholarship of Teaching at the University of Sydney has the following characteristics: it is embedded into policies and practices, characterised by a va-

riety of approaches, aimed at improving practice, tests and questions taken for granted about assumptions about student learning and teaching, contributes to the transfer of knowledge across disciplines, provides a basis for communicating and sharing good practice, provides information about the student experience and finally makes a significant contribution to the field.

This volume recognises and celebrates the work of many academics and administrative staff working across the University. Such work contributes to what Brew (2006) refers to as a type of 'inclusive scholarly community' where important distinctions are made between research-led teaching and the scholarship of teaching, where the former focuses on disciplinary research and the latter pedagogical research. Both types of research build capacity within individuals and across the institution. The development of the scholarship of teaching in particular, suggests a maturity in an institution, where despite external pressures from government and internal ones for increased research productivity, the role of teaching is formally acknowledged as a central platform of academic activity. An institutional tradition supporting the scholarship of teaching reinforces the research-teaching nexus and is an important strategy for migrating good practice across the University. Most importantly, it reinforces the idea that a mature institution learns from its own activities and has this as a publicly espoused value. To this end, The University of Sydney has achieved a great deal and hopefully others will be able to learn from our experience.

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