THE CARRICK INSTITUTE
FOR LEARNING AND TEACHING
IN HIGHER EDUCATION LTD

WHAT'S HAPPENING IN SCIENCE?

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An initiative of the Australian Government Department of Education, Science and Training

THIS DOCUMENT PROVIDES INFORMATION ON THE SCIENCE INITIATIVES OF THE CARRICK INSTITUTE

PREFACE

Underpinning the vital contribution it makes to the general wellbeing of society is the growing understanding of the role that science plays in supporting the development of our knowledge-based economy. From breakthroughs in medical research to scholarship into environmental issues, science is at the forefront in tackling some of the most compelling challenges facing our contemporary world.

This commitment to innovate, to address the fundamental problems that confront us, and to explore new ways of doing things is also reflected in the way in which science is taught in our universities. Whether utilising the capacities of the new technologies, or re-thinking what it means to be a professional scientist in the twenty-first century, there are many examples of the ways in which academics and their colleagues are enhancing the ways in which students engage with and learn about science.

It is therefore fitting that some of the first projects funded by the Carrick Institute when it was established in 2005 tapped directly into these broad areas of concern with a view to developing practical solutions that deliver tangible outcomes.

As our new report ‘What’s Happening In Science?’ reveals, the Institute has now funded 18 science initiatives covering a broad range of areas but each with the fundamental aims of improving the student learning experience and maximising the range of opportunities available to them.

Enhancing student understanding is central to the ‘Threshold concepts’ project which addresses the necessity to re-think the teaching of biology in ways that accommodate diverse learning strategies. Another is using virtual microscopy as a tool to support students to overcome technical and practical difficulties that often hinder effective learning. The “Online assessment feedback’ initiative aims to extend the aspects of human biology that can be assessed online and provide richer, more analytical feedback, of particular benefit when teaching large classes.

Ensuring that students are adequately equipped to study science is the focus of investigations by Carrick’s Associate Fellows Professor Peter Adams and Professor Philip Poronnik of the University of Queensland. Recognising the “flight from science” highlighted by reductions in student numbers, this project seeks to develop interventions that ensure students are equipped with the necessary mathematic and quantitative skills to progress confidently in science.

Students are also at the centre of the physics project ‘Physclips’ which entails developing multi-media resources for teaching first-year university subjects, while a related initiative is looking at forging new directions in physics education across the country. The student experience is at the centre of the ‘Service teaching in Physics’ project while ‘Science report writing’ is seeking to create a student-centred online learning environment for report writing.

This report also outlines a major project sponsored by the Australian Council of Deans of Science on which future changes to curriculum and teaching and learning pedagogy can be based. It looks as well at the world-leading approach being taken to designing science learning and teaching spaces in a number of Australian institutions.

These are just a few of the examples contained in 'What's Happening In Science?'. Taken together they reflect the way the Institute is promoting strategic change in higher education by identifying and supporting innovation and best practice. Most importantly, this report brings together some of the exciting initiatives now underway across the country that aim to stimulate renewed interest in the study of science.

Professor Richard Johnstone

Executive Director
Carrick Institute for Learning and Teaching in Higher Education

1. OVERVIEW

The first projects funded by the Carrick Institute in 2005 were pilots to test how future programs might work. As part of these pilots, two Biological Science assessment projects were funded (PP532 & PP541). The first of these projects was finalised earlier this year and provides a resource website www.bioassess.edu.au which highlights contemporary issues and presents effective and innovative approaches to enhancing biological assessment in higher education. The data collected was not able to be fully mined during the project and is still available for further analysis. The website has potential application and relevance to other disciplines. The other project has also reported and has provided three universities with a good understanding of what first-year Biology students want from feedback and how they use it. Research into the student profile and student expectations underpins the project.

Other projects in the Biological Sciences have been funded more recently. Two projects (CG7-398 & CG-467) will provide a large set of virtual microscope slides to the sector for use in courses such as medicine, dentistry, zoology, anatomy and botany. A new national curriculum in entomology is a collaborative project involving four universities (CG7-515). Two projects are addressing biological concepts, one defining a concept domain in the molecular aspects of biology and developing a web-based multiple choice instrument to assess students understanding of the concepts (PP7-350) and the other researching threshold concepts in biology to develop teaching that is appropriate to different learning strategies (CG7-476). Under the DBI investigations, a project addressing biotechnology is updating what is happening in this area in universities, re-vitalising a network of teachers and looking at the feasibility of industry placement for students. Two associate fellows are investigating the mathematical deficiency of first year life science students to develop interventions to address these deficiencies.

Physics is also well represented in the work being undertaken. An interesting website www.physclips.unsw.edu.au containing multimedia tutorials on mechanics and electromagnetism is now available as a result of the Physclips project (CG620). This should be very valuable to first year and some school physics students. Using virtual reality to teach the laws of relativity is an innovative approach of a project (CG7-454) recently funded. Under the DBI there is also an investigation into new directions in physics education which will examine where graduates go, investigate good practice in service teaching and in laboratory design and teaching. Under a fellowship project the best ways of teaching physics to medical, biological and environmental science students are being investigated.

An interesting leadership project is looking to how respected scientist can lead others to value and improve their teaching (LI616).

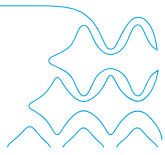
In the general science area, there are three projects. Two projects are aimed at supporting students, one in report writing (CG630) the other with developing the

language of science (CG7-441), both areas of challenge for students. An Associate Fellow is also addressing the writing skills of student with a view to embedding this skill development and assessment in a new BSc. The supporting material from both these projects will be presented on-line. The third project is a major pilot being sponsored by the Deans of Science to develop a database on which future changes to curriculum and teaching and learning pedagogy can be based.

One other project which has recently been supported addresses communication skills for veterinary science students (PP7-340).

In September, under the Grants Scheme a fortnight of activities focusing on innovation in learning and teaching spaces provided the opportunity to showcase three science spaces, the Chemistry tutorial space at The University of Melbourne, the new Chemistry Labs at the University of Newcastle and the Biology Microscopy Lab at Monash University. The international expert, Les Watson noted that these were world leaders in the approaches taken.

There are also a number of projects in Maths/Stats which will be of interest to Science academics and administrators.



2. BIOLOGY

2.1 Biological concept inventory

Diagnostic assessment for biological sciences – Development of a concept inventory. (PP7-350)

Lead Institution: The University of Queensland

Partner Institutions: The Australian National University; The University of Natal (South Africa); The University of Oporto (Portugal)

Team Leader: Dr Tony Wright

Background
This project targets student learning of the molecular life sciences by developing a tool for educators to research their teaching. The project will develop a set of clearly articulated key concepts which underpin undergraduate studies and convert these into a rigorously validated web-based assessment tool (the concept inventory) that tests these concepts. Educators from a range of disciplines will be able to use the concept inventories to enhance teaching and learning by developing an increased awareness of student thinking and learning. This is intended to influence pedagogical practice and improve educators' pedagogical content knowledge.

The underlying rationale for developing the concept inventory for the biological sciences is the exponential growth in knowledge in the biological sciences during the past few decades and the therewith associated change of the nature of science teaching and learning.

Progress
This project just commenced and is currently in its first stage. This first phase will involve the specification of the concept domain and the identification of key component concepts. Focus groups and undergraduate curricula will be used to analyse core Biological concepts, in order to refine and revise the inventory.
In year two of the project, the inventory will be tested then disseminated, in Australia as well as overseas.

Project Commencement: May 2007 **Project Completion:** December 2009

2.2 Threshold concepts

Using threshold concepts to generate a new understanding of teaching and learning Biology (CG7-476)

Lead Institution: The University of Sydney

Partner Institutions: The University of New South Wales; University of Western Sydney

Team Leader: Dr Charlotte Taylor

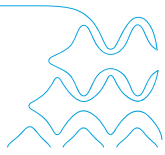
Background
The project rationale is built around the necessity to re-think the way teaching biology is approached in order to address issues of standards of teaching and learning in science; these issues include the exponential increase of new knowledge in the area of biology as well as an increased diversity of the student body.

The project seeks to improve student understanding of biology through the use of novel research into the definition of a threshold concept in biology. Threshold concepts are seen as fundamental to an understanding of biology. Utilising this concept will enable the development of teaching that is appropriate for diverse learning strategies. The project will model the process of strategic change in approaches to teaching biology in Australian Universities. This will be accompanied by extensive discussion and consultation with existing networks of practitioners.

Long term goals of the project are to develop a generic model of diagnosis and intervention for working with threshold concepts, and to share resources and models with the teaching community in biology and related disciplines.

Progress
Currently in its preliminary stages, the project ran a short workshop in September as part of the UniServe Science Conference. A number of workshops are being organised for early next year, in order to identify an appropriate series of threshold concepts. At a later stage, these threshold concepts will be trialled and preliminary intervention resources developed to be set up on WebCT.

Project Commencement: July 2007 **Project Completion:** December 2009



2.3 Entomology curriculum

A National curriculum for Entomology: Capacity building through collaborative, web-based delivery. (CG7-515)

Lead Institution: The University of Queensland

Partner Institutions: Charles Sturt University; The University of Adelaide; The University of Western Australia

Team Leader: Dr David Merrit

Background
The project intends to stem the steady decline of the diversity of entomological (the study of insects) subjects at Australian universities by developing a collaborative, national curriculum that will ensure the sustainability of Australia's capacity in this field. It is crucial that Australia develops well-educated scientists in this area in order to ensure the productivity and competitiveness of Australian plant industries, ensuring human and veterinary health, and understanding the effective use of our biodiversity.
In order to maximise impact of this project and accessibility to students, materials will be made available via the internet. This will help to increase interest in entomology and provide a stimulating learning experience.
The initiative may be seen as a model for wider application in cognate disciplines such as Agriculture.

Progress
Once the project commences, a team operating from different institutions will develop identified subjects of entomology, for flexible delivery to off-campus students. Those primary resources will be sent to students in web-browser readable format on CD with further resources and discussion groups available on the internet. A website will be established as a hub for information on the collaborative curriculum, detailing the subjects, providing news and as a site for interaction with entomology practitioners.
Within two years, an agreed national curriculum with learning materials will be in place.

The project has only just commenced with formal agreements executed in October.

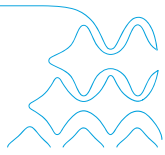
Project Commencement: October 2007 **Project Completion:** November 2009

2.4 Virtual microscopy

Virtual Microscopy for Enhancing Learning and Teaching (CG7-398)

Lead Institution: The University of New South Wales

Partner Institutions: n/a



Team Leader
Professor Rakesh Kumar

Background
This project is intended to provide resources for and to promote the dissemination of well-developed approaches to learning and teaching using virtual microscopy, a key enabling technology for students with differing levels of expertise. Sets of "virtual slides" will be generated for use in learning and teaching within Australian universities, particularly in Medicine, related Health Sciences and Biological Science.

Virtual microscopy can greatly enhance and support student learning in that it helps to overcome technical and practical difficulties that can hinder student learning. The project is based on the demonstrated capacity of virtual microscopy to provide support for collaborative learning, increased student engagement, greater student satisfaction, an environment for effective cross-disciplinary learning and teaching, support for flexible learning, and decentralised teaching.

These virtual slides will be made available to educators across the sector (without a charge), via a repository. At the same time, effective models of the pedagogies and processes involved in using virtual slides will be disseminated via a demonstration website and workshops.

Progress: Funding has been approved. Formal Agreements have not yet been executed.

Project Commencement: Late 2007 **Project Completion:** January 2009

2.5 The virtual slidebox

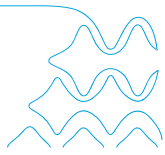
The virtual slidebox – A new learning paradigm for exploring the microscopic world (CG7-467)

Lead Institution: The University of Queensland

Partner Institutions: n/a

Team Leader
Dr Camille Farah

Background
This project is to enhance the learning and teaching of microscopy across a wide range of disciplines by the systematic implementation of virtual microscopy, a highly flexible, innovative and dynamic learning tool, in conjunction with an interactive approach to learning designed to maximise student engagement with the technology. Specifically the project will :



- Incorporate virtual microscopy into the curriculum of the University of Queensland courses delivered by the project team (dentistry, veterinary science, biomedical science, medicine)
- Enhance student learning using surveys, group work, self assessment and independent learning
- Promote the use of virtual microscopy to colleagues and interested parties within the university and more broadly
- Produce a virtual slidebox of over 5000 slides. Including the following materials: oral histology, oral pathology, veterinary histology, veterinary pathology, human histology, and human pathology.

Progress: Funding has been approved and formal agreements have recently been executed.

Project Commencement: November 2007 **Project Completion:** December 2008

2.6 Biological science assessment

Enhancing the assessment of learning in Australian higher education: Biological sciences (PP532)

Lead Institution: The University of Melbourne (Centre for the Study of Higher Education)

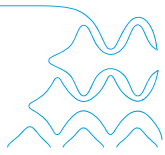
Partner Institutions: The University of Sydney

Team Leader : Professor Richard James and Dr Kerrie-Lee Krause

Project Background
The project aimed to develop and strategically disseminate resources designed to enhance the assessment of learning in the biological sciences in Australian universities. Consultations involved biological science academics, students, and recent graduates, across eight Australian universities about assessment issues, current approaches to assessment and successful assessment practice. The wider disciplinary community were also consulted through round table discussion and national seminars.

The long-term outcomes anticipated for the project include:

- a richer understanding among academics in the biological sciences of the role of assessment in learning and teaching and the range of possible approaches;
- the uptake of effective, innovative practice in assessment and the use of innovative assessment approaches;
- invigorated curricula which accommodate the need for a diversity of assessment opportunities;
- a network of practitioners sharing ongoing ideas and issues



Project Completed
The primary deliverable from the project is a website of ideas and resources for educators in the biological sciences: www.bioassess.edu.au
The website was launched at the leadership project event *Raising the profile of university teaching: Scientists leading scientists* on June 14, 2007.

The website delivers:
- A detailed compilation and synthesis of the core learning outcomes in the biological sciences, including generic skills
- A rich dataset on contemporary assessment issues in biological sciences based on the views of practitioners
- A set of examples of best practice in assessment in the biological sciences in a range of institutional and program settings, including across year levels and fields.

The website enjoys great popularity. In the first six weeks there have been 915 unique visitors to the website, who have accessed 28674 pages.

The project report can be found on The Carrick Institute website.

Project Commencement: September 2005 **Project Completed:** June 2007

2.6 Online assessment feedback

Online assessment feedback as an instrument of reflective learning practice in Human Biology (PP541)

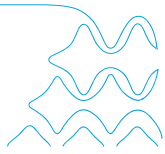
Lead Institution: The University of Western Australia

Partner Institutions: Curtin University of Technology; Edith Cowan University

Team Leader: Dr Jan Meyer

Background
The project team is developing an online assessment system for the improvement of evaluation of Human Biology students' higher level learning and skill development. The project team have sought to address the challenge of teaching large classes, by developing a system which will provide a more sophisticated online dialogue with students and improved individual feedback mechanisms. The assessment system will extend the aspects of Human Biology that can be assessed online (including laboratory exercises); provide analytical tools (including sets of exemplars and remedial materials); administer richer, more analytical feedback; and embed reflective practice and self-performance assessment into the feedback component of the online assessment system.

The project team have collaborated with partner institutions who have implemented the online assessment tool, in an effort to share evaluation and feedback and make improvements to the system.



Progress
The project team has implemented the developed online assessment system within large classes across three institutions. The system has successfully administered assessment questionnaires to large students classes; integrated feedback mechanism into the systems 'Test Banks' and unit assessments; provided an instrument for guiding students' reflective practice; and has provided feedback comments that are context specific (i.e. according to the conceptual errors made).

The project team has received additional funding and has had its completion date extended, in order to further improve the system. The project team sought to extend the capacity of the system to incorporate online assessment of short answers and calculations (and provide feedback for these), as well as interactive diagrams. The project team have extended the program usage within more human biology units across the three institutions.

The project report can be found on The Carrick Institute website.

Project Commencement: November 2005 **Project Completed:** November 2007

2.7 Extending teaching and learning in Biotechnology

Extending teaching and learning initiatives in the cross-disciplinary field of Biotechnology (DBI)

Lead Institution: The University of Queensland

Partner Institutions: Flinders University; Monash University; The University of New South Wales

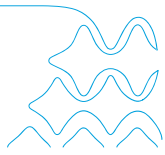
Team Leaders: Associate Professor Ross Barnard and Dr Damian Hine

Background
The project team have previously conducted studies to explore issues in undergraduate Biotechnology. This project will build upon their research in order to:

- Analyse the state of undergraduate biotechnology programs to determine the rate of change in content, changes in student numbers, and program sustainability;
- Explore the feasibility of a range of initiatives to benefit tertiary biotechnology education;
- Involve biotechnology educators (across institutions) as well as industry partners in order to generate insight into strengthening biotechnology education.

The project has proposed research initiatives to develop and improve biotechnology education sector wide. These include:

- Documentation of best practice models for teaching



- Researching the feasibility of integrating problem-based learning into existing programs at member universities
- Rejuvenating the network of Biotechnology educators in all states and increase link to industry and student representative groups through development of 'Uni-BEN'
- Developing a strategy for creating a program for graduate attribute identification and curriculum mapping for Biotechnology degree programs
- Reporting on successful management practices in biotechnology programs gleaned from the national survey.

Progress:

- The project team has collaborated with industry leaders AusBiotech, and this working relationship will continue throughout the projects duration.
- The project has used innovative ways to open communication and collaboration channels (Edna and knowledge database)
- The team has made great efforts to disseminate project data throughout the projects' duration. An extensive list of presentations and papers by the project leaders throughout 2007 is evidence of this.

Project Commencement: January 2007 **Project Completion:** January 2008

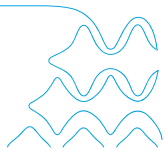
2.8 Quantitative principles in life sciences

Embedding quantitative principles in life sciences education (2006 fellowships)

Associate Fellows: Professor Peter Adams, School of Physical Sciences and Professor Philip Poronnik, School of Biomedical Sciences, The University of Queensland

There is a well documented "flight from science" highlighted by reductions in the numbers of students taking the "enabling sciences". This is paralleled by a "fright of numbers" such that the basic mathematical and quantitative skills of students in the Life Sciences not sufficient for the data acquisition and analysis that underpins fundamental scientific activity. The purpose of this work is to quantify the extent of the mathematical deficiency in first year Life Science students and to develop contextualised interventions to address these deficiencies. We will use an evidence-based approach to address three key questions:

(1) What are the real levels of mathematical skills possessed by, and required by, first year Life Science students?
(2) What are appropriate methods of assessing the levels of Life Science student engagement with mathematical concepts?
(3) How can the essential mathematical principles be embedded in first year Life Science education.



3. PHYSICS

3.1 Physclips

Physclips: multi-media resources for teaching first year university physics (CG620)

Lead Institution: The University of New South Wales

Partner Institutions: RMIT University; The University of Melbourne

Team Leader: Professor Joe Wolfe

Background
The project team responded to a need for greater developed syllabus resources articulated by the Physics community in Higher Education, and have produced a suite of multi media learning resources entitled 'Physclips'. Physclips addresses key topics in mechanics, electricity and magnetism- comprising approximately half of a typical first year Physics syllabus. At the core of Physclips are compressed film clips of demonstrations highlighting key concepts, and hyperlinked levels allowing for overview, an investigative mode and a deeper analysis mode. Physclips also provides an independent library of learning objects. Its flexible design promotes interactive private study and abstraction by teachers and education designers.

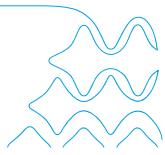
In order to determine the effectiveness of this resource, the team have analysed focus groups and have made comparisons between student classes utilising and not utilising the Physclips.

The project addressed a Carrick Institute priority area 'Innovation in Teaching and Learning, particularly in relation to new technologies'. The project has resulted in a useful resource to benefit Physics departments throughout Australia, and students studying physics at the tertiary introductory level.

Project Completed
The completed project has culminated in five live (web) modules, available online at the web address: www.physclips.unsw.edu.au. A recent development saw the amplification of single topic areas to include more comprehensive information. Web statistics are available and indicate that Physclips is a useful and popular learning aid.

The project report can be found on The Carrick Institute website.

Project Commencement: June 2006 **Project Completed:** July 2007



3.2 Physics using virtual reality

Teaching Physics using virtual reality (CG7-454)

Lead Institution: The Australian National University

Partner Institutions: The University of Queensland

Team Leader: Dr Craig Savage

Background
The project seeks to focus on the new learning styles of the "computer generation" by harnessing an increasing "simulation culture" in contemporary society. The project team will develop virtually interactive science education resources, using gaming technology. The project will develop and draw upon an interactive virtual world to teach topics in physics, with particular focus on special relativity. This is traditionally a conceptually difficult topic for students, and the project has chosen to draw upon research which asserts that special relativity can be formulated in terms of an observer's personal visual perceptions. The project seeks to develop a framework for developing simulation teaching packages, applicable to other disciplines.

The team will employ a software engineer to develop the software and an educational technologist to observe, understand and develop students' use of it. Evaluation of student engagement and learning will directly influence the software engineering improvements to this resource.

Progress
The project has only just commenced with formal agreements signed in November.

Project Commencement: November 2007 **Project Completion:** January 2010

3.3 Physics education in Australia

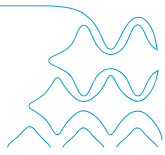
Forging new directions in physics education in Australian universities (DBI)

Lead Institution: University of Technology, Sydney

Partner Institutions: The University of Sydney & collaboration with 18 other institutions

Team Leader: Professor Les Kirkup

Background
Drawing upon the momentum of the team's previous work "Learning and Teaching of Physics in Australian Universities", the project endeavours to develop three strategic



areas of common concern among physics educators. The following areas will be researched, and findings will inform project deliverables:

- Service teaching
  The project seeks to identify, promote and disseminate good practice and collate quality resources. This will be achieved through the development of a website containing innovative resource materials, reporting, and through project workshops and networking meetings.
- Undergraduate experimentation
  The team will investigate effective laboratory learning environments. They will develop a website to engage the academic community in developing sustainable teaching practices, and to provide information about effective project programs.
- Graduates in the workforce
  The team will identify graduate destinations and employment opportunities and will explore the suitability of current course content and learning activities according to employer expectations. Reporting and student targeted advertisements will disseminate this information.

Progress
The project team will collaborate with the Australian Council of Deans of Science and heads of departments and program committees to initiate and sustain change. Workshops and network meetings will be organised within each State and the team will contribute to a national workshop in conjunction with the UniServe Science conference.

The project websites are extensions of the National Physics Project. This is available for viewing: http://www.physics.usyd.edu.au/super/AUTC/.

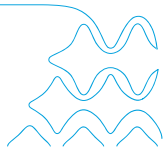
Project Commencement: March 2007 **Project Completion**: December 2008

3.4 Service teaching in Physics

New perspectives on service teaching: tapping into the student experience

Associate Fellow: Dr Les Kirkup, Department of Physics and Advanced Materials**,** University of Technology Sydney

In this Fellowship a deeper understanding of the value of service teaching will be developed through participant-observion in second and third year subjects serviced by first year physics at UTS. Through ‘first hand’ familiarity of the classroom, laboratory and other student experiences (such as on-line learning) in the medical, environmental and biological (MEB) sciences, the project will determine ways in which physics may best support the education of MEB students. A distillation of these experiences, as well as perspectives acquired through stakeholder interviews and focus groups, will result in a framework for guiding the development of physics service subjects adaptable to other disciplines with significant servicing responsibilities such as mathematics and chemistry.



4. LEADERSHIP

4.1 Scientists teaching scientists

Raising the profile of teaching and learning: scientists teaching scientists (LI616).

Lead Institution: Flinders University

Partner Institutions: The University of Adelaide; University of South Australia

Team Leader: Professor David Catcheside and Ms Karen Burke Da Silva

Background
This project seeks to change the culture of science teaching, in order to raise the value placed on teaching, by increasing scientists' capacities for leadership in science teaching and learning, initially in biological sciences. This will be achieved by enhancing the professional development of teacher education amongst science academics and develop their leadership capabilities in the field, thus improving the quality of science teaching and learning across Australian higher education. Sustained innovation in teaching is most likely to occur through the support of effective leaders.

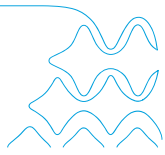
The project aims to produce measurable improvement in scientists' attitudes toward teaching and learning, to increase the scholarship of teaching and knowledge of science education research and to develop a model for exemplary science teaching that can be disseminated and adapted by other higher education institutions.

Progress
A database of exemplary scientists/teachers at Flinders University, University of South Australia and Adelaide University has been developed. Furthermore, networks with scientists from other universities have been created, towards developing a critical mass of South Australian science education researchers focusing on issues of science teaching and learning.

In June 13/14, 2007, a symposium was held, where participants explored the broader environment for contemporary biological science education. This was a useful platform to describe innovations in science education and to establish networks enabling the development of leadership, networking and research skills.

During the next stage of the project, a number of workshops regarding leadership, scholarship of teaching and learning and collaborative projects, will take place.

Project Commencement: August 2006 **Project Completion:** November 2008



5. SCIENCE

5.1 Science report writing

Creating a student centred online learning environment for report writing in the sciences and engineering (CG630)

Lead Institution: The University of Sydney

Partner Institutions: The University of New South Wales

Team Leader: Dr Peter McGee

Project Outcome
The project will create an integrated, student centred, transdisciplinary, cross-campus online learning environment (OLE) to provide students with a range of relevant, discipline-based resources and activities targeting report writing in the sciences and engineering. This will be achieved through:

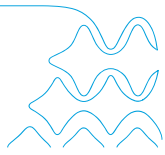
- Creation of an integrated, open source, student-centred, online learning and teaching environment that has two main spaces: the Report Writing Information space (RWI space) and the Topic Area space (TA space).
- Workshops for staff by stakeholders, on how to create the TA space and integrate RWI models into curricula.
- Evaluation strategies addressing student learning of report writing.

The OLE will be available across the university sector and therefore support a large number of students with their general writing and in particular with report writing throughout their undergraduate years. The rationale for this is that science and engineering students often struggle with written assessment tasks; deficiencies in highly-developed written communication skills – as required by academics and employers – are an ongoing concern. The OLE is a strategic way to address these issues and at the same time serves the needs of a more and more varied student body.

Progress
The project is well on track so far, one key success has been the planning and coordination of the diverse activities across disciplines. The team approach has led to greater engagement of discipline staff and students.

The concept design of the OLE is completed and a number of workshops will be conducted to train academic staff in using the question tools. The OLE will be trialled in 2008.

Project Commencement: August 2006 **Project Completion:** December 2008



5.2 Language support for science students

A cross-disciplinary approach to language support for first year students in the science disciplines (CG7-441)

Lead Institution: University of Canberra

Partner Institutions: The University of Newcastle; The University of Sydney; University of Tasmania; University of Technology, Sydney

Team Leader: Dr Felicia Zhang

Background
An emerging issue is the changing nature and diversity of students in science. This project aims to address the language needs of a diverse student body by investigating and testing strategic approaches to learning and teaching in First Year sciences. The project is concerned with the acquisition of language specific to science (rather than for science students to write grammatically correct sentences or for ESL students to improve language use). What this project will achieve is developing students' ability to see interconnectedness between language and scientific problems; developing their strategies to deal with language issues in science; and providing them with techniques, knowledge and experience needed to solve problems more efficiently in the scientific disciplines. The disciplines covered by the project are Biology, Chemistry and Physics.

This project aims to implement foreign language learning strategies to assist students in science to learn more effectively. It will create innovative online language oriented activities and a student-centred interactive face to face lecturing environment to implement these strategies.

Progress
The project has just commenced with formal agreements executed in October.

Project Commencement: October 2007 **Project Completion:** December 2009

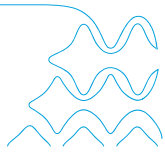
5.3 Examining the paradigm of science education

Reconceptualising Tertiary Science education for 21st Century (DBI)

Proposal Directors: Professor Sue Thomas & Professor John Rice

Project Team: The Australian Council of Deans of Science

Background
Tertiary science education remains largely grounded in the paradigm of technical discipline specialisation. It is a paradigm well suited to the production of researchers and technical



experts. However the shifts in the nature of industry due to globalisation, and changes to the knowledge base due to rapid technological change, challenge the validity of this paradigm. There are now a wide range of roles for people trained in science and mathematics that are not well catered for by the discipline specialist model of science education. These roles require varying depths of technical and conceptual knowledge. This project is the first stage in developing an alternative paradigm, and a consensus for change among Australia's tertiary science institutions.

The key outcomes planned in this project are:

- Development of an evidence 'database' on which future changes to science curriculum and teaching and learning pedagogy can be based.
- Cross-disciplinary national leadership of, and engagement in, the project through the Deans of Science network. This is expected to provide a model for how change can be driven from within an academic area
- Coordination of the input from (and output to) key stakeholders from across science disciplines

Key products of the review are:

- A comprehensive literature review across Science disciplines
- A representative cross-sectional picture of the current science learning environment at Australian Universities
- A list of core domains of scientific knowledge that takes account of how they relate to career aspirations
- A list of possible 'best practice' examples from literature and across Australian institutions.
- A collection and identification of the views of key stakeholders in Science within and beyond Universities
- The emergence of a broad collaborative national framework and reform agenda from within tertiary Science that will facilitate a sustainable approach to pedagogical change

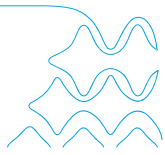
Project Commencement: March 2007 **Project Completion:** August 2008

5.4 Scientific writing in BSc courses

A programmatic approach to developing scientific writing embedded in Bachelor of Science courses

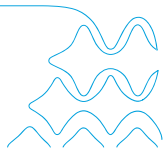
Associate Fellow: -Dr Roger Moni, School of Biomedical Sciences, The University of Queensland

The Business Council of Australia, Federal Government and some UQ staff claim that "science students can't write". Because of the known links between thinking and writing, this disturbing claim doesn't augur well for Australia's ability to educate scientists.



Further, it is unlikely that future scientists will be able to communicate the findings and processes of modern science. With the introduction of a research focussed BSc from 2008, it is imperative that science graduates are both scholarly thinkers and effective communicators. This project will:

- collate 2007 data about the teaching and assessment of writing, and writing competencies of BSc students, and use these baseline data to
- identify required types of writing, build a model(s) to embed the teaching and assessment of writing across the new BSc, and
- sustainably enhance the teaching and assessment of writing by engaging and supporting staff from other institutions in professional development around the model(s).



6. VETERINARY SCIENCE

6.1 Communication skills for veterinary students

Curriculum development and assessment to enhance communication skills for veterinary students (PP7-340)

Lead Institution: Murdoch University

Partner Institutions: The University of Queensland; The University of Sydney

Team Leader: Dr Jennifer Mills

Background
The project will develop curriculum and strategies to assess and enhance professional communication and leadership/ life skills in veterinary students. Effective and empathic communication is an essential attribute of veterinary graduates and includes aspects of personal and social/emotional intelligence and team skills. Uniquely in veterinary science it also includes an applied understanding of the human-animal bond. Assessment of both curriculum and changes in student competencies is an essential part of the project, with a collaborative sharing of experiences and outcomes with staff across all Australian veterinary schools.

The project aims to use educational tools to develop clinical consultation and communication skills in students using electronic and live simulation client scenarios. It will develop strategies to :

- assess and apply Human(Client)-Animal bond in consultations
- assess and enhance competency in communication, emotional intelligence and selected life skills; and
- methods of reporting these (including electronic portfolio)

Progress
The project has only just commenced with formal agreements in place since August 2007

Project Commencement: August 2007 **Project Completion:** September 2009

7. SCIENCE TEACHING AND LEARNING SPACES

7.1 Science Teaching Spaces

During the fortnight of activities in September this year, three innovative science spaces were showcased. Details of these will be provided in the report on 'Places and Spaces – for learning' due to be released late this year. A brief summary of each of these spaces is provided below.

The University of Melbourne – Chemistry tutorial space

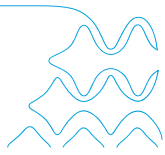
Contact person: Associate Professor Peter Tregloan

The redesigned small lecture theatre now accommodates tutorial activity for about 50 students a session and is essentially a small group interactive learning space. A building, known as the West Theatre was transformed between 2006 and 2007. After the initial planning in 2006 the newly modelled Chemistry Lab opened in February this year, and is in operation 5 days a week, from 9-5 every day. The original tiered lecture theatre became 5 zones on three levels, accessed by steps throughout the space. The new design allows for groups of up to 8 students to collaborate. Tables are designed around a rotating point and can be moved to accommodate 2 groups of 4 in each zone. Through the rotation of modules which comprise the table tops, spaces can be created to allow staff to sit among students within a group as part of supervision and interaction. At the same time use of technology through LCD screens, document cameras and PC's placed within zones allows students to process information and communicate it back to other zones.

The University of Newcastle – Undergraduate chemistry labs

Contact Person: Associate Professor Adam McCluskey

The undergraduate chemistry teaching laboratories and major wet chemistry research laboratory were refurbished in 2006. The laboratories now offer state-of-the-art teaching and laboratory facilities for Chemistry students. The extensive modifications involved laboratories on three floors. The laboratories now feature open plan bench space with secure facilities for the storage of materials when they are not required. There are increased numbers of fume cupboards in line with current occupational health and safety standards and all laboratories are equipped with an innovative thermo-regulation system. The laboratories have been designed to enrich the laboratory and learning experience of undergraduate chemistry students in a modern, highly attractive physical environment.



Monash University - Interactive microscopy and computing teaching laboratory

Contact Person: Associate Professor Gordon Sanson

This technologically advanced laboratory allows the teacher to take any student's microscope or computer image and display it for the whole class or send it to one or more individuals. Students can work at their own pace while still being able to share and join in with the class activity. In teaching how to use the latest software, or using this software for statistical analysis or data presentation, the teacher can control any or all of the student computers from anywhere in the laboratory. This novel system now allows teaching utilising the most up to date methods of image analysis and computing.