**Rosanne Taylor**
Faculty of Veterinary Science

*Scholarly teaching: An individual choice or a Faculty priority?*

Teaching informed by research is well accepted practice in a research led university like Sydney University. However scholarly teaching practices are not as widely embraced, but are vital to enable Faculties to adapt rapidly and effectively to the changing requirements of students and the society they will serve. Our Faculty has undergone a substantial shift from a transmission view of veterinary education to a student centred view, dedicated to making learning possible. Sustaining this scholarly teaching environment requires a systematic, collective focus on learning how to improve, in order to create a context that places students' experience of learning at the centre of faculty teaching decisions. It requires Faculty-level evidence-based practice to transform learning activities for all students, rather than the efforts of a few enthusiastic teachers working in isolation. We began with a deep understanding of learners' and teachers' perspectives of their context and acknowledgement of joint ownership of problems. This provided a platform for developing shared leadership and willingness to address factors that undermine teaching quality and innovation. We sought sustainability by systematically reshaping the faculty's structure, hierarchy, policies and practices to make a quality experience for learners the central consideration in all decisions. Changing the status of teaching so it is the key professional activity uniting a faculty, requires investment in staff learning, support for inquiry, reflection, creativity and innovation in education.

# Students doing Research

**Alex McBratney, Budiman Minasny, Damien Field, Stephen Cattle**
Faculty of Agriculture, Food and Natural Resources, The University of Sydney, 2006
*Students at the cutting edge contributing to the University's Research efforts*

In the Faculty of Agriculture, Food and Natural Resources a unit of study entitled 'The Soil Resource' (SOIL3004) has been constantly evolving (see Table 1) to invoke the new understandings of good teaching and state-of-the-art training in Universities. One of the themes of the teaching philosophies within the University of Sydney is *research-based learning*, which is to offer students the opportunity to learn about research and, to develop skills of research and inquiry that contribute to the Universities research effort. This has resulted in the development and implementation of a field-based teaching activity engaging the students in a relatively new area of research, Digital Soil Mapping (www.digitalsoilmapping.org) involves the design, sampling, data analysis and digital soil map production of contemporary soil classes. This work is at the cutting-edge of the soil related research and is supported by an ongoing ARC Discovery project on Digital Soil Mapping. In the learning environments fashioned, efforts are made to heighten student's awareness that the work they carry out is at the leading edge and they are directly making a contribution to the discipline. The approach also engenders high-level generic quantitative skills readily applicable to student research programs. A future challenge presented to the unit to enhance learning outcomes could involve the students in co-designing the sampling scheme.

Table 1: Evolution of the teaching/training methodology

| Year | 1990 | 2006 |
|---|---|---|
| No of students | 19 | 53 |
| Location | Mt Annan Botanic Garden – single issue | Pokolbin district, Hunter valley – multiple land uses – richer set of problems and issues |
| Technology – sampling | 20m grid - little to no prior info. – relatively small area — 20 ha | random catenas – a whole range of a priori data layers which are made available to the students. – much larger areas -200+ ha |
| Technology – coring | Hand auger (laborious) | Field coring rig |
| Technology – location | Topographic map | GPS |
| Underlying model | conventional soil survey | digital soil mapping |
| Principal output | hand constructed soil map | digital soil map constructed using statistical and GIS tools |
| Student outcomes | Knowledge of traditional techniques<br>Limited communication skills | Thorough grounding in latest technologies and cutting-edge digital soil mapping methodology (developed at USyd)<br>Experience of land management issues<br>Generic report-writing skills |

**Damien Field and Markus Grafe**
Faculty of Agriculture, Food and Natural Resources
*From experimentation to publication*

It has been reported in the literature (1) that the experience of young learners in traditional science practical classes strongly influences how they conceptualize science and scientific research, i.e., that science is a set of irrefutable facts and any anomalies they observe in their practical experiences are aligned with their lack of technical abilities. With this in mind, we set out to challenge this observation by developing a research-based practical experience as part of the Environmental Science Chemistry (SOIL4007) offered to final year students in the Faculty of Agriculture, Food and Natural Resources. Students undertook a series of interrelated experiments on a soil profile they had sampled in the field, from which they collated and interpreted the resulting data for publication in the *Australian Journal of Soil Research* (AJSR). The students were required to keep their own detailed laboratory book describing their experiments, record how they overcame difficulties they encountered, and through consultation with each other and the literature try to explain any anomalies they observed. The students were given complete autonomy on the theme of the paper they were to write for the journal. Keeping in

line with the requirements of publishing research material in science, the students were informed that the work was to be assessed using the criteria that a reviewer for AJSR would use to accept the manuscript for publication.

**Keywords**: research-based teaching, interrelated experimentation, student autonomy, publication

**Source**: (1) Ala Samarapungavan, E. L. W. & Bodner, G. M. Contextual epistemic development in science: A comparison of chemistry students and research chemists. *Science Education*, **90**(3), 468-495.

## Students learning Research Methodologies

**Dale Hancock, LL Nguyen, Gareth Denyer, Jill Johnston**
Faculty of Science
*Bringing gene chips into the undergraduate class*

Gene chips are increasingly employed in molecular biology research to monitor the expression of a large number of genes in a single experiment. We have introduced this versatile tool into our third year Biochemistry Advanced course to provide undergraduate students with an opportunity to carry out experiments using state-of-the-art techniques. The experiment is presented in six laboratory sessions and takes students from the tissue sample right through to data analysis. The model chosen, the murine erythroleukemia (MEL) cell-line, shows large changes in gene expression when treated with agents such as dimethyl sulfoxide (DMSO). Students isolate RNA from control and DMSO-treated MEL cells, prepare fluorescently-labelled c DNA and apply the labeled samples to a standard cDNA chip. After scanning the chip, up- and down-regulated genes are selected using an "in-house" user-friendly database program. Not only do students gain experience in a wide range of molecular biology techniques but they also have the excitement of using cutting-edge technology normally reserved for the lecture theatre and research laboratory..

**Vanessa Barrs, Julia Beatty, Geraldine Hunt, Paul Canfield, Hannah Forsyth**
Faculty of Veterinary Science
*Pathways to research for Small Animal Clinicians*

Recent veterinary graduates are highly focused on their role as clinicians and often have difficulty identifying linkages between practice and research. The new postgraduate program at the University Veterinary Centre, Sydney, enables postgraduate veterinary interns to identify these linkages, providing a crucial pathway from graduate veterinarian to clinical researcher.

This is achieved by immersing postgraduate interns in a rigorous academic environment, including regular class activities and assessments that link to their learning as clinicians. This supervised apprenticeship in which expertise is modeled and explored in practical ways, enables students to engage in case-based research in collaboration with clinical academic supervisors. Equipped with skills required for scientific investigation and publication, students progress further to plan and execute clinical research projects.

Additive analytic and non-analytic reasoning processes developed in the clinical setting are essential skills for effective clinical research. Exploration of the relationships between clinical research and veterinary practice provides opportunities for graduate veterinarians to consider undertaking higher research degrees.

# Faculty investigating student learning

**Rosemary Thompson, Charlie Macaskill, Dave Galloway, Timothy Schaerf**
Faculty of Science

*The Wave Concept Project*

Wave ideas are used to describe a very diverse range of physical phenomena, with a mathematical framework that encompasses certain unifying features. Mathematical work with waves is much more difficult for students not familiar with the underlying physical concepts. Traditionally these are developed in high school, in science experiments with vibrating strings, ripple tanks and prisms, but many mathematics students at the University of Sydney no longer have this background.

The aim of the Wave Concepts Project is to develop an on-line module to provide demonstrations of physical phenomena, and more particularly to relate these directly to the mathematics, as presented in three units of study. These are senior or advanced intermediate units [MATH3078/3978, PDEs and Waves (Normal/Advanced), and MATH2965, Introduction to PDEs (Advanced)]. The module is not remedial in approach; the intention is to rapidly enhance physical insight and appreciation of the role of mathematics in problem solving. In future it is hoped to expand the module to allow for demonstrations resulting from student projects, and research interests of staff, to be included. The diversity of relevant research problems is reflected in the interests of our group. These range from biomedical ultrasound (sub-millimetre waves in the body), through geophysical fluid dynamics (e.g. surface waves in the ocean, ship waves, planetary waves) to solar astrophysics (waves in the Sun's corona and interior).

A *WebCT* quiz based on the Wave Concepts Module will form part of the assessment for MATH3078/3978 from 2007. During 2006 participation is voluntary. We have developed an initial 18 question quiz that focuses on familiar phenomena. For example, one question concerns the change in direction of wavefronts approaching a shoreline. This can be readily observed by visiting the beach, or understood mathematically from the given relation between wave speed and water depth. This quiz will be released twice in 2006, before and after the relevant lectures on wave theory. The results will be used to help in identifing those physical concepts that need to be elaborated in the final form of the Wave Concepts Module.

**Paul Sheehy, Gerard Marcus, Federico Costa, Rosanne Taylor**
Faculty of Veterinary Science

*Evaluation of the impact of e-Learning on learning experience of undergraduate students in the Faculty of Vet science using SCEQ and USE survey data*

The evaluation of the impact of e-learning activities on the learning experience of students can often be difficult to quantitate using assessment outcomes, as many factors may influence the final assessment mark for individual students including the appropriateness of the assessment as well as support and context provided. The Faculty of Veterinary Science has turned to student perception of impact on learning experience as a measure of the influence that e-learning approaches has had at both a unit of study level (utilising USE data) and at a year/ degree level (utilising SCEQ data). As a Faculty we have focused on the blended delivery of authentic inquiry based online learning activities and as a result were interested in the impact of these e-activities on student learning. In 2003 the Faculty chose to include an e-learning question in the USE surveys which asked 'The online component (WebCT, VEIN and OLIVER) of the Unit enabled me to learn effectively'. Over time we have seen a steady increase in the mean response from all surveyed units of the student response (% agree or strongly agree) from 36% (2003), 43% (2004), 46% (2005) to 48% in semester 1 of 2006. It should be noted that this is a general reflection on the Faculty wide quality of e-learning support as different units of study are evaluated each year. In addition we are able to see which units of study have successful e-learning support and which units of study may require some remediation. Similarly, the SCEQ data for the questions relating to e-learning activity have also shown significant improvement over time and against other comparable faculties (see Table 1 and 2).

**Table 1: Mean percentage of students that Agree or Strongly Agree to the SCEQ e-learning questions prior to 2005**

| SCEQ Question 14*. | Faculty of Veterinary Science | All Science Faculties | All Faculties at USyd |
|---|---|---|---|
| **2001** | 64% | 66% | 61% |
| **2003** | 57% | 65% | 62% |
| **2005** | 74% | 67% | 64% |

Q14. Where it was used, information technology helped me learn.
* other questions seen in Table 5 are not in SCEQ surveys prior to 2005.

**Table 2: Mean percentage of students that Agree or Strongly Agree to the SCEQ e-learning questions in 2005**

| SCEQ Question | Faculty of Veterinary Science | All Science Faculties | All Faculties at The University of Sydney |
|---|---|---|---|
| **Q14** | 74% | 67% | 64% |
| **Q38** | 87% | 76% | 73% |
| **Q41** | 55% | 45% | 45% |
| **Q43** | 61% | 45% | 45% |
| **Q45** | 59% | 49% | 48% |

Q14. Where it was used, information technology helped me learn.
Q38. Resources on University of Sydney websites (eg. WebCT, Blackboard, degree course sites, faculty sites, etc.) supported my learning.
Q41. Communication online with students and staff helped my learning.
Q43. The online learning experiences of my degree course were well-integrated with my face-to-face learning.
Q45. My online experiences helped me engage actively in my learning.

From these data sets we are able to see that e-learning is influencing student learning experience favorably over entire degrees and as importantly we are able to identify individual units of study that have either excellent e-learning support and use those to benchmark against other units or alternatively to identify units of study where students express a dissatisfaction with the level of e-learning support offered and offer additional support and educational design expertise to assist staff in enhancing the learner support offered. These data allow us to evaluate, remediate and plan for enhanced e-learning support of student learning experience through and evidence based approach which could easily be implemented in other faculties.