

Physical chemistry in the lab

Imagine giving students the opportunity to advise academics on what they seek from an undergraduate laboratory course. The Australian Physical Chemistry Enhanced Laboratory Learning Project (APCELL) was carried out in just such a manner with a view to improve the learning, motivation and enjoyment of laboratory experiences by students studying chemistry.

Recently, at the School of Chemistry in the University of Sydney, over 40 academics and students from 23 Australian and New Zealand universities went into the laboratory to learn how to learn. Academics were required to think like students and students were given the opportunity to educate academics in what they want from an undergraduate laboratory course. For many academics it was somewhat of a shock to be reunited with techniques and apparatus that they had not used since they themselves were undergraduates, and to experience teaching from the students' perspective.

The exercise was part of the Australian Physical Chemistry Enhanced Laboratory Learning (APCELL) Project. Thirty different experiments from universities across Australia (and New Zealand) were given a thorough trial in the laboratory by academics and students. Over four days, participants critically evaluated the teaching and learning potential of the experiments and provided recommendations for improvement through a peer review process.

The overarching aim of the project is to measurably improve the learning, motivation and enjoyment of chemistry laboratory experiences by students studying chemistry. The motivation for the project was an awareness that students were indicating that their laboratory courses were not always interesting or motivating and that, as a learning experience, they could be improved. Academics throughout Australia, and elsewhere,¹ have recognised the problems for students studying physical chemistry. For instance, students' interests and expectations have changed over the last 20 years or so. Today's chemistry students

more often study chemistry as a means to an end rather than for its own sake. What motivates these students is not a fascination with the underlying concepts of chemistry but the applied relevance of the concepts in their particular context. Related to this, the workplace tools and tasks of physical chemistry have changed, and many of the industry standard instruments and techniques are not seen in the undergraduate laboratory.² Also, while our understanding of university learning and teaching has advanced as a result of educational research, the pedagogy underlying many experiments used in laboratories lags behind.

The aim of the Project is achieved by 1 Establishing a network of physical chemistry educators and students to share expertise in on-going curriculum development that reflects the varied needs of students and teachers across the nation.

2 Developing a suite of physical chemistry experiments that will facilitate improved student learning in physical chemistry. The use of an "Educational Template" ensures that experiments are based on sound pedagogy.

3 Creating an electronic database of all experiments, including the intended learning outcomes, typical data, analysis of results, and demonstrator notes and available across the Web.

While the project has at its core the development of a database of physical chemistry teaching experiments, the project is more than just another collection of academics' 'favorite' lab experiments. The development, review and submission cycle ensures that, ultimately, all the experiments in the APCELL database will have a sound educational basis and the potential to provide effective learning experiences for students.



The first task of the APCELL Project was the development of the 'Educational Template'. This operates as a pro-forma for submitting experiments and also provides a framework to support the authors and submitters of experiments in thinking about the educational design of their experiments. For some experiment authors, completing the template is an unfamiliar task. For some academics, thinking about how students experience and learn from their teaching, rather than what content they will cover and how they will explain things, can be quite a shift in perspective.

After the initial submission of experiments, the next major milestone was the Experiment Workshop, held at the end of January in the School of Chemistry, University of Sydney. The Workshop showcased the experiments that had been submitted to the APCELL database by having groups of students and academics undertake them just as would undergraduate students. With this experience fresh in their minds, the academics and students then discussed and evaluated experiments in terms of student learning. A crucial aspect of the Project in general and the Workshop in particular, has been the involvement of students in this evaluation process. One of the lessons learnt from having students involved for many academics is that they have found that they need to put in more effort than they initially thought necessary to communicate to students why they have been given a particular experiment in their course.

On the other hand, students have expressed concern that assessment methods in laboratories are not very clear. APCELL is facilitating a nationwide staff-student dialog to address these potential barriers to effective

undergraduate laboratory learning.

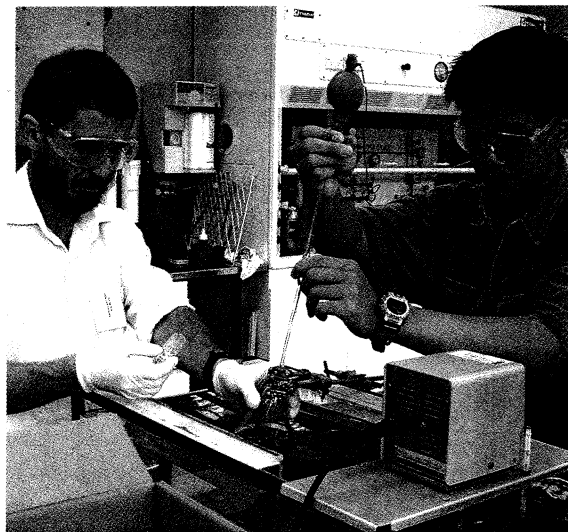
Through working together in the laboratory, in small group discussions and in larger panel-led discussions, students and academics attending the Workshop had a chance to explore each other's views on teaching and learning in the laboratory. While it was an intensive 4 days, with 30 different experiments being run in 6 sessions, and with discussion sessions before and after the laboratory work, it was the consensus of the participants that they had all benefited enormously from the Workshop.

More than one academic made the comment that they had found ways in which they could immediately improve their teaching practices. For instance, Dr Barry O'Grady of the University of Tasmania made the comment that 'Even after 33 years of teaching, it provided me with a new way of looking at the laboratory teaching program'.

The success of the Workshop, and the Project in general, has shown that it is important to develop and implement methods to ensure the ongoing viability of the submission and refereeing process beyond the initial funding period of the APCELL Project. The APCELL Project has the potential to provide a mechanism to support the recognition and reward of staff's scholarly work on laboratory teaching.

Ms Pippa Hepburn, a student of Curtin University, provided this testament to the Workshop,

'The really enjoyable aspect of this project was seeing so many academics seriously discussing how they could improve their teaching. I had no idea that lecturers cared this much!...I am returning to university with a more positive attitude to labs, learning and science in general.'



Michael Ridd (left) of James Cook University is reacquainted with basic laboratory techniques by Hadi Lioe from the University of Melbourne.

'Thanks for a most enjoyable few days'.

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For further information visit the APCELL web site, www.apcell.org.

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2 Information from the 32 consortium team members.