

Achievements of an ACELL workshop

Justin Read and colleagues describe some of the achievements of the recent ACELL workshop and some benefits for participants beyond improving the quality of student learning.

The Australasian Chemistry Enhanced Laboratory Learning (ACELL) project aims to help improve the quality of student learning in the undergraduate chemistry laboratory. Laboratory work accounts for about 48% of the time chemistry students spend in formal learning activities, according to the RACI's recent *Future of Chemistry Study*,¹ and it is vital that activities in this fundamental learning environment be educationally sound. Some of the rationale for the ACELL project has been described previously,² as has the physical chemistry predecessor of the current project.³⁻⁵

One of the criteria for the acceptance of an experiment into the ACELL database is that it be tested in a third party laboratory, which serves two purposes. First, this testing serves the pragmatic function of ensuring that everything necessary for the experiment to operate correctly has been provided. Submitters are required to provide

demonstrator and technical notes, as well as student notes, plus anything else that might be needed to run the experiment. Second, the submission is accompanied by a template which describes the educational objectives of the exercise. This testing provides the opportunity for review of both objectives and their implementation, by students and staff actually carrying out the experiment. Such third party testing is difficult to organise, which is why the ACELL project organises workshops to carry out this testing process on several experiments at a time.

The February 2006 ACELL workshop at the University of Sydney was attended by 33 academic staff delegates and 31 undergraduate students, drawn from 27 universities around Australia and New Zealand, plus the ACELL management team. The three-day workshop was supported by technical staff from the universities of Sydney and Adelaide, and 33 experiments were tested and evaluated, including collection of

staff and student feedback. Each day of the workshop began with a panel discussion, at which educational issues related to laboratory learning were discussed. Although staff delegates were discipline experts and student delegates provided insight into the lived experience of laboratory learning, formal knowledge of education research was not widespread. These panel discussions initially sought to engage chemistry academic staff in reflecting on their own curriculum decisions about teaching and the design of laboratory practice;⁶ processes were used to encourage staff to adopt a learner-focused design perspective. These processes drew on the experiences of the students, and include having both staff and students work collaboratively as equals on submitted experiments as 'students', providing each with a window into the other's perspective.

Each discussion session was followed by two three-hour laboratory sessions, separated by lunch. A one-hour debrief session, used to discuss experiments tested that day, was held in a local hotel at the end of each day, and was followed by dinner. Over the course of the workshop, each staff delegate tested four experiments, and spent two



ACELL delegates working on a series of different experiments.

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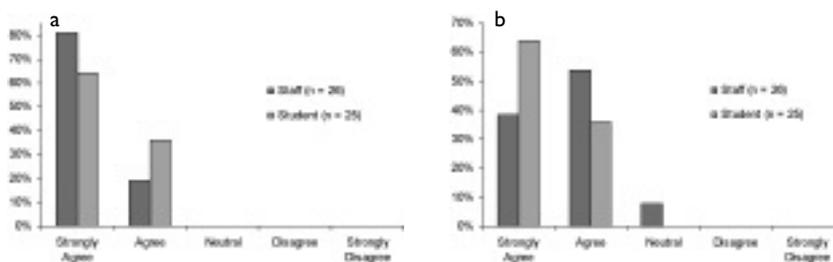


Figure 1. Delegates' responses to the survey item 'the ACELL workshop offers a useful means to improve students' learning in laboratory exercises' (a) and 'participating in the ACELL workshop has increased my understanding of educational issues' (b).

sessions acting as demonstrator for their submitted experiment; each student delegate tested six experiments. This is a highly intensive workshop format (several staff commented on their surprise at how tiring they found the process), but was also a rewarding process for the delegates. As one staff member commented, 'meetings of this type need to be a basis of communication between practitioners at Australian institutions'.

Data on the workshop were collected in several ways. First, delegates were asked to complete surveys about each experiment they tested, which, together with the discussions at the debrief sessions, provided feedback on each experiment to its submitter. Second, a survey was conducted at the end of the workshop, which examined the workshop process itself and its strengths and weaknesses. Each of these surveys was designed to provide a mix of hard (quantitative), medium (coded qualitative) and soft (verbatim comment) data, allowing a deeper understanding to be achieved through the use of methodological triangulation.^{7,8} Finally, some in-depth interviews with delegates have been completed, and more are planned for the future. Analysis of these data showed the positive contribution of the workshop to improving student learning and professional development. This development was facilitated by both the insight gained through delegate interactions and the improvement in understanding and awareness of educational issues.

In order for staff–student delegate interactions to be most valuable, ACELL deliberately sought to break

down barriers so that delegates could work as equals. This was one of the reasons for having all delegates work in the laboratory as 'students', for assigning staff delegates to some experiments outside their area of subdiscipline chemical expertise, and also for holding the debrief sessions in an informal location with drinks and nibbles provided. Despite this setting, it was clear that delegates approached these sessions very seriously, with many discussions of experiments continuing at dinner. Said one student: 'the debrief sessions seem to be the most valuable, since we were all able to critique the experiments and really get our opinion heard, and especially to get changes made to better the experiments'. Another commented that these sessions were 'where the majority of good feedback to the demonstrators occurs, as "students" could bounce ideas of each other'; this comment also highlights the collaborative environment that existed throughout the workshop. The level of engagement in these sessions was positively commented on by staff as well, with one describing the most surprising aspect of the workshop as 'how engaged staff and students were, even over the beer sessions'. The value of these sessions was also reflected by the fact that several delegates suggested they be moved to a more formal location, such as a tutorial room, because the background noise level at the hotel could be distracting.

Delegates unanimously agreed that the workshop provided a useful means to improve student laboratory learning (Fig. 1a) and this was achieved in several ways. First, the

workshop provided the rare opportunity for staff to think about educational issues uninterrupted, facilitated by the immersion nature of the workshop design. One staff member commented that the most valuable aspect of the workshop was that it 'made me sit down and think carefully about what I wanted my students to get out of my experiment, and how I could judge if they had been successful'.

Interview data suggests that such reflection occurred not only at the workshop itself, but also prior to it when preparing the template on their submitted experiment. Second, the workshop afforded networking opportunities: in identifying the most positive aspects of the workshop, staff commented on the 'opportunity [provided] for discussions with like-minded interested colleagues' and the networking afforded by 'meeting other people with a similar interest in education'. Third, participation in the workshop was reported by delegates to have led to an improvement in their understanding of educational issues (Fig. 1b).

One staff member commented that 'as a scientist, I feel lacking in educational knowledge'. Such a sentiment is likely a natural consequence of the typical academic career path with its heavy research focus. Because teaching is a core activity for academic staff, it is desirable for staff to be given the opportunity to address any such knowledge deficit, and the ACELL project provides just such an opportunity. This improvement in educational awareness was also of benefit to student delegates, who noted that they will be more aware of learning goals in laboratory work in the future, with beginning research students also commenting on their behaviour as demonstrators at their home institutions. As one student put it, 'that was one of the best chemistry experiences I have had in the last four years – knowing that there are people that are concerned with teaching in labs and what makes a great lab and how they can be improved has given me ideas that

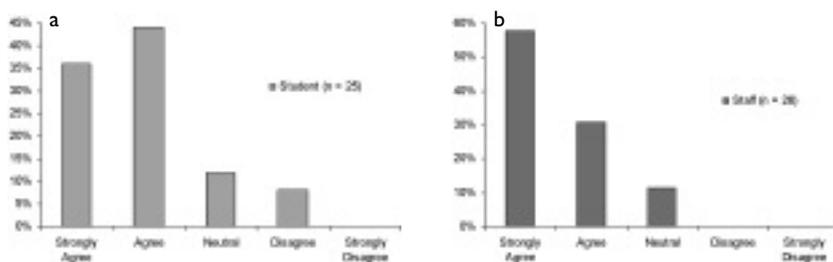


Figure 2. Student delegates' responses to the survey item 'academic staff are more interested in laboratory learning than I had previously realised' (a) and staff delegates' responses to the survey item 'participation in the ACELL workshop has reminded me of what it is like to be a student' (b).

I can take back when I demonstrate to students'.

Another benefit from the workshop was that staff and students gained insight into the other's perspective. Students were particularly surprised at the interest that staff have in improving the quality of laboratory learning. One student described the most valuable aspect of the workshop as 'being able to give feedback on the labs as a student. It was a rare opportunity and I did not realise how interested the demonstrators were in student opinion.' Another commented that, 'most of all, though, I was shocked to find that the academics at the universities really want to make our laboratory experience as worthwhile as possible'. The most surprising aspects of the workshop for two other students were 'how dismayed staff felt at the current way practicals

are run and what they wanted to achieve from them' and 'the eagerness of staff to improve their own teaching and improve teaching standards in general'. Figure 2a suggests that these opinions were widely held amongst student delegates, and that their workshop participation had led to a reappraisal of this opinion. Recent Australian research into the first year experience^{9,10} has shown that around 30% of university students respond negatively when asked about the quality of university teaching, and that, over the last decade, students have become more positive as a result of improved perceived staff approachability and enthusiasm. ACELL has a role to play in such improvements, in part by changing the views of participating students (as one student put it, 'the workshop was fantastic. I have a deeper appre-



Throughout the workshop, students and staff collaborated as equals.

ciation and outlook on practicals and my application to them. If every student could see what happened over these three days, I think all attitudes would change'), and in part by energising staff while equipping them with tools to better meet students' learning needs.

Amongst staff, there was strong agreement that participating in the workshop had reminded them of what it is like to be a student (Fig. 2b). The workshop was organised so that morning sessions had staff–staff and student–student teams, with teams being mixed in the afternoon. This organisational structure had several advantages: it allowed staff to work together with students as equals, while still allowing for peer networking; it allowed staff to work together in an unusual environment – as one staff member put it, producing a 'great collegial interaction between staff from different institutes'; and it helped to ensure a broad range of perspectives on each experiment. Working as a student on a lab exercise is something that some staff had not done for a long time. As one staff member said, 'carrying out experiments which I have not recently done reminds me of, or shows me, some of the difficulties students may have with an experiment'. Another staff member commented on the value of 'being placed in the position of a student doing an unfamiliar exercise', and yet another commented in surprise that 'the students performed better than the staff in some experiments!' From a constructivist standpoint,^{11,12} it is well established that students learn best from student-centred activities; however, it is difficult for staff to design such activities if they have difficulty placing themselves in their students' position. The ACELL process provides a useful window for staff into the student's perspective, thereby facilitating the design of learner-centred laboratory exercises.

One final benefit for staff was new ideas that they could take back to their own university. One staff member commented that there were a 'couple of pracs that I am going to

seriously plagiarise', while another commented that they had encountered 'ways to incorporate more variables into [the] lab to make them more "enquiry-driven"'. Interview data suggests that some staff are attempting to introduce some ACELL experiments into their existing curricula, in place of some of their less effective laboratory exercises. Such incremental change is made possible by the collaborative efforts of all participating institutions, and will hopefully lead to continuing improvement in student laboratory learning.

It seems clear that the ACELL workshop had many benefits for all of the delegates involved. Although its prime aim was to allow the third-party testing of submitted experiments, staff and students gained benefits far beyond this aim – from professional development, through gaining insights into each other's worlds and into the operation of universities throughout Australia and New Zealand, to meeting new and interesting people. The workshop assisted in the development of a community of practice for those responsible for laboratory experiments in undergraduate programs. From the ACELL management team's perspectives, it was gratifying that the whole team

interacted so well, that so much was achieved, and that the feedback received was so overwhelmingly positive – this would not have been possible without the enthusiasm and dedication of all the delegates. Their collective achievement might best be summarised with one final student comment:

ACELL was such a great experience! I have met some amazing people, quirky people, and fascinating people. It makes you realise that there really are people out there with the same interests. I am very honoured to have been part of a group that can make such a profound change to the chemistry curriculum in Australia/NZ. Cheers for the opportunity! :)

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A group of delegates discuss an activity involving a problem-oriented approach to understanding analytical chemistry.