

ACELL
Australasian Chemistry Enhanced Laboratory Learning

The ACELL Project (The Australian Chemistry Enhanced Laboratory Learning)

“Developing Better Ways of Teaching in the Laboratory”

Scott Kable
*School of Chemistry
Univ. of Sydney*

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4-Sept-2006

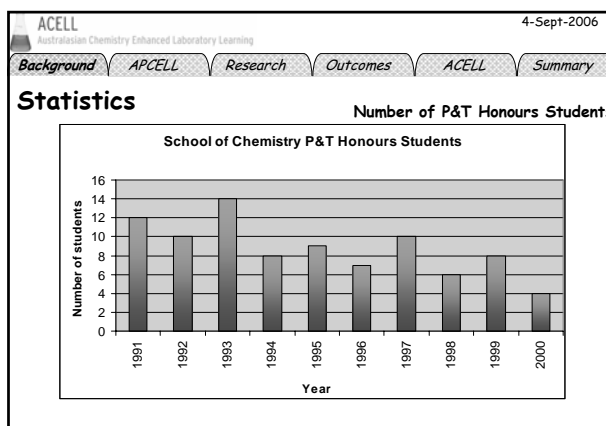
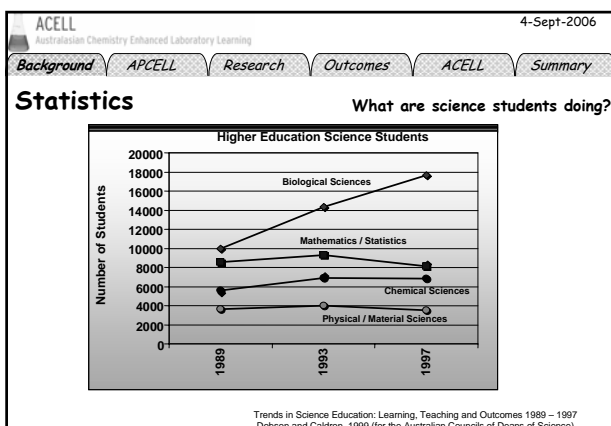
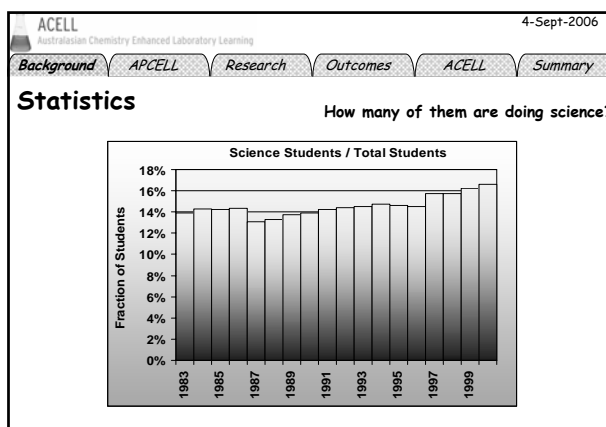
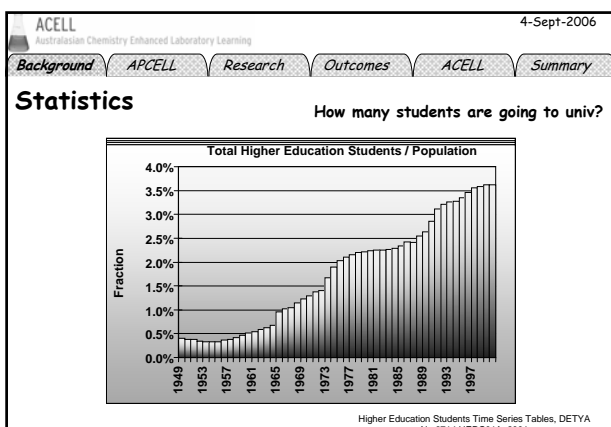
Background APCELL Research Outcomes ACELL Summary

Australasian Chemistry Enhanced Laboratory Learning Project

Directors: *Simon Barrie (ITL, Sydney)*
Bob Bucat (Chem, UWA)
Mark Buntine (Chem, Adelaide)
Geoff Crisp (ITL, Adelaide)
Adrian George (Chem, Sydney)
Ian Jamie (Chem, Macquarie)
Scott Kable (Chem, Sydney)

Assoc. Dir. *Justin Read (almost PhD in Chem. Ed., U.Syd.)*

>30 partner universities in Australia / NZ



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Description of problem

Some "facts":

- 35 Australian universities teach chemistry - at least to First Year.
- ~20,000 students per year take these courses.
- Laboratory training is an **ESSENTIAL** component in chemical education.
 - RACI accreditation = 350 hours / year

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Laboratories

Physical Chemistry is particularly vulnerable to student discontent in the laboratory

- Arcane concepts
- Antiquated experiments
- Perceived lack of relevance
- Reliance on expensive instrumentation that not all departments can afford
- Boring

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Laboratories

What Can We do to Reverse the Trend?

Maybe teachers can teach better

Maybe students can learn better

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Laboratories

Think back to your own undergraduate experience...

- recall one laboratory exercise you remember as being a good learning experience.
 - Why?
- recall one laboratory exercise you remember as being a poor learning experience.
 - Why?

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Australian
Physical
Chemistry
Enhanced
Laboratory
Learning } **APCELL**

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History of APCELL

1. The Idea

- ~8 years ago
- discussed at several occasions that we were together (e.g. conferences)
- several other people also knew about the idea and had already had some input.


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History of the project

2. When we started...

- In September 1998, Mark Buntine and I decided we would have a go at getting funding for the idea.
- We wrote to all 35 Australian Universities that teach chemistry.
- N.B. An existing network (the R.A.C.I.) was invaluable and important to demonstrate network already exists.





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History of the project

3. The Proposal

- CTL reviewed several drafts of our application, and it is here that we realise we don't speak the same language!!
- Barrie (ITL) joins team.
- Funded by CUTSD (\$167,000)
 - pays for Assoc. Director (Dr Ian Jamie)
 - pays for first APCELL workshop

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Chemical Education Research

- Research Led Teaching
- Enquiry-Development Cycle
- Action Research
- Broader Education Research

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Research Led Teaching (RLT)

The use of disciplinary research in teaching - for example, the use by a teacher of one of their current journal publications reporting a key piece of cutting edge research;

Teaching and curriculum that uses evidence derived from research and inquiry - for example, designing an assessment task on the basis of published education research or one's own inquiries into how students approach particular assessment tasks;

Research into teaching and learning - for example, a research investigation into how students approach different assessment tasks.

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Formulation of APCELL development project funding application

- Research literature on student learning
- Research literature on laboratory T&L
- Research literature on academic development

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The Inquiry-Development Spiral



- Inquiry into the nature of the barriers
- Why hadn't somebody done something about this before?
- T&L conceptions
- Resources

- Inquiry into student learning from the student experience perspective
- Gather data on students' perceptions of their teaching & learning experiences

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The Inquiry-Development Spiral

Ian Jamie joins team

Dissemination of teaching development products
 Resources that support further inquiry into T&L
 APCELL database, Template, Review Tools, Resources, People

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(Canberra Workshop)
 Participatory development of template
 Engage with academics' views of T&L
 Shared student learning perspective

↙

(Sydney Workshop)
 Collaborative review / inquiry into T&L effectiveness of APCELL laboratories
 Engage with academics' views of T&L

→

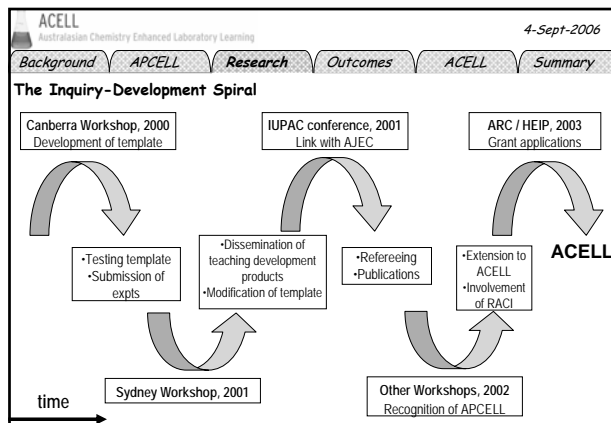
Development of laboratory classes and resources using template
 Peer (staff and student) review of laboratory classes and resources - and subsequent revision

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Experiment workshop, Sydney, Jan, 2001

55 participants, including 20 students
30 experiments, all set up and performed over 3 days
extensive review

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Outcomes of APCELL

- Database of Experiments
- The Educational Template
- Workshops at Aust. Phys. Chem. and Chem. Ed. conferences
- Collaboration with the *Australian Journal of Education in Chemistry*
- Uptake of experiments and methods by Chemistry departments
- Network of academics and students
- Communication

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The Educational Template

Section 1: Summary of the Experiment

Section 2: Educational Analysis
What are the intended learning outcomes
How the outcomes are achieved
How the outcomes are monitored

Section 3: The Student Learning Experience

Section 4: Documentation
student notes, demonstrator notes, technical notes, etc

Section 5: Peer Assessment Criteria

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APCELL Database

APCELL database
A database of experiments that have been educationally validated.
including student, demonstrator and technical notes
14 fully refereed experiments (available to all)
~20 further submitted experiments (available upon registration)

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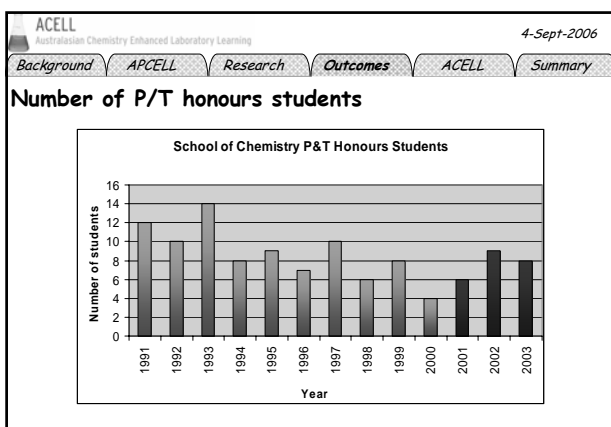
Refereeing and Publications

- Educational template and documentation assessed by academics and students
- Experiment set up and run by academics and students in an independent laboratory
- Fulfils "scholarly activities" criteria, and Quality Improvement/Quality Assurance criteria
- Experiment entered into APCELL database - publicly available
- Publication in *Australian Journal of Education in Chemistry* - refereed journal

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Refereeing and Publications



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Where to from here... ? (ACELL?)

| | |
|-------------|----------------------------------------------------------------------------------|
| Sep-1998 | Approach to Australian Universities for support |
| Late - 1999 | CUTSD approves project funding |
| Feb-2000 | Launch of project (11th National Convention, RACI) |
| Jan-2001 | Experiment Workshop, University of Sydney |
| Jul-2001 | Presentation at World Chemistry Congress, Brisbane |
| Jan-2002 | Presentation and Workshop at RACI meeting, Christchurch, NZ |
| Feb-2002 | Official end of APCELL project (phase 1?) and electronic publication of database |
| Nov-2002 | Workshop at Chem. Ed. Conference, Melbourne |
| May-2003 | Team expanded |
| Feb-2004 | Joint Workshop of Phys.Chem. / Chem. Ed. Conferences, Hobart |
| April-2004 | ACELL HEIP application submitted and funded (~\$144,000) |
| Late-2004 | ACELL STARTS! |

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All of Chemistry - ACELL

Three principal aims

- Database of educationally and chemically sound experiments, that have been tested by both academic staff and students
- Provide for professional development of chemistry academic staff
- Facilitate the development of a chemistry education community of practice

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Methods - Educational Template

Section 1 - Summary of the Experiment

Section 2 - Educational Analysis

- Learning outcomes in areas
 - Theoretical and Conceptual Knowledge
 - Scientific and Practical Skills
 - Thinking Skills and Generic Attributes

Section 3 - Student Learning Experience

Section 4 - Documentation

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Educational Analysis

For each learning outcome:

- What should students learn?
- How will students learn it?
- How will staff and students know that students have achieved the learning outcome?

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February 2006 ACELL Workshop

- 33 academic staff
- 31 undergraduate students
- 27 universities from across Australia and New Zealand
- 33 experiments

⇒ 3 very full days

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Workshop Program

| | 8:30 am to 9:00 am | 9:00 am to 10:00 am | 10:00 am to 1:00 pm | 1:00 pm to 2:00 pm | 2:00 pm to 5:00 pm | 5:00 pm to 5:30 pm | 5:30 pm to 6:00 pm | 6:00 pm to 7:00 pm | 7:00 pm to ??? |
|------------------|-----------------------------|--------------------------|----------------------------------|--------------------------------------------------------|----------------------------------|-----------------------|-----------------------|--------------------------------|----------------|
| | Lecture Theatre 4 | | Level 3 and Level 5 Laboratories | Lecture Theatre 2 Foyer and Chemistry School Courtyard | Level 3 and Level 5 Laboratories | | | "The Pull" Royal Hotel | |
| Monday 13 Feb | Registration | Welcome and Introduction | Experiments | Lunch | Experiments | Clean Up and Set Up | Review of Experiments | Dinner at Royal Hotel | |
| Tuesday 14 Feb | Forum on Student Refereeing | Panel Discussion | Experiments | Lunch | Experiments | Clean Up and Set Up | Review of Experiments | Dinner at Royal Hotel | |
| Wednesday 15 Feb | | Panel Discussion | Experiments | Lunch | Experiments, plus Clean Up | Final Discussion, LTA | Review of Experiments | Workshop Dinner at Bunn Gastro | |

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Laboratory Testing



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Collaborative Work



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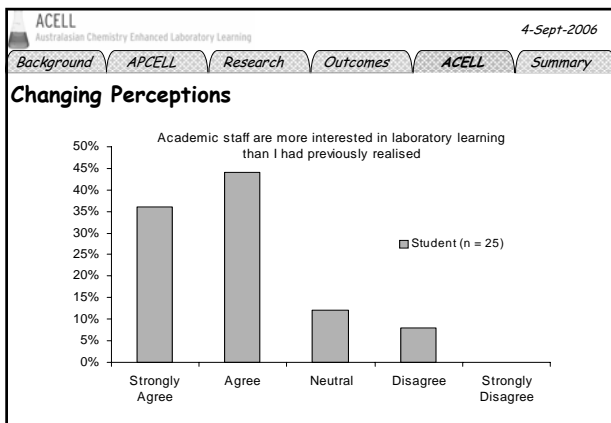
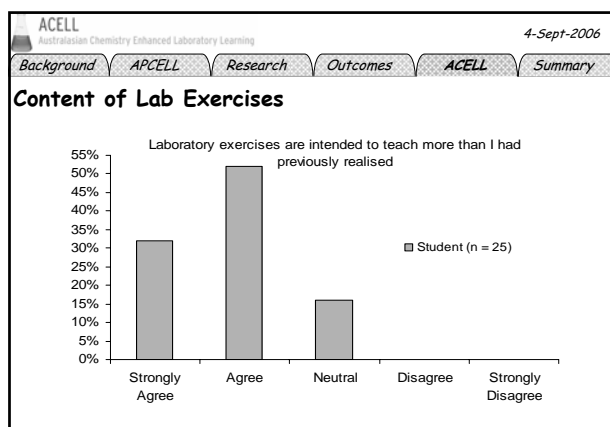
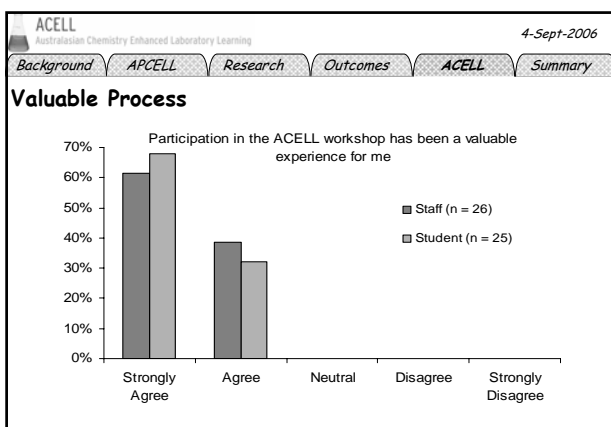
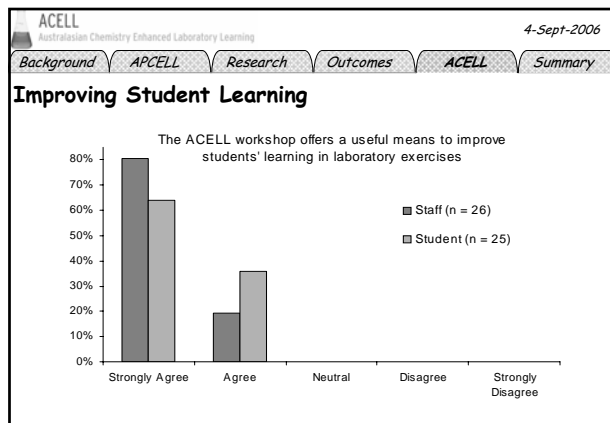
Group Discussion



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Evening Debrief Sessions

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Delegate Feedback

Staff: "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"

Staff: "The interaction of participants was excellent - so much better than a conference - 'learning in a fun environment'"

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Perceptions

Student: "I learnt that also there are teachers / lecturers that actually do care about their students and want to improve their learning experience"

Staff: "That there were so many academics interested in education and student interests"

Staff: "The enthusiasm with which students engaged in the activities and the thoughtful comments given"

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Improving the Experiments

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"

Student: "The templates showed me exactly what objectives lecturers were actually trying to get across in practicals"

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Potential of ACELL

Staff: "Workshop was excellent and meetings of this type need to be a basis of communication between practitioners at Australian institutions"

Student: "The workshop was fantastic. I have a deeper appreciation 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"

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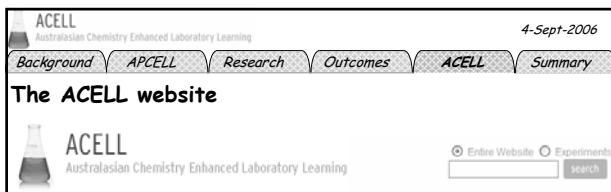
The ACELL Website

- ♦ Experiments and their documentation
- ♦ Publications, including published papers
 - 13 published experiments from APCELL
- ♦ Information on ACELL events
- ♦ Education resources for ongoing professional development
 - Process information - content analysis
 - Theory information - constructivism

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The ACELL website



hyperlink to website

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Summary and Acknowledgements

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Summary

- ♦ Database of student-tested, educationally sound undergraduate experiments
 - 30 under review, aim is to have >50 reviewed by mid-2007
- ♦ Professional development of delegates
- ♦ Provision of educational resources
- ♦ Building a community of practice
- ♦ A model for other countries and domains
 - being trialled in microbiology at U. Adelaide


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Acknowledgements


Staff and student delegates
HREC at the University of Sydney

Funding and support



Australian Government
Department of Education,
Science and Training

*Aust. gov't grants
(CUDST, HEIP)*



*Royal Aust.
Chem. Institute*

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Acknowledgements

"The Team"


Sydney:

- Justin Read
- Simon Barrie
- Adrian George




Adelaide:

- Mark Buntine
- Geoff Crisp




Macquarie:




- Ian Jamie







Western Australia

- Bob Bucat



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<http://acell.chem.usyd.edu.au>