

ACELL
Advancing Chemistry by Enhancing Learning in the Laboratory

Making Laboratory Exercises Good Learning Experiences:

The ACELL Project

Scott Kable and Mark Buntine
Simon Barrie, Bob Bucat, Geoff Crisp,
Adrian George, Ian Jamie, Justin Read

Are you from the tertiary or secondary sector?

- Tertiary
- secondary

Sector	Percentage
Tertiary	29%
secondary	71%

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Tertiary secondary

Had you heard of ACELL before coming to this conference?

- Yes
- No

Response	Percentage
Yes	45%
No	55%

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Yes No

Who here thinks they know what ACELL is about?

- Yes
- No

Response	Percentage
Yes	31%
No	69%

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Yes No

Who here has participated in an ACELL experimental workshop?

- Yes me
- Unfortunately not

Response	Percentage
Yes me	69%
Unfortunately not	31%

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Yes me Unfortunately not

Context

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 / B.Sc.
 - 2006 "Future of Chemistry" Report: 48% of student time in lab.

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Laboratories:

Chemistry laboratory activities are particularly vulnerable to student discontent:

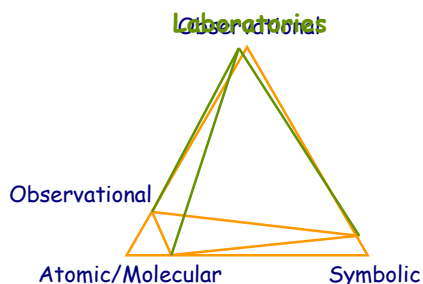
- Arcane concepts;
- Perceived lack of relevance;
- Reliance on instruments as black boxes;
- Following recipes; and,
- Boring and/or repetitive.

Laboratories:

- Potential benefits from lab work
 - Develop technical skills
 - Make theory more concrete
 - Engage students in the practices of science.
- Challenge
 - Develop a lab program that lives up to its potential

Laboratories:

David Treagust
Roy Tasker



APCELL

- Project began 1999 with phys chem focus;
- Bring departments together;
- Build on established effective experiments;
- Provide resources needed to implement new experiments easily:
 - Technical Notes.
 - Demonstrator Notes.
 - Student Notes.
 - Results Proforma.
 - Hazard Assessment.

Outcomes of APCELL

- Database of educationally validated experiments and related website materials;
- The Educational Template;
- Workshops at Australian 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.

Refereeing and Publications



All of Chemistry – ACELL

■ Four 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**.
- Researching **learning** in the laboratory environment.

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A Question...



What do you think are the criteria for
a high quality undergraduate
chemistry laboratory?

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Another Question...



What do you think students say
makes a good chemistry lab?

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What Chemistry Students Think Makes a Good Lab...

Make it

- relevant to why I'm here ← Gwen Lawrie, Sunday
- a good use of my time ← George Bodner, in reponse to David Treagust's talk
- applicable to my world
- clear why I'm doing the lab
- clear what I am supposed to take away
- challenging, but do-able

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What Chemistry Students Think Makes a Good Lab...

Let me

- do something of which I can be proud
- have fun – laboratory work shouldn't be a chore
- engage my mind and not just my hands
- have the help I need, but don't take over – support my autonomy and allow me choice
- see that you value my efforts and achievement

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Chemistry Student Feedback...

Gwen Lawrie, Sunday

- “If we are simply following a recipe without thinking about what we are doing and without any idea of why we are doing it – sure we get through the lab, but what have we learnt ... nothing much.”
- “What is learnt along the way is what makes the journey worthwhile, how we get there counts – it’s why I’m here.”

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What Does the Educational Research Say...

- Similar things, but more cautiously...
 - By following a recipe students “are not ‘doing an experiment’, but ‘carrying out an exercise’”
 - making limited intellectual demands on students, who “often seem to go through the motions...with their minds in neutral”.
 - Bennett and O’Neale (1998, p. 59)
- Insufficient evidence of benefits from lab work ...Hofstein and Lunetta (1982, 2004)

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Guidance on Other Considerations

- Student-Centred / Constructivist Perspectives
- Not Discovery...
 - Mayer, 2004
 - Kirschner, Sweller, & Clark, 2006 (+ responses)
- Design Issues around Cognitive Load
 - Sweller, 1994
 - Johnstone and Al-Shuaili, 2001

Roy Tasker

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Back to ACELL Aims...

1. Database of **educationally** and **chemically** sound experiments, that have been **tested** by both academic staff and students.
2. Provide for **professional development** of chemistry academic staff.
3. Facilitate the development of a chemistry education **community of practice**.
4. Researching **learning** in the laboratory environment.

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ACELL Aim 1

Database of **educationally** and **chemically** sound experiments, that have been **tested** by both academic staff and students.

Chemically sound =
chemically accurate
+ works reliably
+ safe
+ transferrable to another location

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ACELL workshops:

- Set up for 3rd party testing of experiments (*i.e.* away from the experiment’s “home” lab);
- Experiments tested by staff and students (typically ~50:50);
- Tested under as realistic conditions as possible (3 hour lab, 8 “students” per experiment);
- Extensive feedback given to submitters – both formal and informal.

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Workshops:

- July, 2000 (Canberra)
- Feb, 2001 (Sydney)*
- Feb, 2002 (Christchurch)
- Nov, 2002 (Melbourne)*
- Feb, 2004 (Hobart)*
- July, 2005 (Sydney)
- Feb, 2006 (Sydney)*
- Jan, 2007 (Adelaide)*
- July, 2007 (Auckland)
- Nov, 2007 (Sydney, physics)*
- Apr, 2008 (Adelaide, biology)*

* experimental workshops



Educationally tested:

Educationally tested =

- set of learning objectives
- + recognised processes to facilitate learning objectives
- + indicators so staff and students can each judge achievements

- Staff are not very good at writing down educational objectives and validation of objectives (assessment, etc)

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?

ACELL Aim 2

Provide for **professional development** of chemistry academic staff.

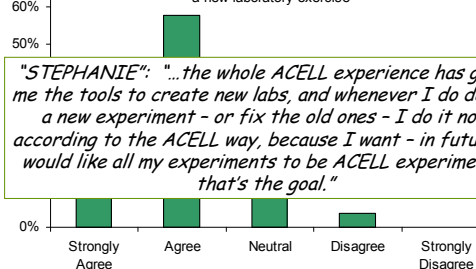
- Recognition of the potential in this area evolved over time
- Facilitated through
 - Workshops;
 - Educational Template;
 - ACELL Student Learning Experience (ASLE) survey;
 - Website.

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

Providing Lab Development Tools

I would use the ACELL educational template when designing a new laboratory exercise



"STEPHANIE": "...the whole ACELL experience has given me the tools to create new labs, and whenever I do design a new experiment - or fix the old ones - I do it now according to the ACELL way, because I want - in future, I would like all my experiments to be ACELL experiments, that's the goal."

The ASLE Instrument

- Designed to test the educational issues expounded in the Educational Template
 - Should serve to improve the student experience via aspects of education theory that the teacher has been exposed to and trained in.
- Questions reflect current educational theories
 - Interest, content knowledge, generic skills, discipline skills.
 - Disguised in "everyday" language.
- 3 different metrics:
 - 14 x Likert questions.
 - 5 x open ended questions.
 - Recorded interviews.
- Validation
 - ACELL workshops, with iterations.
 - On-going process.

14 Likert items:

- Q1: This experiment has helped me to develop my data interpretation skills.*
Q2: This experiment has helped me to develop my laboratory skills.
Q3: I found this to be an interesting experiment.
Q4: It was clear to me how this laboratory exercise would be assessed.
Q5: It was clear to me what I was expected to learn from completing this experiment.
Q6: Completing this experiment has increased my understanding of chemistry.
Q7: Sufficient background information, of an appropriate standard, is provided in the introduction.
Q8: The demonstrators offered effective support and guidance.
Q9: The experimental procedure was clearly explained in the lab manual or notes.
Q10: I can see the relevance of this experiment to my chemistry studies.
Q11: Working in a team to complete this experiment was beneficial.
Q12: The experiment provided me with the opportunity to take responsibility for my own learning.
Q13: I found that the time available to complete this experiment was:
Q14: Overall, as a learning experience, I would rate this experiment as:

ACELL Aim 3

Facilitate the development of a chemistry education **community of practice**.

Shared experience...

- Networking through workshops;
- Communication via website and email;
- ACELL presence at all Australian Chem. Ed. Conferences since 2000;
- ACELL sponsorship of attendance at initial workshops (this is important to establish community).

Previous speaker!



Mentoring

- ACELL provides educationally validated survey instruments;
- assistance in proper ethical treatment of surveys and data;
- assistance in educational analysis leading to publication on ACELL web site;
- assistance in preparing an educational research manuscript, inc. pointers to key literature, educational concepts, etc

The ACELL Website

- Experiments and their documentation
 - Publications, including published papers
 - 13 published experiments from APCELL
 - 4 published papers from ACELL
 - Information on ACELL events
 - Education resources for ongoing professional development
 - Process information – content analysis
 - Theory information – constructivism
- <http://acell.chem.usyd.edu.au>

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Entire Website Experiments

Home
About ACELL
2006 Workshop
2007 Activities
Education Information
Publications
Experiments
Experiment Database
Contribute to ACELL
Update Account
Log Off

Hydroboration-Oxidation of an Olefin: Octyl Alcohol

Experiment Details | Educational Analysis | Student Experience | Related Documents

Introduction

The hydroboration-oxidation of 1-octene to prepare the anti-Markovnikov addition product, 1-octanol, is performed in this experiment using $\text{BH}_3 \cdot \text{THF}$ for the hydroboration and basic H_2O_2 for the oxidation.

The ratio of anti-Markovnikov product, 1-octanol, to the Markovnikov addition product, 2-octanol, is measured by gas chromatography. Because the addition reaction known as "hydroboration" is general for all classes of acyclic and cyclic alkenes as well as alkyne, it is a powerful synthetic tool.

It provides an introduction to the handling of air-sensitive reagents and also gives students experience running a gas chromatograph (GC). The reaction is done on microscale (ca. 1.3 mmol) to give students experience carrying out synthetic transformations on small quantities of material. To make efficient use of time, students can be trained to run the GC standards of 1-octanol and 2-octanol after the hydroboration has been initiated.

Level of Experiment

experiment database login
Justin is currently logged in
Account Administrator
Last visited 19/09/2009

Contact ACELL
C/- The School of Chemistry
The University of Sydney
NSW 2006, Australia
P: +61 2 9351 2731
F: +61 2 9351 3329

Documents in the Demonstrator Notes, Technical Notes, Hazard and Risk Assessment, and Feedback categories are only available to users with Academic accounts. Users with Ordinary accounts can [contact us](#) to request an upgrade if they hold an academic appointment, or have another legitimate reason for requesting an upgrade to an Academic account.

Student Notes

Student Notes (PDF format)	Acrobat PDF	71kb
Student Notes (Word format)	Word Document	116kb

Demonstrator Notes

Demonstrator Notes (PDF format)	Acrobat PDF	91kb
Demonstrator Notes (Word format)	Word Document	543kb

Technical Notes

Technical Notes (PDF format)	Acrobat PDF	29kb
Technical Notes (Word format)	Word Document	59kb

Additional Notes / Documents

Tetraphos-2 (ChemDraw)	Chem-Draw File	9kb
Tetraphos-2 (GIF image)	GIF image	8kb

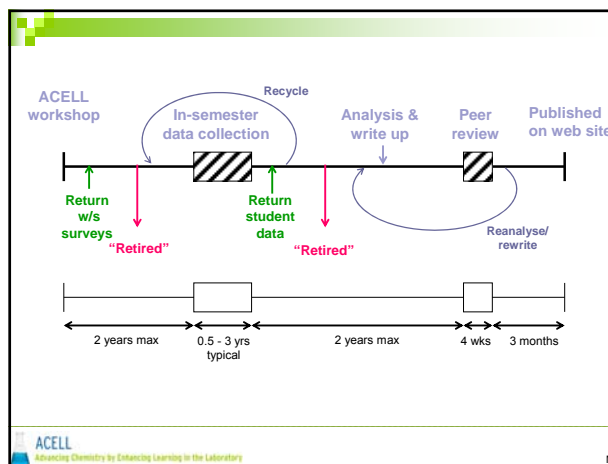
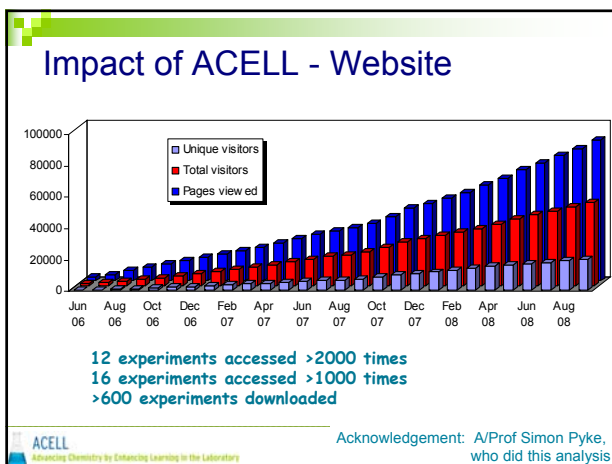
Two representations of the structure of bis(2-(diphenylphosphino)ethyl)phosphine, tetraphos-2, $\text{P}(\text{CH}_2\text{CH}_2\text{PPh}_2)_2$

Full structure of bis(2-(diphenylphosphino)ethyl)phosphine, tetraphos-2, $\text{P}(\text{CH}_2\text{CH}_2\text{PPh}_2)_2$

Educational Template

Educational Template	Acrobat PDF	48kb
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Completed ACELL Educational Template



ACELL Aim 4

Researching **learning** in the laboratory environment.

- Work of the Director team

14 Likert items:

Q1: This experiment has helped me to develop my data interpretation skills.
Q2: This experiment has helped me to develop my laboratory skills.
Q3: I found this to be an interesting experiment.
Q4: It was clear to me how this laboratory exercise would be assessed.
Q5: It was clear to me what I was expected to learn from completing this experiment.
Q6: Completing this experiment has increased my understanding of chemistry.
Q7: Sufficient background information, of an appropriate standard, is provided in the introduction.
Q8: The demonstrators offered effective support and guidance.
Q9: The experimental procedure was clearly explained in the lab manual or notes.
Q10: I can see the relevance of this experiment to my chemistry studies.
Q11: Working in a team to complete this experiment was beneficial.
Q12: The experiment provided me with the opportunity to take responsibility for my own learning.
Q13: I found that the time available to complete this experiment was:
Q14: Overall, as a learning experience, I would rate this experiment as:

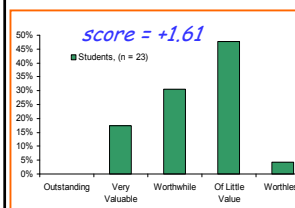
Students' perceptions of learning experience:

Q14: Overall, as a learning experience, I would rate this experiment as:

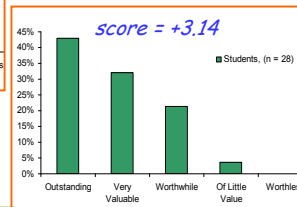
A: Outstanding	A: +4 B: +3 C: +2 D: +1 E: 0
B: Very valuable	
C: Worthwhile	
D: Of little value	
E: Worthless	

Score = weighted average

Wide range of learning experiences



Q14: Overall, as a learning experience, I would rate this experiment as



Click up to 4 responses that you think correlate well with an overall positive laboratory experience.

- Q1: Developing data interpretation skills
- Q2: Developing laboratory skills
- Q3: Interest
- Q4: Clear assessment
- Q5: Clear learning objectives
- Q6: Increased chemistry understanding
- Q7: Sufficient/appropriate background
- Q8: Effective demonstrators
- Q9: Good prac notes
- Q10: Relevance to chemistry studies
- Q11: Developing teamwork
- Q12: Responsibility for own learning
- Q13: Sufficient time to complete



Click up to 4 responses that you think correlate well with an overall positive laboratory experience.

- Q1: Developing data interpretation skills
- Q2: Developing laboratory skills
- Q3: Interest
- Q4: Clear assessment
- Q5: Clear learning objectives
- Q6: Increased chemistry understanding
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- Q8: Effective demonstrators
- Q9: Good prac notes
- Q10: Relevance to chemistry studies
- Q11: Developing teamwork
- Q12: Responsibility for own learning



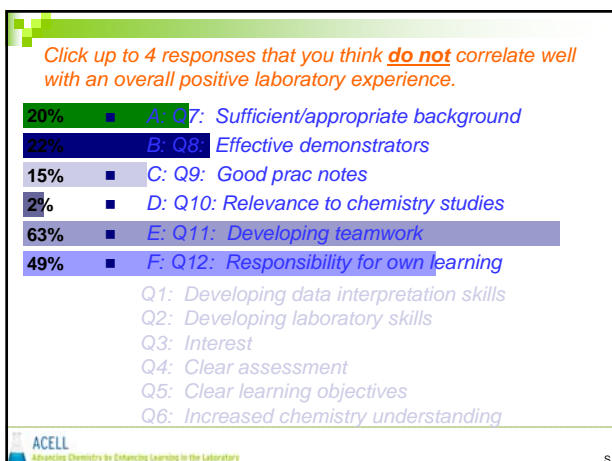
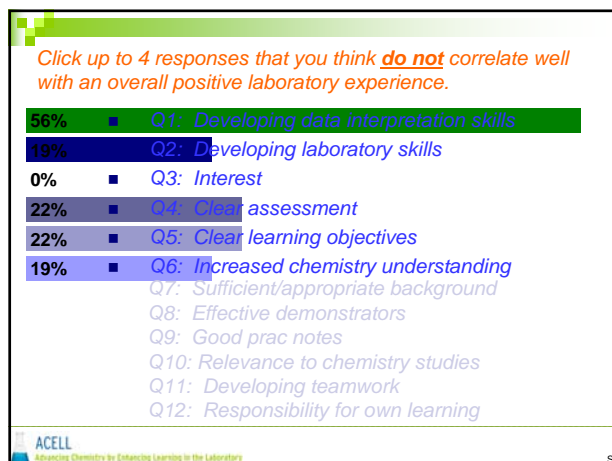
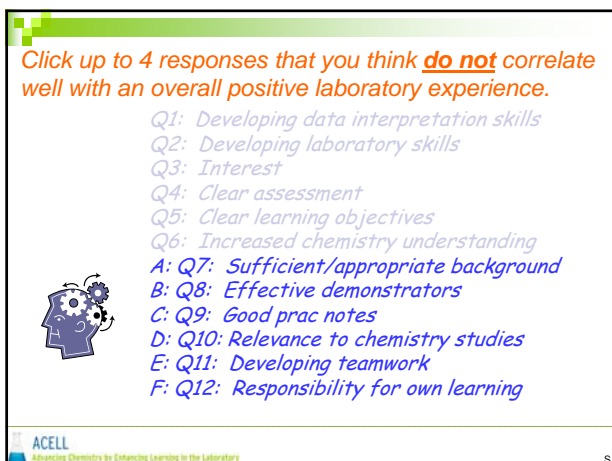
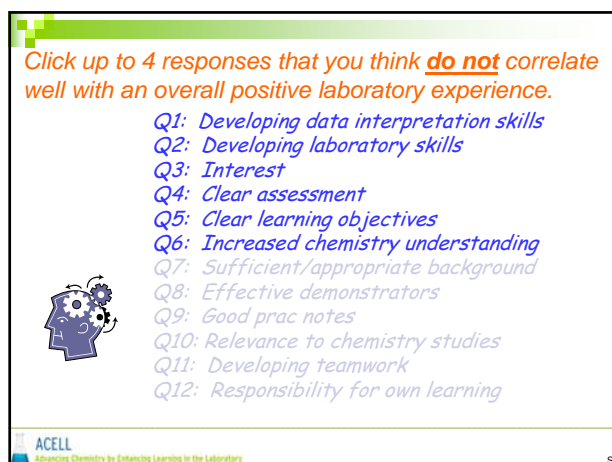
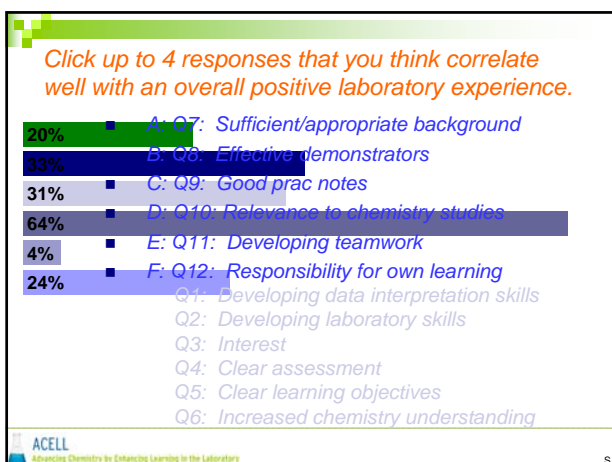
Click up to 4 responses that you think correlate well with an overall positive laboratory experience.

- 17% ■ Q1: Developing data interpretation skills
- 22% ■ Q2: Developing laboratory skills
- 54% ■ Q3: Interest
- 46% ■ Q4: Clear assessment
- 33% ■ Q5: Clear learning objectives
- 50% ■ Q6: Increased chemistry understanding
- Q7: Sufficient/appropriate background
- Q8: Effective demonstrators
- Q9: Good prac notes
- Q10: Relevance to chemistry studies
- Q11: Developing teamwork
- Q12: Responsibility for own learning

Click up to 4 responses that you think correlate well with an overall positive laboratory experience.

- Q1: Developing data interpretation skills
- Q2: Developing laboratory skills
- Q3: Interest
- Q4: Clear assessment
- Q5: Clear learning objectives
- Q6: Increased chemistry understanding
- A: Q7: Sufficient/appropriate background
- B: Q8: Effective demonstrators
- C: Q9: Good prac notes
- D: Q10: Relevance to chemistry studies
- E: Q11: Developing teamwork
- F: Q12: Responsibility for own learning





Your Responses:

- Clickers responses to first Q

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Your Responses:

- Clicker responses to second Q

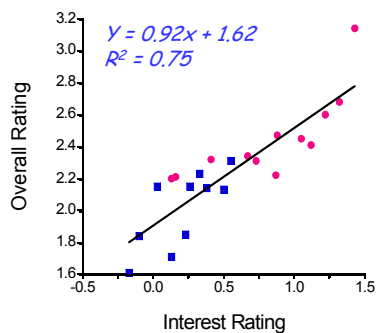
What do students say? The dataset

- >22 experiments
- surveyed in 8 different universities (same instrument)
- across all of chemistry (sub-discipline and year level)
- paper + web surveys
- combination of ACELL and "other" experiments
- >1300 responses overall (min = 13, max = 143, av = 47)

Strongly correlated

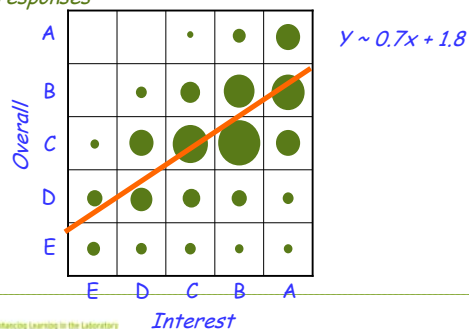
Interest:

SA: +2
A: +1
N: 0
D: -1
SD: -2

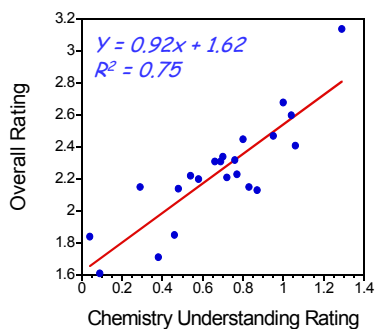


Higher order correlation...

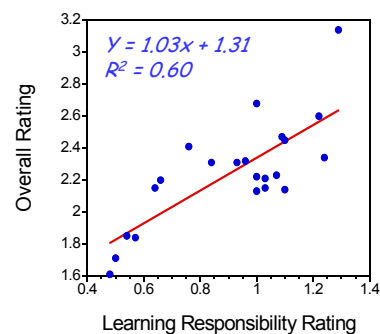
Area \propto # responses

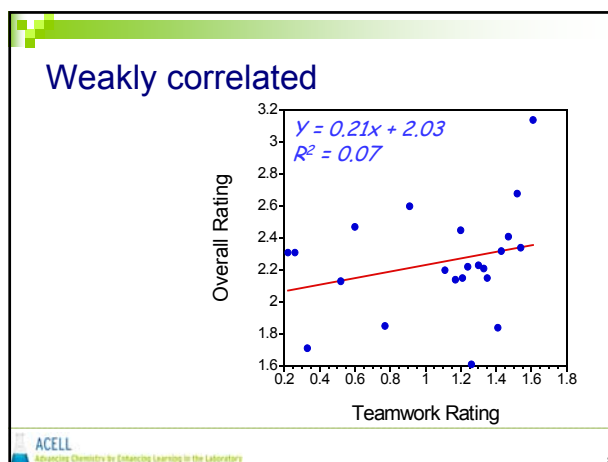
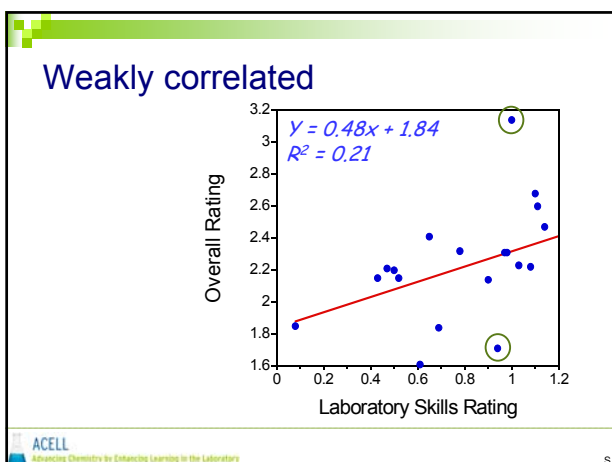


Strongly correlated



Strongly correlated





- ### Overall correlations
- Strong correlation ($R^2 \geq 0.60$)
 - Interest, understanding of chemistry, data interpretation, responsibility for own learning
 - Medium correlation
 - Learning objectives, procedure & instructions, relevance to my studies
 - Weak correlation ($R^2 < 0.4$)
 - Demonstrators, lab skills, team work, background info, assessment
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- ### Why are these factors strongly and weakly correlated?
- 'motivation' vs 'maintenance' factors?
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- ### Overall correlations
- Strong correlation ($R^2 \geq 0.60$)
 - Interest, understanding of chemistry, data interpretation, responsibility for own learning
- ACELL acceptance criteria:
- score > +0.5 on 3 out of 4 of the above
AND score > 2.2 on "overall" rating
- ACELL
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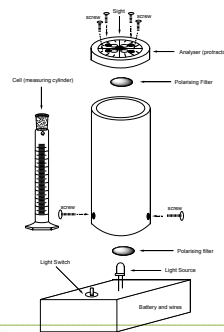
- ### 3 case studies
- Staff vs student perceptions
 - The effect of time
 - Learning outcomes
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Case study 1: Polarimetry

or, “differences between staff and student perceptions of an experiment”



Demystifying the polarimeter



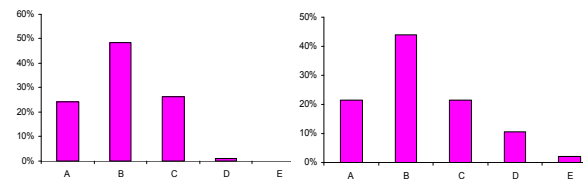
acceptance criteria

Q	Short description	Score	Pass?
1	Data interpretation		
3	Interest		
6	Understanding chem		
12	Responsibility for own learning		
14	Overall		

Highlighting strengths

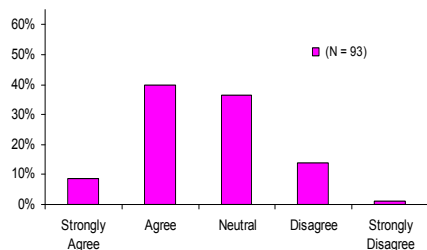
Q12: "The experiment allowed me the opportunity to take responsibility for my own learning"

Q4: "It was clear to me how this laboratory would be assessed"



Highlighting strengths & weaknesses

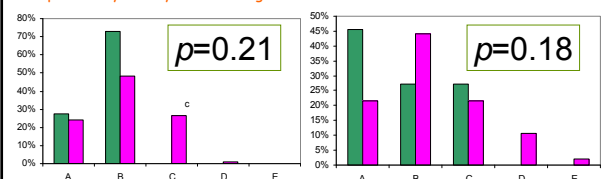
Q3. I found this to be an interesting experiment



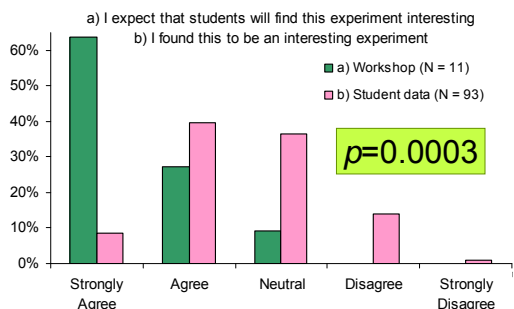
Comparison with workshop responses

Q12: "The experiment allowed me the opportunity to take responsibility for my own learning"

Q4: "It was clear to me how this laboratory would be assessed"



Comparison with workshop responses



Student comments:

- "More precise methods and apparatus"
- "Equipment - was easy to move / change equipment and results would be altered"
- "Better light source"
- "Perhaps a more complex polarimeter,..."

Possible reasons for misalignment of staff/student perceptions?

Situational / individual interest: Justin Read, Sunday

Case Study 2: Synthetic Chem.

Acetylation of ferrocene

- 2nd year experiment
- surveyed in 2006, 2007, 2008



What happened between 2006 and 2008?

Average scores

Number	Item	2006 (N = 24)		2007 (N = 24)		2008 (N = 34)	
		mean	st dev	mean	st dev	mean	st dev
1	This experiment has helped me to develop my data interpretation skills	+0.63	0.97	+0.36	0.95	+0.52	0.80
2	This experiment has helped me to develop my laboratory skills	+1.21	0.72	+0.91	0.87	+1.15	0.71
3	I found this to be an interesting experiment	+0.50	0.88	+0.14	0.89	+0.30	1.13
4	It was clear to me how this laboratory exercise would be assessed	+0.38	1.06	+0.86	0.83	+0.55	0.97
5	It was clear to me what I was expected to learn from completing this experiment	+0.58	0.97	+0.27	1.24	+0.24	1.09
6	Completing this experiment has increased my understanding of chemistry	+0.87	0.87	+0.00	1.02	+0.58	0.83
7	Sufficient background information, of an appropriate standard, is provided in the introduction	+0.18	1.01	-0.23	1.02	+0.58	1.09
8	The demonstrators offered effective support and guidance	+1.04	0.93	+0.95	1.25	+1.21	0.93
9	The experimental procedure was clearly explained in the lab manual or notes	+0.57	0.95	+0.41	1.14	+0.42	1.03
10	I can see the relevance of this experiment to my chemistry studies	+1.00	0.90	+0.59	1.26	+0.62	0.81
11	Working in a team to complete this experiment was beneficial	+0.52	1.04	+0.79	1.03	+1.07	1.14
12	The experiment provided me with the opportunity to take responsibility for my own learning	+1.00	0.85	+0.68	0.78	+1.03	0.88
13	I found that the time available to complete this experiment was	-1.00	0.80	-1.21	0.88	-0.82	0.77
14	Overall, as a learning experience, I would rate this experiment as	+2.13	0.63	+1.92	0.88	+2.31	0.54

Selection criteria scores

Q	Item	2006 (N = 24)		2007 (N = 24)		2008 (N = 34)	
		mean	st dev	mean	st dev	mean	st dev
1	Data interpretation skills	+0.63	0.97	+0.36	0.95	+0.52	0.80
3	Interest	+0.50	0.88	+0.14	0.89	+0.30	1.13
6	Understanding of chemistry	+0.87	0.87	+0.00	1.02	+0.58	0.83
12	Responsibility for own learning	+1.00	0.85	+0.68	0.78	+1.03	0.88
13	Time available	-1.00	0.80	-1.21	0.88	-0.82	0.77
14	Overall learning experience	+2.13	0.63	+1.92	0.88	+2.31	0.54

2006 → 2007

2007 → 2008

Changed instructions
Expt moved to first prac

Expt moved back in semester

Effect of sufficient time

- Take whole cohort: 2006-8
- Separate according to "sufficient" (N=25) and "insufficient" (N=54) time to complete.

- 1. Paired t-test on all questions
 - Significant difference at $p=0.002$
- 2. Wilcoxon rank sum test on distributions of individual questions

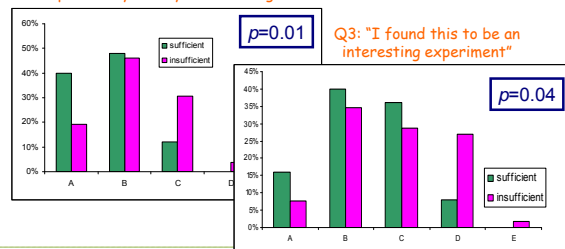
Wilcoxon rank sum test

Q	Item	Significant
1	Data interpretation	almost
2	Laboratory skills	
3	Interest	YES
4	Clear assessment	
5	Clear learning expectations	
6	Understanding of chemistry	NO
7	Background information	
8	Demonstrators	
9	Lab notes	
10	Relevance	
11	Teamwork	
12	Responsibility for own learning	YES
14	Overall	almost

YES: $p < 0.05$
almost: $p < 0.1$
NO: $p \geq 0.1$

Interest and Responsibility

Q12: "The experiment allowed me the opportunity to take responsibility for my own learning"



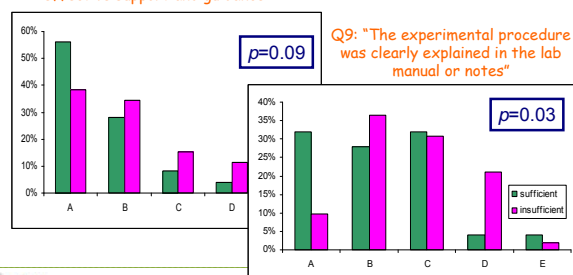
Wilcoxon rank sum test

Q	Item	Significant
1	Data interpretation	
2	Laboratory skills	
3	Interest	
4	Clear assessment	
5	Clear learning expectations	
6	Understanding of chemistry	
7	Background information	
8	Demonstrators	almost
9	Lab notes	YES
10	Relevance	almost
11	Teamwork	
12	Responsibility for own learning	
14	Overall	

YES: $p < 0.05$
almost: $p < 0.1$
NO: $p \geq 0.1$

Demonstrators and Prac Notes

Q8: "The demonstrators offered effective support and guidance"



Wilcoxon rank sum test

Q	Item	Significant
1	Data interpretation	
2	Laboratory skills	NO
3	Interest	
4	Clear assessment	NO
5	Clear learning expectations	NO
6	Understanding of chemistry	NO
7	Background information	NO
8	Demonstrators	
9	Lab notes	
10	Relevance	
11	Teamwork	NO
12	Responsibility for own learning	
14	Overall	

YES: $p < 0.05$
almost: $p < 0.1$
NO: $p \geq 0.1$

Wilcoxon rank sum test

Q	Item	Significant
1	Data interpretation	almost
2	Laboratory skills	NO
3	Interest	YES
4	Clear assessment	NO
5	Clear learning expectations	NO
6	Understanding of chemistry	NO
7	Background information	NO
8	Demonstrators	almost
9	Lab notes	YES
10	Relevance	almost
11	Teamwork	NO
12	Responsibility for own learning	YES
14	Overall	almost

YES: $p < 0.05$
almost: $p < 0.1$
NO: $p \geq 0.1$

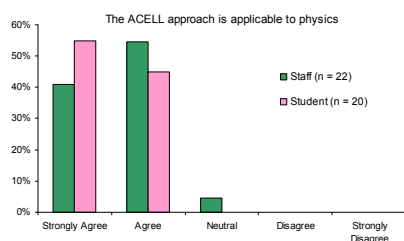
Where to from here...?

- A model for other domains:
 - Evolution to ASELL (S=science)?
 - chemistry.asell
 - physics.asell (first physics w/s held at UTS, 12/07)
 - biology.asell (first biology w/s held at Flinders, 4/08)
 - etc.

ASELL (Physics)

- Workshop held in Nov 2007
- Delegates surveyed using identical instrument to chemistry delegates.

Physics workshop feedback



Physics Workshop photos:



Pairs of staff

Participating in the ACELL workshop has increased my understanding of educational issues



The design of laboratory exercises involves more than I had previously realised



ASELL (Biology)

- Workshop held in Apr 2008
- Anecdotal feedback is the for **molecular** biology/biochem expt, ACELL worked well
- Feedback for **observational** expt, ACELL methods had some issues.

Case Study 3: Immunology

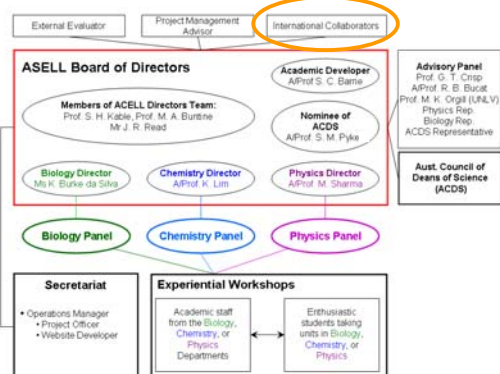
- Mammalian lymphatic system
 - 2nd year immunology experiment
 - surveyed in 2007

Differences in perceived learning outcomes

- Intended learning outcome:
 - learn about the response of the lymphatic system to the injection of colloidal carbon.
- Student surveyed learning outcome:
 - how to dissect a mouse!

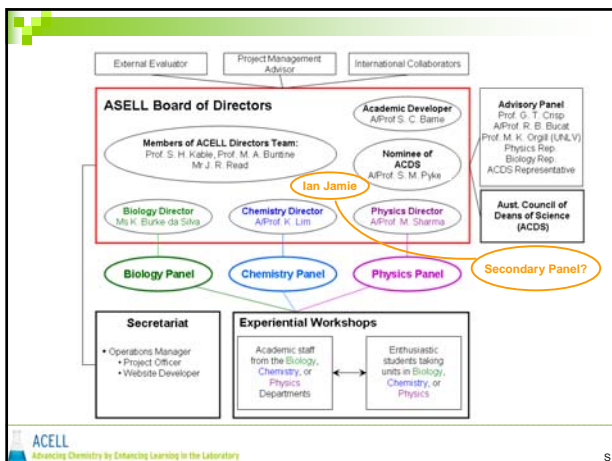
Moving ASELL forward...

- Demonstrated to work for Physics and Biology
- Presented to A/Deans (L&T) in Jul 2008
- Presented to ACDS AGM in Oct 2008
 - Deans' issue: how to embed sustainably into normal Faculty processes??



ACELL (international?)

- Would the ACELL approach work in the more diverse university sector of UK/US/Europe/Asia?
- Team set up in US with NSF application underway for Feb 2009
- Interest in UK and Ireland in setting up an ACELL team



ACELL (secondary)

■ Issues:

- National curriculum
- Needs a champion
- What are the motivators for a teacher to join/lead ACELL?
- Less discipline expertise? (OH&S)?
- Teacher "sabbatical"?

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"The Team"

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