Chapter 4: Appendix 3B. Agricultural Chemistry 2 Survey report

This survey sought to investigate whether students transfer knowledge, skills and understanding from a first year unit of study in Chemistry to a second year unit of study. The survey instrument was approved by the Human Ethics Committee at The University of Sydney. The survey was conducted towards the end of semester 1, 2002 and was given in class time to students enrolled in AGCH2002 Agricultural Chemistry 2.

1. Demographics
There were 61 students in the cohort; 27 responded to the survey (44.3%).

General information

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<tbody>
<tr>
<td>Gender</td>
<td>female 72.1%</td>
<td>male 27.9%</td>
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<tr>
<td>Study pattern</td>
<td>full-time 96.3%</td>
<td>part-time 3.7%</td>
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<tr>
<td>Age range</td>
<td>18-21 yrs 81.5%</td>
<td>22-25 yrs 3.7%</td>
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<td>over 25 yrs 14.8%</td>
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Previous “chemistry” history:

| Passed Fundamentals of Chemistry A & B | 81.5% |
| Passed Standard first year chemistry units | 11.1% |
| Passed Advanced first year chemistry units | 3.7% |
| Entered without prerequisite chemistry | 3.7% |

Final average mark

| Respondents | 64% |
| Total cohort | 60% |

2. Perceptions of the relationship of the first year units of study with the second year unit of study

Question 1
Why do you think that the program coordinator required you to do a chemistry unit of study before going on to take the unit of study Agricultural Chemistry 2 AGCH2002?

The majority of students (77.8%) felt that first year chemistry had knowledge and skills that were assumed in Agricultural Chemistry 2. Stoichiometric calculation in particular, often felt to be a difficult section of the course, was believed to be an essential skill introduced and practiced in first year chemistry. Another challenging topic was organic chemistry and reaction mechanisms. Some students felt that without the first year basics, they would have had a difficult time in second year Agricultural Chemistry. This was expressed:

- Having not done chemistry at school, a knowledge of the details and implications of the periodic table, basic stereochemistry and stoichiometry, derived from the Fundamentals of Chemistry was essential to be able to even start to understand the practicals and lectures. Without this understanding, I would have probably given up on Ag Chemistry within the first week.
- Background information in chemistry is essential for understanding in this AGChem2 course. Make it easier to understand and develop the course.
- First year chemistry provided the fundamental skills and knowledge required in order to proceed with a more detailed understanding of agriculturally specific chemistry.
- In AGCH2002 you are required to learn about particular molecules and chemical processes, this is less overwhelming and easier to understand with a previous basic chemistry course.

A sizable percentage of students (22.2%) mentioned practical work learnt in first year chemistry being of particular help in tackling the second year subject:

- So we have the required skills for 2nd year chemistry, which are especially needed for chemical practical class (lab report) in calculations.
- ... Background to understanding what is being discussed, introduction to techniques – experimental.
- So as to learn the basics of chemistry so we would apply these to practical agricultural chemistry.
Question 2
As you studied AGCH2002 how did you use your understanding from first year chemistry? Why did you use the knowledge from first year chemistry in the ways you did?

The responses to this question echoed the answers to question 1, with two-thirds (66.7%) of students finding that the first year chemistry is basic and necessary to understanding the 2nd year material. Again, organic chemistry and stoichiometry received special mention, but so did titration, atomic orbitals and biochemistry.

- Theory and exposure to experimental techniques. Understand lectures where topics have assumed knowledge and pace is quick, so no time for introduction or private study.
- Past notes were referred to throughout this semester’s chemistry lectures. Understanding of titration, balancing chemical equations and stoichiometry have been essential knowledge.
- The organic chemistry component was the most useful, primarily because it was the main area of concern in AGCH2002.

Again, practical work gained a special mention in 22.2% of the responses:
- Mainly in pracs. Already know how to do most experiments. Do not use a lot consciously but refreshed when study similar topics.
- Basic practical technique, especially titration and subsequent calculations …
- I used the practical knowledge gained from 1st year practical classes to help me with these second year practical classes, e.g. What a piece of equipment is used for and the correct way to use it.

Some students (11.1%) did not feel there was much overlap, transfer or continuity from first to second year chemistry:
- Yes, I did use first year chemistry to a degree. However, the majority of AgChem2002 was totally new to me.
- Some practical work was repeated from first year but most principals I used in AGCH2002 were from school. Chemistry didn’t play an important role in AGCH2002.

3. Was there any transfer of knowledge from first year to second year?

To investigate evidence of transfer the responses to the open-ended questions were analysed using phenomenography. The responses to question 1 were used to identify the degree of linkage or transfer of knowledge perceived by the students and the responses to question 2 were used to identify approaches to studying the second year unit.

For question 1 the amount of linkage or transfer of knowledge was rated on a 5 point scale:
1. no answer or no linkage perceived
2. general introduction perceived from the first year subject to the second year subject
3. general background knowledge or skills perceived from the first year subject to the second year subject
4. basic concepts perceived from the first year subject to the second year subject
5. overlapping content or significant similarity perceived from the first year subject to the second year subject

For question 2, the approach to study is based on the work of John Biggs (1999) SOLO taxonomy which was translated to a 5 point scale. The scale categorised answers as:
1. no answer, or didn’t use any information or skills from the first year subject to the second year subject
2. recognised one item of transfer (e.g. titration practicals were done in each)
3. recognised more than 1 item of transfer (e.g. practical work and content on the periodic table or bonding)
4. related content and skills or understandings
5. comparison of the range and/or depth of understanding in the two subjects
   OR cause and effect
   OR analysis of similarities and differences. (e.g. because we had done this item of work the course was easier to interpret)
If the students perceived few linkages, their approach to the study of these subjects is thought to be more of a surface nature – they are merely rote learning facts without tying it together into a web of knowledge. Agricultural Chemistry 2 makes use of many of the chemistry concepts covered in first year chemistry, and so, if the students recognized this, they were seen to display a deeper understanding of the subjects.

The mean for question 1 was 4.0 and the median was 4.0. The mean for question 2 was 3.3 and the median was 3.0. Thus students have generally perceived the significant links between the first and second year units of study and the reasons for insisting on two prior units of study, but students were ambivalent about whether they have utilised this prior knowledge extensively.

A Pearson’s correlation determination was made between the data.

**Correlations Agricultural Chemistry 2 n=27**

Correlation coefficients shown in normal type

*Significance value shown in italics. More significant values are closer to zero.*

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<th>Mark</th>
<th>Linkage</th>
<th>Approach</th>
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*Correlation is significant at the 0.05 level (2-tailed)*

There was a significant positive correlation between gender and age – meaning that the older students tended to be male. Age and part-time status also displayed a positive correlation, but because there was only one part-time student, this can be disregarded.

There was a significant positive correlation between the two open-ended questions. Thus, those who recognised the necessity for doing the prerequisite chemistry units, also saw significant content or skills links between the junior and intermediate units of study, though this did not automatically translate into better marks.

**Conclusions**

In answer to the question “Did students transfer knowledge, skills and understanding from a first year unit of study in chemistry to a second year unit of study in agricultural chemistry?”, students do report an understanding that the second year subject had a prerequisite first year subject in order to establish essential concepts and understandings. Students were ambivalent as to whether they had used the prior knowledge sufficiently well in their second year studies. This may particularly be so among unsuccessful students but only two of these completed the survey. Thus, students can identify the designed intention that knowledge should be transferred but feel that they may not have done so to a significant extent.

As far as translating this prior experience into performance – 25% of students failed the second year unit of study. From the data, we have been unable to identify a correlation in the extent to which students feel that they have transferred the knowledge and skills and their final grade.

**References**