Work Towards an Integrated Practical Chemistry Course

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Oxford Chemistry Course

After the chemistry review, a Director of Teaching was employed.

His roles are :

1) To link the teaching in all 3 sub-departments of chemistry.
2) To modernise the lecture course.
3) To improve liaison with schools.

Old Course – 1st year

- 180 students split into three groups by college.
- 2 afternoons a week in lab for ½ of the year, i.e. 4 weeks per sub-department.
- All ‘recipe style’ experiments.
- Experiments related to the lecture course but not necessarily completed in parallel with lectures.

Old Course - 2nd/3rd year

- Same rotation as 1st year but rota is repeated through the whole year.
- All students do 2nd year labs in all sub-departments but in only 2 of 3 labs in 3rd year.
- Mainly ‘recipe style’ experiments

‘Problems’ with course

- Poor links to lectures.
- No links between sub-departments and thus no ‘joined up’ thinking from students.
- Basics just expected or assumed to be picked up along the way.
- Students are not assessed, so are not as involved in the lab as we would like.
- Skills learned are insufficient for the 4th year, which is entirely research.

Laboratory teaching today

"Nobody with any familiarity with the realities of teaching will deny the difficulties involved in designing and conducting good lab courses within a normally tight budget. Any changes require a long lead time, stable plans, adequate finances and a large commitment of time and energy. It is not surprising many such courses are not updated and redesigned"

Teaching in Laboratories; Bound, Dunn and Hegarty-Hazel, 1986

Developing the New Course

- Three students employed over the summer of 2006.
- Each student contacted one third of the ‘top 100 research universities in the world’.
- Each student also focussed on the needs of a single academic year.

Information Gathering

- Many negative responses, i.e. no response or no willingness to divulge information
- Also many positive responses, though some respondents were keen to use the results of the work, but less keen to provide details of their courses.
- Very little evidence of PBL in action.

Results (cont.)

- Often several people share responsibility for the lab course. In some courses one person is responsible for each experiment.
- In many courses, no links exist between the different branches of chemistry.
- Hours of work, number of experiments to meet requirements, etc all different.
- Blocks of labs in the same subject.

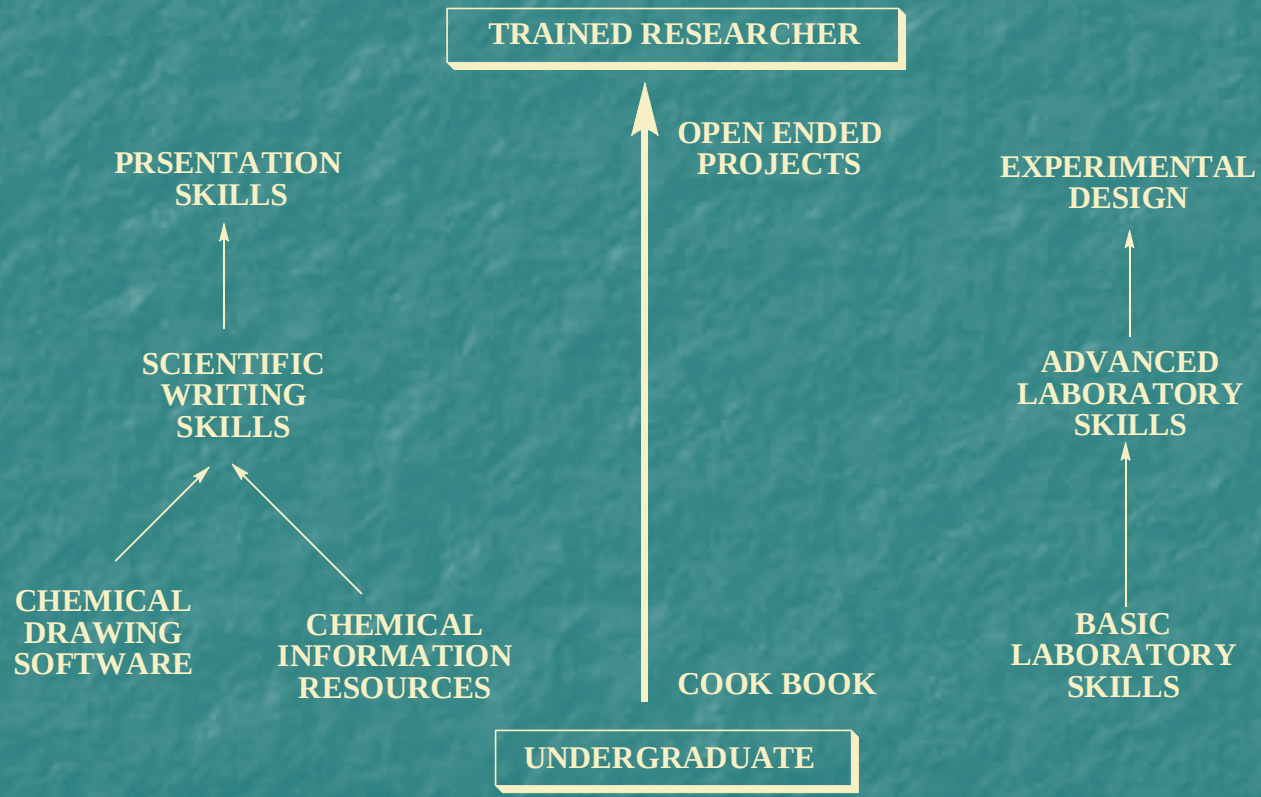
Results (cont.)

- Use of pre and post lab sessions is common. Smaller lab books needed.
- Videos often used as a teaching aid.
- Many Universities operate a scheme similar to the Oxford research year, but none is so extensive.
- Many linked experiments in the education literature but few in practice; most do not cover all 3 sub-areas of chemistry.

New Course - Administration

- All labs will operate the same opening hours and same requirements.
- One short book per year, not three.
- All experiments will require a pre- and post-lab discussion with the senior demonstrator.
- Introduce ‘assessment’.

New Course – Overall Objectives



Adapted from Hollenbeck *et al*, J.Chem.ED,, 83, 12, 2006, 1835

Foundation Course

- 1st four weeks to settle student in and bring everyone up to a similar standard.
- Week 1: simple, with an emphasis on safety.
- Course will relate to A-level courses while linking seamlessly into new lecture course.
- Experiments to be fun (!) and integrated across at least 2 of the 3 sub-departments.
- Group work to be introduced.

Foundation Course (cont)

- Week 1 – Introduction and tour of the 3 lab sites / COSHH / Identification of unknown sample
- Week 2 - Instruments
- Weeks 3 and 4 – Synthesis of compounds for use in Physical experiments

1st year

- Continuing on from foundation course, therefore covering basic techniques.
- Discovery approach to all experiments, while still ‘cook book’ like
- Use internet and chemical databases

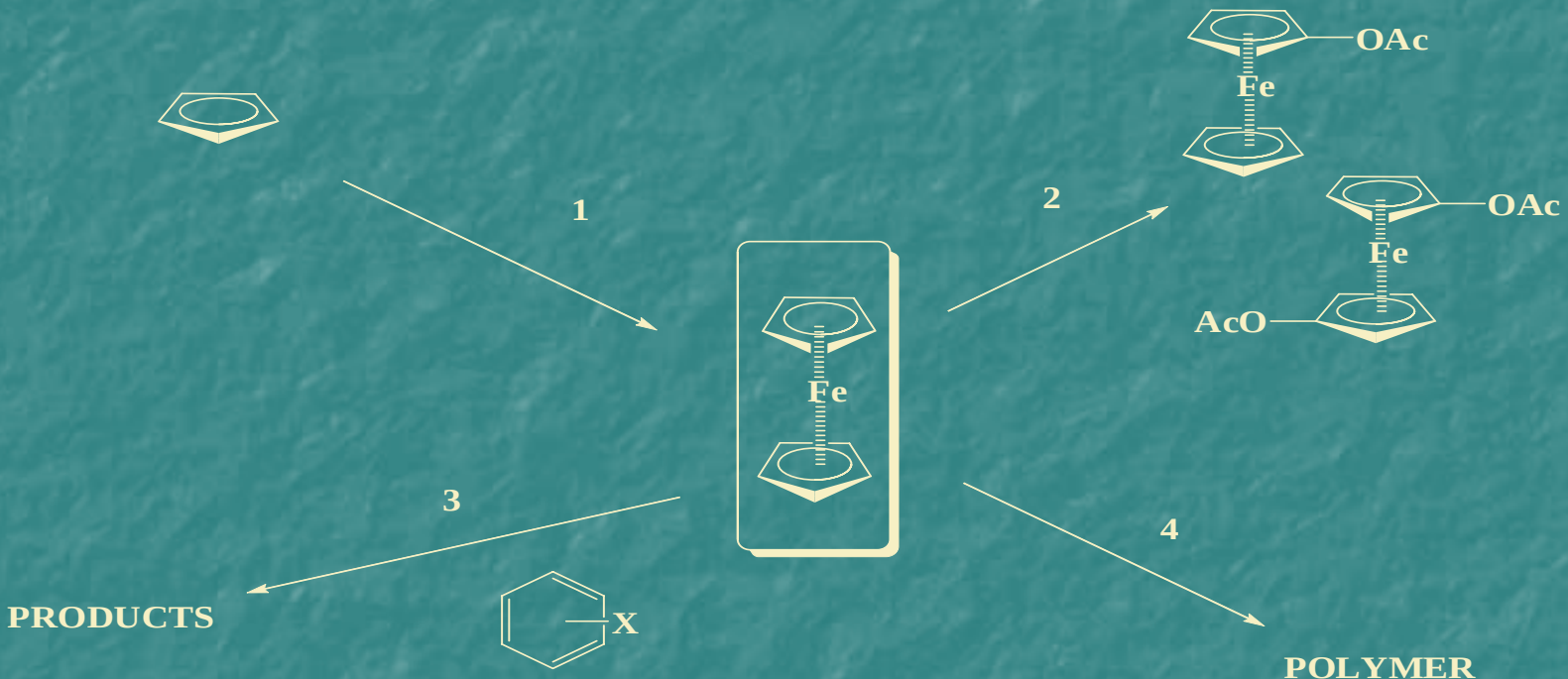
Further work

- Gather information on the success of the new course.
- How is time in lab affected ?
- What effect does assessment have on students ?
- Assuming success of foundation course and 1st year course improve the subsequent years.

2nd year

- Each sub department has core experiments that illustrate important areas/techniques, leading to a chemistry ‘tool kit’.
- From this core, students can explore.
- Introduces freedom for students to tackle what interests them rather than academics.

Example of Integrated Experiments



1) Synthesis of Ferrocene
2) Reactions of Ferrocene
3) Kinetics of Ferrocene
4) Use of Ferrocene derviatives as catalysts

3rd year

- Month long mini projects in which students pick a topic and design experiments to test their ideas.
- Work in research groups for week to gain ‘real life’ experience.
- Push the boundaries with all science courses.

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