

**The Changing Nature
of
University Courses
in
Chemistry and Chemical Engineering**

A CEG SEMINAR

SALTERS' HALL

Thursday, 2 February 2006

The Changing Nature of University Courses in Chemistry and Chemical Engineering

Salters' Hall

Thursday, 2 February 2006

Aim

The aim of the Seminar was to evaluate the success or otherwise of changes and innovations that have been introduced in recent years in response to external variations in input and output; and this will be used as a basis on which to make recommendations of good practice to the Seminar, and more widely as appropriate.

Participants

Participation at the Seminar was by invitation and numbered about 60. Those who attended included representatives of the teaching professions in schools and universities, university managements, Funding Councils, examining and validating authorities, Government departments, a range of employers, together with members of the Chemical Education Group (given below).

The Association of the British Pharmaceutical Industry
The Association for Science Education
The British Association
Chemical Industries Association
Institution of Chemical Engineers
The Royal Institution of Great Britain
The Royal Society
The Royal Society of Chemistry
The Royal Society of Edinburgh
The Salters' Institute
Society of Chemical Industry

Welcome

The attendees were welcomed by Dr Richard Homan, Deputy Chairman of The Salters' Institute and Chairman of the Chemical Education Group. Sir David Harrison, Director of The Salters' Institute chaired the Seminar.

Setting the Scene

Dr Colin Osborne, Education Manager, Schools and Colleges, the Royal Society of Chemistry, gave breakdowns of the figures for the number of students taking Advanced Level Chemistry and going on to University to study Chemistry. These illustrated the current trends:

- Number of A-level chemists roughly constant over 10 years
- Numbers completing first chemistry degree have fallen by 20% over past 6 years
- There are, surprisingly, more acceptances to chemistry degrees than applications
- More than 90% of those taking A-level chemistry do not take chemistry degrees
- Increasing A-level numbers will have a minimal effect on intake numbers
- Bright students study chemistry at GCSE and A level
- Not enough of the top academic cohorts pursue chemistry degrees

Dr Osborne outlined what the RSC were doing to encourage a greater uptake of Chemistry:

- The RSC and HEFCE signed a joint statement committing the organisations to work together after publication of the HEFCE-commissioned Roberts' 'Review of Strategically Important and Vulnerable Subjects' in June 2005.
- HEFCE invited the chemistry community to bid for £20-30M funding to sustain chemistry higher education
- The RSC is coordinating the proposal. All HEIs have been contacted through Heads of Chemistry UK (HCUK)

Dr Trevor Evans, Chief Executive, the Institution of Chemical Engineers, illustrated that there had been a rapid decline in first degree applications evident in the late 1990's following intake peak at circa 1400 in 1992. An action plan was approved by IChemE Council in 1998 – "The Wilkinson Report" which resulted in a focused and targeted campaign "whynotchemeng" launched in 2000 after detailed market research and analysis.

Dr Evans gave breakdowns of the figures for the number of students studying Chemical Engineering at University and the current trends:

- 21 IChemE accredited courses in UK
- Almost all provision geared to CEng
- Current graduate output circa 1200
- Chemist/Chemical Engineer ratio is 2.2:1
- Steady increase in applications since 2002
- Applications via clearing are down
- Top UK universities seek 'international' positioning
- Possible evidence of bias towards overseas applicants
- Proportion of female applicants has levelled out

Presentations

Chemistry

Professor Steven Chapman	The University of Edinburgh
Dr Peter Griffiths	Cardiff University
Dr Patrick MacGowan	The University of Leeds
Dr Nick Norman	Bristol Chemlabs CETL

Chemical Engineering

Professor Jonathan Seville	The University of Birmingham
----------------------------	------------------------------

The presentations highlighted what was being done by Departments to increase the number of student applications to study Chemistry and Chemical Engineering and to ensure that students have the necessary support to finish the course:

- Interaction between schools and departments including 'open day' visits to schools
- Interview days for prospective students
- Improving the "look" of a department
- Attractive literature advertising courses
- Support of recruiting campaigns such as IChemE 's "whynotchemeng"
- As fewer students have the "classic" A2 subject combination of maths/physics/chemistry, additional courses are given throughout the first year to help students. Although students have a broader knowledge in the scientific arena, they lack some of the basic principles and concepts
- Ongoing monitoring of course content and structure
- Recruitment of overseas students

The presentations also highlighted the implications of:

- Full economic cost of teaching
- Department closures giving a bad press for Chemistry
- Introduction of higher tuition fees

The Seminar divided into small groups which discussed four questions.

Q1 To what extent are the trends in the number of student entries in Chemistry and Chemical Engineering shown in statistics published nationally reflected in experience on the ground in universities? Is there anecdotal evidence on any trends in the quality of student entries? Are there any pointers to future trends in number and quality, in 2006 and beyond?

It was generally perceived that the academic quality of the student intake was going down. This was particularly true with maths skills and to a lesser extent with English comprehension skills. This had already been highlighted by employers. Students' grades were going up but this is not reflected in their skill levels. Students have a broader knowledge of chemistry but lack basic skills (including practical) and do not have a firm enough understanding of fundamental concepts. They lack the skill to apply knowledge to new situations and to critically evaluate information. Students have not developed as independent learners as much as in the past as too much assessment reduces the time available to learn. There is a perceived inflexibility in the delivery of the curriculum.

If you would like more information regarding the Statistics from the Royal Society of Chemistry, please visit their website: <http://www.rsc.org/Education/Statistics/index.asp>

If you would like further information regarding the Statistics from the Institution of Chemical Engineers, please contact Mrs Lucy Taylor at taylor@icheme.org.

The "whynotchemeng" campaign has increased numbers applying to study Chemical Engineering at University and the numbers accepting places has also increased. It was emphasised that Chemical Engineering needs students with Mathematics, Physics and Chemistry at Advanced Level, but there has been a decline in the number of students taking this combination. The ratio of the number of students taking Chemistry to Chemical Engineering is 2.2:1.

Funding of HE courses is a major issue.

Q2 Are there any comments on the various responses by university departments generally to the impact of these trends, with particular regard to teaching methods and to the content and structure of courses.

Changes have been made in first year teaching to reflect the diversity of students' backgrounds and gaps in knowledge. The use of the term "remedial" should be discouraged (e.g. with additional Maths courses). Changes in learning styles at school need to be reflected in degree courses. More difficult chemistry topics have been moved to later years in degrees. More industrial placements should be introduced into degree programmes.

There is now a greater portfolio of degree courses and combinations. Changes to chemistry courses e.g. the 3+2 + 3 model allow for greater flexibility. Labs have been upgraded. Excellence in research is not necessarily the same as excellence in teaching. Raising A-level grade requirements has increased the number of good applications.

University school liaison and outreach activities have improved (e.g. a school teacher fellow at University) and have led to a greater understanding between schools and universities.

There is now increased sharing of information on successful strategies between university departments.

Q3 Are there external influences which exert special influence, for example, the spread in the knowledge base of the student entry, the national funding of Chemistry and Chemical Engineering departments, or the changes in the graduate employment market.

There is a funding issue with Chemistry departments operating at a loss and subsidised by other departments. This has been accepted by Government but action to rectify it needs to be accelerated. Departmental closures have an adverse effect; student expectations are adversely affected.

The introduction of tuition fees, which have to be paid off later when in employment, means that students are more critical of the end product and future salary prospects.

The quality of careers advice needs to be improved and there is the need for early intervention – KS3 at the latest. There is a disparate range of A level choices being taken by students wishing to study Chemistry or Chemical Engineering. The popularity of medicine has reduced the number of girls taking Chemistry and Chemical Engineering. At school students are not aware that not all Chemistry students become “chemists”. The image of “Chemistry” still appears to be a major issue.

More subject-specific support for science teachers from Primary level upwards is needed.

Q4 What recommendations should be made to the organisations that comprise the Chemical Education Group, and more widely as appropriate?

Through activities undertaken individually or co-operatively by the Member Institutions of the CEG and by using their influence to encourage:

- Greater support at LEA and school level for subject-specific CPD and increase opportunities for relevant CPD e.g. Chemistry for non-chemists, expand RSC programme
- Support for initiatives to improve the quality of teaching (at all levels)
- Advice towards a more coherent choice of A Levels
- More appropriate maths, in support of science, to be taught in schools
- Mutual understanding of where students are coming from and where they may go on graduation
- Facilitate a meeting of University Admission Tutors
- More support for and co-operation on outreach initiatives
- The media to be encouraged to publish a more positive image of chemistry and what it does
- The promotion of chemistry as a degree as ideal preparation for a number of differing careers
- Emphasis of the economic benefits of a chemistry education and training
- Expansion of the number of industrial placements for students
- Continued lobbying for increased funding for Chemistry departments