Letters

Assessment of Chemistry Degrees

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I read with interest Professor Bailey's perspective on the assessment of chemistry degrees within the UK. I believe that it is unfair to say that, to a large extent, we do not use appropriate methods for awarding and classifying degrees in chemistry.

The formal examination, if it is correctly structured, can be a very effective method for judging the depth of a student's knowledge, as well as their ability to solve problems.

I am certainly not against the other forms of assessment noted in the article (e.g. collaborative project work, poster displays, essays, etc). Indeed, we assess these activities in our teaching programme at Bath, as do most other UK chemistry departments. What does concern me is that we keep the balance of assessment methods about right. I suspect that most chemistry academics are more competent to assess examination scripts accurately (including answers to discursive topics) than they are to assess, for example, collaborative project work. In my experience, examination marks offer a better representation of a student's ability than any other single method of assessment.

Professor Bailey urges us to use more opportunities for assessment, and to ensure that we only assess those skills which we would like our students to develop. Fine. But let's not abolish the formal (well-structured) examination in the process.

Professor Pat Bailey replies

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I do not disagree with the views of Jonathan Williams – formal exams do indeed test many important skills, and are undoubtedly the assessment method in which we have greatest confidence.

Exams can assess (amongst other things) knowledge base, problem solving, critical thinking, reasoned argument, and essay writing skills. But I think that exams are often rather more limited in their scope because:

a) we set too many of them, leading to rather predictable and mundane questions;
b) exams are rarely designed with the explicit intention of rewarding a set of pre-defined skills.

From my perception of chemistry exams throughout the UK, I feel that students can often simply revise and learn the material for a specific modular exam and then forget it; and when asked for "explanation" type answers, they obtain good marks primarily for flagging up the key facts in their answers (i.e. getting the right tick list), rather than for being able to construct a well-reasoned, well-written argument. So the feedback (i.e. marks) students receive suggests "learn your facts, regurgitate them, then forget them, and you'll do well". This is, of course, absolutely fine if this is what is expected of graduates with a good chemistry degree. Nevertheless, many of our brighter and keener students obtain a much deeper understanding of their subject, although I fear that our assessment methods do not reward this adequately.

Conversely, most of the so-called "key skills" are flagged up by us as REALLY IMPORTANT, but are actually rewarded with a nominal percentage of the marks for a degree, particularly if one considers that such marks often show poor discrimination between students. With so much testing/examining elsewhere in the course, small wonder that students see straight through our words... and conclude that key skills are not very important at all!

Nevertheless, I'm not necessarily advocating that (say) 30% of degree marks should be allotted to generic transferable skills. But I simply point out that TEACHING such skills as part of a course, without giving serious marks for them, will inevitably produce many graduates who are not skilled in this way. Similarly, if we state in our course descriptors that we are addressing the key skills identified in the Dearing Report and Chemistry Benchmarking Document, we must be able to demonstrate that our degree classifications genuinely include these skills. If they do not, I would expect TQA to identify this as a deficiency, and it would be small wonder if employers continued to bemoan the poor level of generic skills in chemistry graduates.

Some Thoughts Following 'Crossing The Borders'

From Dr Alan Goodwin
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I was privileged to hear Onno de Jong's presentation at the Chemical Education Research Group lecture at Variety in Chemistry Teaching 1999, as well as to read the paper in its pre-publication format. I wholeheartedly agree with him about the importance of getting 'domain specific' aspects of teaching and learning back at the top of our agenda. Indeed, it seems axiomatic that the main focus of chemical education should be the understanding of chemistry, and yet this often seems to be eclipsed in interchanges with HEFCE and OFSTED by concerns for management, assessment, resources, cross-course policies etc. It seems that the actual learning of chemistry is considered to be unproblematic.

Overall I agree with de Jong that there are important lessons to be learned by paying close attention to the interactions which take place during learning. However, I am not convinced that recording and applying protocols is the only place to start – especially for academics who are more concerned with improving their teaching than with doing educational research.

The paper provides evidence that interesting insights can be gained by recording interactions in a classroom and transcribing the result – and then analysing the resulting transcript. Unfortunately, as de Jong agrees, this is a very time-consuming process and it seems a very expensive way of collecting data. I am particularly concerned that attempting to engage practising teachers in such activities would simply increase the bureaucratic pressure on them and

alienate them further from educational research. This is not to undermine the importance of focusing on the teaching and on classroom interactions, but to suggest that such data could more efficiently and more naturally be obtained by the teacher noting 'critical incidents' which occur during interaction with students during classes. These can be backed up with information from students' written work (including examination scripts) and through reflection on their own learning.

Most academics teaching chemistry have a wealth of experience of this sort, which is a really rich vein of information about the learning of chemistry. A little time spent analysing and reflecting on this experience can generate domain-specific ideas which are worth sharing with others (through discussions, letters etc) or which could form the basis of further investigations at the practitioner level. de Jong's description of the students' conceptual difficulties with the Daniell cell is a good example of a problem which can be revealed by reflecting on observation and experience. I would speculate that Student 2's response "Yes! I do not understand it either" could equally well be that of the teacher. It was certainly mine when a student first pointed out the problem to me. A key step in understanding how student misconceptions arise is the recognition that we academics cannot know everything, and that we are still learning[1]. Individual experiences provide important research data, the application of which can lead to improved learning. We are all researchers in chemical education when we document, reflect on, and share our experiences. Let's keep this high on our agenda.

1. Goodwin A J, 'The Teaching of Chemistry: Who is the Learner?' Chemistry Education, Research and Practice in Europe, 2000, 1(1) Published on www at: http://www.uoi.gr/conf_sem/cerapie/

Key Skills Development Support from Central Services

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Recent articles in this journal[1,2] illustrate the growing expectations on Higher Education Institutions (HEIs) to provide an environment which develops key skills as well as subject expertise. The introduction of an employability performance indicator[3] for HEIs and the pressure from students who are contributing financially to their education have brought key skills onto the agenda of all academic disciplines. The problem for hard-pressed academics is how to incorporate the teaching of these skills into an already overcrowded curriculum. There is a growing opportunity for central services to support academics in this role. After discussing these problems with interested academics at the recent Variety in Chemistry Teaching meeting[4], I was encouraged to explain how this support is provided at the University of Newcastle upon Tyne in the hope that it may encourage chemists to seek the support of equivalent units in their own university.

The Academic Development Unit within the Careers Service aims to advance the embedding of key skills within academic curricula and provides a range of support activities. Many of our current projects stipulate that we work with academic departments and some enable us to buy the time required for academic staff to develop suitable resources. Our activities include:

- Keeping a database of effective practice, including materials which can be adapted by interested colleagues
- Disseminating effective practice by means of a website[5] and internal mailbase
- Providing an environment for the exchange of ideas and sharing of concerns across disciplines, through the mailbase and staff training seminars and presentations
- Identifying sources of external funding for development activities and supporting academic colleagues in the bidding process
- Developing and delivering materials and workshops to develop key skills in the student body

We are currently working closely with our Chemistry Department to develop support for students taking a sandwich year. In addition to subject specific sources, such as those developed by Drs. Wallace and Murray at Nottingham Trent University[6], we have been able to offer substantial support and delivery through external funding (from the DfEE Innovations fund) which has paid for all involvement from the ADU. This project funded the development of a reflective workbook and a series of workshops to improve students' learning from their industrial training.

Our response to many requests for assistance from academics is to disseminate existing good practice. The materials developed by Bailey[7] have inspired similar activities in departments from Archaeology to Microbiology. In the last week I have directed a colleague in Ecological Resource Management to "A Question of Chemistry"[8] and sent details of Roger Maskill and Imelda Race's[9] work to an academic in Marine Biology – both were impressed and relieved to discover materials that they could easily adapt for use in their own subjects.

These types of activities are not unusual to Newcastle. Like other active central support units, we are brought into frequent contact with academics, students bodies, employers, learned societies and other support units giving them many opportunities to identify, support and disseminate effective practice. Wherever they are found, a central support unit can act as a communication channel between you and other innovators. You can help them by introducing them to resources like UChemEd, which I find useful even outside chemistry. They can help you by providing you with the same kind of stimulation from colleagues of other disciplines that you enjoy when mixing with other chemists at Variety.

References

1. Belt S Clarke M Phipps L 1999 Exercises for chemists involving time management judgement and initiatve *UChemEd* 2 16
2. Duckett S Garrett J Lowe N 1999 Key Skills: What do Chemistry Graduates think ? *UChemEd* 3 1
3. Due to be announced by the DfEE early 2000
4. Shinton S 1999 Supporting Innovation *Proceedings of Variety in Chemistry Teaching* (eds Garratt J and Overton T) Royal Society of Chemistry
5. See http://www.careers.ncl.ac.uk/academics
6. Murray R and Wallace R 1999 Good Practice in Industrial Work Placement (Project Improve)
7. Bailey P and Shinton S 1999 *Communicating Chemistry* (Royal Society of Chemistry)
8. Garratt J Overton T and Threlfall T 1999 *A Question of Chemistry* (Pearson Education Ltd, Harlow)
9. Maskill R and Race I 1999 *Personal and Professional Development for Scientists* (HEFCE) See http://wwwueaacuk/che/ppds/