

## **CEG SEMINAR REPORT**

on

### **Chemistry in the Curriculum**

This report contains a brief summary of the main speakers and the group and plenary discussions. The group discussions were an important part of the proceedings and the Education Officers have kindly provided more detailed reports from their own groups which are included at the end of the papers. The Seminar Programme, which includes the group discussion questions, is also attached.

#### **What is happening in Chemistry in our schools today.**

**John Holman**

John reminded us that despite some setbacks, chemistry is alive and well within our schools. Although few primary teachers have qualifications in science this is one of the great success stories of the National Curriculum. Newspapers are quick to denigrate England's low place in international tables of the mathematical ability of nine year olds but omit to point out that we are 8th in science and even better in practical science.

Another success of the National Curriculum is that everyone from 5 to 16 years old studies all three sciences and some earth science. It was, however, a disaster that the National Curriculum was never piloted; too many pupils experienced the mistakes. Too many changes have disillusioned the teachers who started enthusiastically. These changes have produced a chemistry curriculum which is more directed to the needs of the specialist chemist than the 1989 version.

Many teachers feel that in both Chemistry and Dual Award Science there is an inadequate preparation for A level Chemistry; but motivated students can overcome these difficulties. Students still perceive chemistry (like physics) as difficult and research from Durham University supports this perception. This must be, at least partially, responsible for the percentage decline in the numbers of A level Chemistry students. It is surprising that an attractive course like GNVQ Science has not attracted more students. Greater breadth in the whole post 16 curriculum is long overdue and in all subjects more breadth within the subject, as for example with the Salters' Chemistry A level, is necessary.

We should take heart from the breadth of knowledge and skills within a chemistry degree course which is uniquely able to provide employment opportunities in a wide field, including those outside the chemical industry.

**Mike Coles**

Although OFSTED and SCAA have been interested in changes in standards, a recent Royal Society of Chemistry project has studied changes in subject matter, depth of treatment and the demands which examination questions make on candidates in both GCSE Chemistry and Dual Award Science. The conclusions indicate that there is considerable variation across the courses and suggest, with some reluctance, greater regulation in future. Such regulation should follow a new vision of Key Stage 4 Chemistry and the purpose of Chemistry teaching. Such a vision should be developed independently of examination boards.

Finally the Characteristics of Scientific Capability, developed as a result of research amongst those working as scientists at all levels, were listed. They are:

- Being able to use a scientific knowledge base
- Generic (non scientific) skills
- Ability to manipulate skilfully equipment and materials
- Understanding how to experiment
- The ability to analyse data
- Appreciating the nature and structure of science work

#### **The View from the Classroom**

**Elaine Coop**

It is the colour, smells and bangs which make chemistry exciting to the eleven year old. Since chemistry is at the centre of all our lives, teachers must promote this to make the subject interesting. Teachers must use the curriculum to provide opportunities for challenging student centred learning. Chemical investigations can be set in a relevant context ranging from the efficiency of disposable nappies to the quality of drinking water world-wide, using Internet connections with schools in Tokyo and Europe. The development of a range of skills including information gathering and decision making is integral to such work.

### **Glyn James**

There is a long history of learning science through inquiry, this was basic to the Nuffield Schemes. While OFSTED seems to favour traditional methods, the curriculum must provide opportunities to reward curiosity. Young people learn by observation, questioning and developing explanations under the skilful guidance of their teacher. Although knowledge is of primary importance, pupils should be freed from unnecessary knowledge so that they may enjoy the privilege of understanding and so that the full ability range may be stimulated.

### **Elaine Wilson**

The good teacher is essential to enhance the curriculum. Each pupil brings their own level of ability but the teacher provides the support, opportunity and motivation to produce achievement.

There is a culture of 'covering the National Curriculum' rather than achieving an 'overview of chemistry'. A reduced curriculum would help. A move towards learning outcomes rather than level descriptors could bring systematic inquiry to the forefront and restore some of the awe and wonder so essential in science.

### **Industry**

### **Dr Robin Paul**

The Chemical Industry which is critical to the future economic competitiveness of this country, values education and particularly the development of a wide range of appropriate skills. The people who work within industry should be motivated and stretched; developing relevant skills is more significant than innate ability. Industry values motivated focused individuals who can contribute to team work. It needs conscientiousness, reliability, communication skills, the ability to think clearly and commitment.

Leaders in industry need a high level of understanding. It is harder to gain a place on a university veterinary course than one in chemical engineering. Does this indicate that our best brains are not encouraged to turn to an industry which must compete with the countries of the Pacific Rim?

Industry needs a public who can appreciate cost benefit, analysis of risk, appreciate that "science" is uncertain, have some understanding of statistics and a healthy scepticism.

The Chemical Industry is ready to help and support schools in showing its relevance to pupils. It is holding open days to invite the public to see how it works. It will provide speakers for schools. It is concerned to show society a fascinating and economically important industry.

### **A Summary of the Group and Plenary Discussions**

When the National Curriculum was established in 1989, there were no pilot schemes, which meant that large numbers of pupils suffered from the inherent mistakes. Before any further revision, it is essential that the aims and objectives of chemistry teaching are clear. The curriculum, at least to the age of 16, must respond both to the needs of those who will become specialist chemists and equally important the needs of laymen, who in the 21st Century must be scientifically literate. A vision of chemistry teaching must provide an understanding (not just a knowledge) of the world in which we live. Every substance is a chemical and the stigma of that word must be erased. Chemistry is fun and exciting and the motivation of our pupils is a priority.

At present there is too much factual knowledge to allow the space to respond more specifically to a range of pupils. Some seminar members believed that this could be achieved with a core and options for specialists or generalists. Chemistry concepts are made fascinating by teaching them within a context that is relevant to the pupils experience. The outcome must include not only knowledge, but also a range of skills both crosscurricular and scientific which should be integral to the course.

The delivery of an exciting, relevant curriculum, as for any subject, needs high quality teachers. On-going professional development is essential but chemistry teachers should be part of the community of chemists as well as the community of teachers. This would imply more opportunities for industry secondments.