

**Note on:
Health and Safety in the Teaching of
Practical Chemistry in Schools**

The Royal Society of Chemistry (RSC) has serious concerns about the decline in the teaching of practical chemistry in schools. This Note argues that blame for this decline should not be placed on health and safety legislation. The RSC believes that practical chemistry can be taught in schools without risk to the health and safety of pupils provided appropriate precautions are taken.

1. Introduction

It is essential that the UK continue to produce well-qualified scientists with a sound grounding in practical science if it is to maintain its position as a leading scientific and technological nation. Chemistry is one of the most important of the sciences in this respect. However, the amount of practical chemistry teaching in schools and in some cases its quality, have declined in recent years. There are fears that this will compromise the supply of suitably-qualified chemists and chemistry teachers. We believe that school pupils will not be adequately prepared for practical work in industry and higher education courses.

Laboratory work is an essential element in pupil learning which cannot be adequately replaced by other approaches. The risks associated with the teaching of practical chemistry needs to be kept in perspective. Public understanding suggests that health and safety legislation is the main reason why chemistry experiments are prohibited, even though very few cases of injury to children have been recorded. In fact, legislation does not 'ban' any chemicals or procedures likely to be used in school chemistry. The fear of litigation has led to health and safety legislation being used as an excuse to avoid the teaching of practical chemistry skills. In contrast, schools do not ban physical sports activities, such as cricket, simply because they are seen as "dangerous". Laboratory-based classes make a positive contribution to understanding chemistry and should be actively encouraged. Governing bodies should be reassured by knowing that, even in today's risk-averse society, provided that proper risk assessments have been carried out and appropriate risk controls or precautions are in place, all reasonable steps have been taken to safeguard the safety of pupils. Evidence suggests that practical chemistry in schools does not and has not, posed a significant risk to pupils.

It is vital to engage the minds of our potential future scientists. In addition to chemistry practical classes in school, there are many successful public events throughout the year which aim to inspire these potential scientists. Science Week, for example, sees thousands of school-aged children attending an exciting mix of lectures, demonstrations and hands-on practicals in all manner of science-based subjects. In such circumstances, if chemistry-based lectures can be safely given to 1000 plus school children, then adequately managing 20 or 30 children in a school laboratory should be readily achievable.

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2. Benefits of Laboratory Practicals

Practical chemistry teaching offers opportunities for students to:

- learn to handle chemicals safely and with confidence;
- gain experience in using chemical apparatus, such as burettes, and
- develop basic manipulative skills.

Moreover, it assists the process of beginning to:

- identify hazards;
- learn to assess and control risks;
- evaluate the effectiveness of control measures;
- learn to follow procedures and behave responsibly; and
- wear appropriate personal protective equipment.

School pupils have much to gain from experimental work, whether it is performed by themselves, or by simply watching others perform experiments. Laboratory practicals at school give pupils a good grounding in the basic principles of science and can include:

- hands-on experiments where students perform an activity or technique;
- investigations where students try to make logical deductions based on the methods under examination;
- demonstrations where the teacher performs the experiments in front of the class; and
- projects in which students design simple experiments to answer a particular question and then conduct the experiments.

Practical chemistry can provide a useful change from text or e-learning and, when well taught and supervised, can motivate and excite the students. There are diminishing opportunities for students to experience real risks as virtual reality gains popularity. Chemistry is one of those few remaining subjects in the curriculum where risk can be evaluated in a safe environment and in an appropriate context.

3. Health and Safety Legislation and Practical Science

Health and safety legislation was never intended to inhibit the teaching of practical science. It was designed to protect the health and safety of employees (e.g. teachers and laboratory technicians) and those affected by those work activities (pupils), not to prevent them from undertaking practical work in school laboratories.

The Health and Safety at Work Act (1974) as amended, applies to all workplaces, including schools. This means that the schools via their employers (the Local Education Authorities) have a duty to ensure the health and safety of teachers, technicians and pupils. In fulfilling this duty, schools and their governing bodies need to be satisfied that adequate arrangements are in place to ensure that laboratory activities are carried out safely.

The most wide ranging legislative requirements are those contained in the Management of Health and Safety at Work Regulations (1999) as amended, often referred to simply as the Management Regulations. These requirements apply to all school activities including sports, outdoor activities, domestic science, technology and science. This means at a practical level, that teachers are required to undertake risk assessments and introduce appropriate risk control measures before embarking on any activity. There is no reason to single out practical chemistry as a subject for special and onerous legislative requirements.

In the case of school chemistry laboratories the more specific Control of Substances Hazardous to Health (COSHH) Regulations, apply. The COSHH Regulations (2003) require the assessment and control of risks associated with work activities involving the use of hazardous substances, which includes most chemicals. By carrying out COSHH assessments of laboratory activities, schools comply with the general requirements of the Management Regulations. The COSHH Regulations do, however, prohibit the use of a very limited number of specified substances that are not, in any case, used in schools. The COSHH Regulations do not imply that the use of other chemicals are “banned” or that experiments are “prohibited”. Nevertheless, anecdotal evidence suggests that some Local Education Authorities

and school governing bodies are citing legislation as a reason to discontinue practical chemistry teaching. Anxious parents have contributed to this situation by expecting a risk-free environment for their children.

COSHH risk assessments can form part of class protocols which teachers would need to prepare and discuss with laboratory technicians prior to undertaking practical lessons. Furthermore, pupils can be actively involved in the risk assessment process, for example, by collecting the information on hazards, assessing risks and discussing control measures.

There is a wide range of guidance on legal requirements to help ensure that work activities are carried out safely and with minimal risk references to which are given in the Section 8, "Sources of Further Information", below.

4. Realistic Risk Assessment for Practical Classes

In recent years health and safety has had a bad press. The Health and Safety Executive (HSE) and other organisations including the RSC are concerned to redress the imbalance arising from the adverse publicity and to give a balanced view of health and safety and have been running campaigns on risk education. HSE's "Myth of the Month" campaign illustrates some of the misconceptions about health and safety. A visit to HSE's website also shows that several of these myths relate to school-based activities.

There is scant evidence to show that school children are injured in laboratory practical classes. Moreover, causes of such accidents are more likely to be due to poor behaviour, such as horseplay, than any risks from the use of chemicals. Sensible risk assessment in schools is not about eliminating risks altogether, nor about stifling practical experiments. It is about making sure that sensible precautions are in place.

Pupils learn more from practical work in a carefully controlled environment than from videos or e-learning methods. Pupils without practical experience who progress to undergraduate level courses involving experiments are at a disadvantage. They may choose instead to study theoretical or computational chemistry in order to avoid practical work for which they are ill-equipped. In some cases, universities have found it necessary to institute intensive practical training prior to the start of the first term to ease the transition and to equip students with the skills they may be lacking.

5. Controlling the Risks

The approach to controlling the potential risks from practical chemistry teaching is the same, in principle, as that which should be taken to control any other type of risk in schools. All that is required to teach practical chemistry safely is to look at the way in which chemicals are used and to consider how to control the exposure to these chemicals by pupils (and teachers) so that any risks to health and safety are acceptably low. There may be concern that the risks are not reduced to zero. However, pupils are exposed to higher risks in many other school activities, e.g. sports and technology, and indeed when crossing the road to get to and from school. These risks have clearly been judged 'acceptable' even though they are not zero.

It is not difficult to control chemical risks and there is plenty of guidance available to help. Information on the hazards likely to be found in school chemistry laboratories is given in the data sheets published by CLEAPSS (Consortium of Local Education Authorities for the Provision of Science Services), ASE (Association for Science Education, SSERC (Scottish School Equipment Resource Centre), HSE and the RSC. Details on the guidance available are given in the Section 8, "Sources of Further Information", below.

6. Conclusion

Health and safety legislation was never intended to inhibit the teaching of practical chemistry but to ensure that it is carried out with minimum risk. The RSC urges head teachers, classroom teachers and governing bodies to recognise the importance of practical chemistry and to ensure that the guidance they give to science departments is proportionate to its safety compared to many other activities carried out in schools without such concerns.

7. Sources of Further Information

EHSC Note "Individual Legal Responsibilities for Health and Safety at Work", Royal Society of Chemistry (2003)

EHSC Note "Risk Assessment at Work", Royal Society of Chemistry (2007)

EHSC Note "COSHH in Laboratories", Royal Society of Chemistry (2003)

EHSC Note "Health and Safety of Young Persons Working in Chemical Laboratories", Royal Society of Chemistry (2007)

Association for Science Education (ASE), College Lane, Hatfield, Hertfordshire, AL10 9AA. Tel: 01707 283000. Website: www.ase.org.uk

'Safeguards in the School Laboratory', 11th Edition, ASE (2006), ISBN 9780863574085

'Topics in Safety', 3rd Edition, ASE (2001), ISBN 9780863573163

CLEAPPS, The Gardiner Building, Brunel Science Park, Kingston Lane, Uxbridge, UB8 3PQH. Tel: 01895 251496. E-mail: science@cleapss.org.uk. Website: www.cleapss.org.uk

'CLEAPPS Hazcards', CLEAPPS, (2007)

'Laboratory Handbook', CLEAPPS – available on CD only.

"Surely that's banned?" CLEAPPS Bulletin 125, (2005) – Report for Royal Society of Chemistry – available on both CLEAPPS and Royal Society of Chemistry websites.

Scottish School Equipment Resource Centre (SSERC), 2 Pitreavie Court, South Pitreavie Business Park, Dunfermline, Fife KY11 8UB. Tel 01383 626070. E-mail: sts@sserc.org.uk. Website: www.sserc.org.uk

'Hazardous Chemicals. A manual for science education', SSERC – available on CD only.

"Safety Net", SSERC – a manual covering safety issues in chemistry, biology and physics and available to members only on CD.

Health and Safety Executive. Tel: 08701 545500. E-mail: hseinformationservices@natbrit.com. Website: www.hse.gov.uk. The website includes "Myth of the Month" which is aimed at debunking popular misconceptions about health and safety. The Risk Education page has links to a number of websites of other organisations offering guidance and support.

HSC - Education Service Advisory Committee (ESAC) "Health and Safety Guidance for School Governors and Members of School Boards, HSE Books, (1998)

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