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SSR School Science Review

Practical work I

The Association for Science Education

The ASE's journal for science education 11–19

BIOLOGY FIELDWORK FOR THE NEW A LEVEL SPECIFICATIONS

> An appreciation of the complexity and diversity of the natural world is only possible by experiencing it – this cannot be achieved solely in the classroom.
>
> Head of Biology, Caterham School

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Editorial Board and Associates

Editor

Geoff Auty

Editorial Board

Editorial Associates

The Editorial Associates support the Editorial Board in advising the Editor on the suitability of submitted articles.

ASE Health and Safety Group Representatives

Editorial

I have always understood that practical work is central to education in science. In my own school days, the timetable placed us in a laboratory for a double period while the remaining single period of three might have been in a laboratory but could be in a distant classroom.

When I started teaching, the same arrangement applied. Before my first term started, the head of department sent me a scheme of work for the 11–16 classes, and it consisted of a set of titles for the practical work with further brief notes about follow-up. When we met, he said there should not be a week without a practical feature to the teaching, and that it should be for the students to do themselves whenever possible. Timetable constraints meant that the single period might not be in a laboratory but, if it was, there would be the opportunity for a demonstration to reinforce what had been seen in the previous lesson. It was all about 'learning by doing' and no thought was ever given to testing the practical experience directly, but that experience was considered a vital component of the process by which learning took place. To check the inclusion of practical work and what it had achieved, end-of-course examination questions might require students to describe 'how to measure', 'how to investigate', etc. This required lengthy essays that no doubt took a long time to mark.

Arrangements were different in the sixth form. The double period was always for class practical work and the emphasis was on accurate measurement. The content of those lessons was quite separate from the other six periods. In chemistry, they were mostly rehearsals for the practical exam. There were just two strands: volumetric analysis (testing concentration of solutions, etc.) always seeming to involve burettes, pipettes and two-pan balances; and qualitative analysis (trying to find out what substances were in a mixture). Physics was more varied. With apparatus such as travelling microscopes and spectrometers (not enough for one per student), we worked on a rota basis week by week. In the other six lessons (often not in a laboratory), we covered a lot of mathematical theory, and any practical work was usually teacher demonstration. Details such as the history of science were also covered, but there was no doubt that practical experience at age 16 as well at 18 was essential to gaining good examination marks in the sciences.

In more recent years, we have seen the introduction of practical examination at age 16. With so many students to test, this presents logistical problems, and an end-of-course examination is not really viable. Hence examination has been replaced by assessment that can be spread throughout the course but is easier to handle as distinctive work towards the end.

Now the concern is that, as teachers have become more skilled in devising investigations at which their students will be successful, there is little discrimination. The consequent logic is obvious: '*It's not worth having a race that everybody wins. Drop the practical assessment!*' So there is a new concern. If practical work is not tested, it will not be done.

The result is that, after many months of debate, there seems to be no clear picture on the way forward, and a suitable approach to practical work is occupying the attention of the entire science education community at the moment.

I was very pleased when Michael Reiss, a long-standing member of the *School Science Review* team, agreed to be guest editor for a theme on practical work in school science. He was so successful in finding willing contributors that we have had to split the theme material into two parts. In this edition, the focus is on the work done within the school curriculum, which Michael introduces on p. 13. In September, there will be practical ideas for extracurricular and enrichment activity, which in my view are equally important.

With such a large theme, we only have space for three other contributions. There are two *Science notes*. Paul Elliot shows that a very simple balance can be made to illustrate that gases have mass (or have differing densities). Alan Goodwin describes how to demonstrate explosive reactions in gases. This adds further ideas to his article in our 'Small-scale science' theme in March 2011. In the final article, Teresa Celestino and Marco Piumetti use concept maps to illustrate connections between chemistry and other subjects, and to consider ethical issues related to science.

Geoff Auty
Editor, School Science Review

Health & Safety

For all practical procedures described in *SSR*, we have attempted to ensure that:
- all recognised hazards have been identified;
- appropriate precautions are suggested;
- where possible procedures are in accordance with commonly adopted model risk assessments;
- if a special risk assessment is likely to be necessary this is highlighted.

However errors and omissions can be made, and employers may have adopted different standards. Therefore, before any practical activity, teachers should always check their employer's assessment. Any local rules issued by their employer must be obeyed, whatever is recommended in *SSR*.

Unless the context dictates otherwise it is assumed that:
- practical work is conducted in a properly equipped laboratory;
- any mains-operated and other equipment is properly maintained;
- any fume cupboard operates at least to the standard of Building Bulletin 88;
- care is taken with normal laboratory operations such as heating substances or handling heavy objects;
- good laboratory practice is observed when chemicals or living organisms are handled;
- eye protection is worn whenever there is any recognised risk to the eyes;
- fieldwork takes account of any guidelines issued by the employer;
- pupils are taught safe techniques for such activities as heating chemicals or smelling them, and for handling microorganisms.

Readers requiring further guidance are referred to:
Hazcards (CLEAPSS, 2007 and updates)
Topics in safety, 3rd edn (ASE, 2001)
Safeguards in the school laboratory, 11th edn (ASE, 2006)
Safety in science education (DfEE, 1996)
Preparing COSHH risk assessments for project work in schools (SSERC, 1991)
Hazardous chemicals: an interactive manual for science education CD2 (SSERC, 2002)
Be safe! Health and safety in school science and technology for teachers of 3- to 12-year-olds, 4th edn (ASE, 2011)

Contributing to *SSR*

We welcome contributions for all sections of *School Science Review*.

These can be emailed to The Editor, ssreditor@ase.org.uk, or posted to The Editor, *School Science Review*, ASE, College Lane, Hatfield, Herts AL10 9AA.

Detailed advice on the submission of articles and Science notes is available on the ASE website at: www.ase.org.uk/journals/school-science-review/submissions.

Themes being considered for the future for which submissions are invited:
- Teaching science through literacy
- Mathematics in science