SCORE
SCIENCE COMMUNITY REPRESENTING EDUCATION

EXECUTIVE SUMMARY

PRACTICAL WORK IN SCIENCE: A REPORT AND PROPOSAL FOR A STRATEGIC FRAMEWORK

BACKGROUND

The importance of practical work in science is widely accepted and it is acknowledged that good quality practical work promotes the engagement and interest of students as well as developing a range of skills, science knowledge and conceptual understanding. It is also acknowledged that in the UK more practical work takes place in science lessons than most other countries. However concerns have been expressed by sections of the science community, industry and business that schools in general are not doing enough practical work and that its quality is uneven.

This report into practical work in science in the UK during 5-19 education reviews evidence and, based on its key findings, proposes a strategic framework for enhancement of the practical work in science in schools and colleges.

SOURCES OF EVIDENCE

Between September 2007 and June 2008, SCORE engaged with a wide range of stakeholders in order to explore three main questions:

- What is meant by practical work and what is its purpose?
- What are the factors that facilitate good quality practical work and the barriers that militate against it?
- What are the key elements that need to be addressed in order to improve the quality and the scope of practical work in science across schools and colleges?

Evidence was drawn from four main sources: a literature review, an open call for evidence, online surveys of teachers and technicians and a series of stakeholder workshops. Throughout, the process for gathering and analysing evidence has been iterative with each stage building on earlier steps.

KEY FINDINGS

1. There is overarching agreement that 'practical activities' can be put into three broad groups: core activities, directly related activities and complementary activities. Practical work in science includes the core activities and the directly related activities. The complementary activities are important in supporting the development of conceptual understanding in science through practical work.

Practical work in science

Core activities
Investigations
Laboratory procedures and techniques
Fieldwork

Directly related activities
Designing and planning investigations
Data analysis using ICT
Analysing results
Teacher demonstrations
Experiencing phenomena

Complementary activities

Science-related visits
Surveys
Presentations and role play
Simulations including use of ICT
Models and modelling
Group discussion
Group text-based activities

2. The importance of practical work in science is widely accepted and it is acknowledged that good quality practical work promotes the engagement and interest of students as well as developing a range of skills, science knowledge and conceptual understanding.

3. There is a strong commitment to high quality practical work in science among teachers, technicians, and other stakeholders alike.

4. There is a wide range of good practical work in science taking place across the UK but there are indications that the situation could be improved by extending good practice and focussing on the quality, rather than just the quantity, of practical work.

5. Effective pedagogy is at the heart of improving the quality of practical work in science. When well planned and effectively implemented, practical work stimulates and engages students' learning at varying levels of inquiry challenging them both mentally and physically in ways that are not possible through other science education experiences.

6. Many teachers indicated that they felt confident doing practical work but there was a very strong indication that this was because they had been able to gain experience over a period of time.

7. There is well-documented evidence of the shortcomings of equipment funding and replacement of laboratories which require continued monitoring and should be addressed as part of wider strategy and improvement in facilities.

8. Although there are currently no serious threats to practical science from health and safety requirements, there is a negative impact resulting from perceptions as to the restriction imposed by health and safety concerns, particularly regarding field trips. This latter situation needs to be addressed and kept under review as new legislation, pupils' behaviour and a lack of technical support can result in significant reductions in practical work in science.

9. Although many teachers expressed dissatisfaction with the amount of time and resources for practical work in science and reported falls in provision, the time devoted to it is still substantial, with 80% indicating they spent more than 40% of lesson time at KS3 doing practical work, though only 56% and 45% reporting that they spent more than 40% of time at KS4 and KS5 respectively.

10. There was concern expressed that teachers did not necessarily feel confident in carrying out practical work outside their specialist discipline. The importance of mentoring of inexperienced teachers was noted as a way of building confidence.

11. Subject-specific professional development, or rather the lack of it, has been highlighted in other reports. More specifically the questionnaire responses indicated that, although 21% of teachers had engaged in CPD specifically related to practical work in the last year, over 40% indicated they could not remember 'ever' receiving CPD on practical work. Opportunities for training and professional development for teachers and for technicians, to support practical work, need to be improved and teachers and technicians engaged with these.

12. The use of ICT is a vexed question that exposes inherent tensions. There is, however, an underlying consensus that ICT should supplement and enhance practical work not replace it. How this is to be done is not well understood and many respondents to the questionnaire did not see ICT as a way of improving practical work.

13. Current assessment demands are damaging and restricting practical science; 66% of the respondents to the questionnaire indicated that the amount of practical work at KS4 had been reduced in recent years. Lack of experience and/or understanding of the aims of the new GCSE courses appear to have adversely affected the amount of practical work at KS4 in a considerable number of schools.

RECOMMENDATIONS – DEVELOPING A STRATEGIC FRAMEWORK

The importance and value of practical work in science has again been re-enforced during this project, and the potential for improving its quality is recognised. The major challenge is to take advantage of this underlying support and to integrate the strengths of the existing good practice with the potential for future opportunities.

The findings support a strategy which:

a. improves the effectiveness of existing provision through improved dialogue and awareness of initiatives and an agreed definition of what is considered to be practical work in science;

b. embodies a strong communications strand – for dissemination of information, including details of support, that is available to support practical work and engages in debate about ways in which practical work in science can be further improved;

c. strengthens support and professional development specifically focused on improving practical work in science thereby building capacity and sustainability;

d. is based on evidence which can better define the problems, support the monitoring and evaluation of the impact of the strategy during its implementation and influence existing and future policy-making.

The strategy should include five strands as follows:

a. **Leadership and management** through the establishment of a 'management group', convened by SCORE, with a membership that includes, for example, SCORE members, representatives of DCSF, DIUS, National Network of Science Learning Centres, Secondary National Strategy, SSAT, CLEAPSS, the Gatsby Charitable Foundation and industrial partners.

b. **Communication and dissemination** to raise the profile of practical work and to maximise the awareness of the support that is available to support practical work in science.

c. **Facilities and resources** to bring together the best advice on facilities and resources to support practical work in science.

d. **Developing professional expertise in practical work in science**, principally through existing mechanisms. It is essential that there is some dedicated resource (human and financial) to ensure that the practical work elements are not lost because of other pressures.

e. **Research and evidence** to better inform future developments and monitor the impact of any interventions. In particular further consideration needs to be given to the detail required of a wider benchmarking of the current state of practical work in science in schools and colleges.

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