Report summary

Successful science

An evaluation of science education in England 2007--2010

This report draws on the results of visits by inspectors to 94 primary, 94 secondary schools and two special schools between June 2007 and March 2010. These schools were selected broadly to represent the profile of schools in England, but excluded schools in Ofsted's categories of concern. It also draws on the outcomes of subject conferences organised by Ofsted. During the past year, 2009–10, inspectors reported on post-16 science education in 31 colleges and their reports have also formed part of the evidence.

There has been an improving trend in the provision of science education over the period of this report, especially in secondary schools, but there are areas that need further improvement, particularly in primary schools. The most important focus for schools is to ensure that pupils are engaged and challenged by their work in science, particularly in scientific investigation and how science works. Students need access to relevant courses that provide them with clear, high-quality pathways through their education, allowing them to attain the highest standards possible, both in the short term and when they progress to further and higher education. The best schools are already doing this.

Achievement in science was either good or outstanding in just over two thirds of the schools visited. While this overall proportion of 'good or outstanding' was similar for primary and secondary schools, there was a larger proportion of secondary schools where achievement was judged to be outstanding. Overall levels of attainment in primary schools, as measured nationally by teacher assessment data, were broadly similar to those observed during the previous inspection cycle; however, attainment at the higher levels was slightly reduced. Over the same period, success rates for separate science subjects at GCSE level have increased significantly: in 2010 around 12,000 more students than in the previous year were awarded grades A* and A at GCSE in each of the three separate sciences of biology, chemistry and physics.

The highest-performing schools, both primary and secondary, had clear priorities for raising standards and had several features in common. These included rigorous monitoring and evaluation of performance, aligned with challenging target-setting for individual pupils. The schools focused strongly on improving the quality of teaching

and learning, with staff within science departments planning together and sharing good practice. These characteristics are explored later in the report.

In both primary and secondary schools, teaching in science was at least good in around three quarters of the schools visited. This proportion is higher than for schools' overall performance in teaching and learning. Science, being a core subject, is a priority area for schools compared with the foundation subjects.

While the quality of teaching in the primary and secondary schools visited was similar overall, there was a slightly higher proportion of outstanding teaching in the secondary phase. Teaching was good when teachers had a clear understanding of what knowledge, understanding and skills were to be developed; understood how development in scientific enquiry promotes effective learning; understood the relationship between concepts and the cognitive demand they make; and were clear about what pupils already knew, understood and could do. The impact of good teaching was seen when pupils understood clearly the standards they had achieved; knew what they needed to do to improve and were involved in peer and self-evaluation; took part in decision-making, discussion, research and scientific enquiry; and were engaged in science that had relevance to their lives. In none of the schools visited was science teaching overall inadequate.

Primary teachers' take-up of science-specific continuing professional development was low in the schools surveyed. While much of the professional development they received overall was relevant to science, it was often generic, for example being focused on improving teaching and learning or assessment generally. In just under two thirds of the primary schools where science-specific continuing professional development was evaluated, it was no better than satisfactory. In the secondary schools where this provision was evaluated, the picture was better: nearly six out of 10 secondary schools had professional development for science that was good or outstanding.

The curriculum in the best schools, both primary and secondary, engaged pupils' interest and enthusiasm and promoted good progress in knowledge, understanding and skills in science. Again, the curriculum was more often outstanding in the secondary schools visited than in the primary schools. This was achieved best through collaboration among teachers on planning for science and the effective sharing of good practice. In secondary schools, the introduction of a wider range of courses since September 2006 has been beneficial. In the last year covered by this report (2009–10), entries at GCSE for each of the three separate sciences increased by approximately 30,000. The entitlement of students achieving Level 6 in science at the end of Key Stage 3 to study the three separate sciences at GCSE has promoted recruitment to post-16 A-level science courses. Schools that entered students inappropriately for vocational courses such as BTEC limited their choice of pathways through post-16 education.

Post-16 science education has been inspected in both schools and colleges. Science provision was good or outstanding in 15 of the 31 colleges where science and

mathematics were a focus for inspection and was inadequate in five. The proportion that was inadequate is a matter of concern, as is the proportion of good and outstanding provision which was lower than that earlier in secondary education. The strengths and weaknesses seen in science in these colleges were also often evident in school sixth forms. Since the last report, lessons where notes are simply dictated to students were seen less frequently. Good practices seen in Key Stage 3 and 4 have been transferred to sixth form teaching. These included more frequent assessment being used to inform planning and teaching, more rigorous target-setting and regular monitoring of progress.

In the schools visited in 2007–10, assessment was better overall than it was for the schools featured in the last three-yearly report. It was good or outstanding in just over three quarters of the secondary schools and slightly under two thirds of the primary schools visited. In the secondary phase, there was a greater focus on the performance of individuals, with effective monitoring and tracking systems that allowed their progress to be identified. In a welcome development, a smaller proportion of schools in this survey compared only the performance of classes and cohorts rather than individuals. The increased focus on individuals' performance and that of different groups provided a good basis for intervention with them and promoted progress more effectively.

Overall, teachers used information and communication technology (ICT) effectively in their teaching. In both primary and secondary schools, ICT was used to present pupils with experiences that could not be provided first-hand. Teachers used ICT to build ideas pictorially and diagrammatically, using data from a range of sources, including the internet. Laptops were used to capture, manipulate and display data to enhance learning and promote the development of scientific skills. The use of ICT in the outstanding schools involved pupils in interactive presentations and independent research.

The removal of the requirement for statutory tests in science at the end of Key Stages 2 and 3 has helped schools to avoid an undue concentration on revision in Years 6 and 9 and freed teachers to be innovative in planning their teaching and in enriching the science curriculum. The increased range of courses for students at Key Stage 4, including the three separate sciences and vocational science, has also provided breadth in the science curriculum to meet the needs of a wider range of students, although not all the students surveyed have benefited from this yet.

Key findings

- In the schools which showed clear improvement in science subjects, key factors in promoting students' engagement, learning and progress were more practical science lessons and the development of the skills of scientific enquiry.
- Although pupils' progress in science was good or outstanding in 70% of the primary schools visited, a lack of specialist expertise limited the challenge for some more able pupils. Progress was outstanding in one in 10 of the primary

schools visited, compared to one in six of the secondary schools. This is reflected in the slight decline since 2007 in the performance of higher-attaining pupils in teacher assessments in science at the end of Key Stages 1 and 2.

- Progress of students in science was good or outstanding in around two thirds of the secondary schools visited. Some improvements in achievement were observed in lessons during the course of visits, often associated with courses that were better matched to students' needs. National standards have increased slightly in Key Stage 3 over the period of the survey. The proportion of A* to C grades awarded at Key Stage 4 has remained approximately the same but the proportion of students achieving grades A* and A has increased.
- The removal of the requirement to carry out statutory tests in science at the end of Key Stages 2 and 3 has encouraged teachers to plan engaging schemes of work in science that avoid an undue focus on revision in Years 6 and 9. It has provided scope to vary the length of key stages appropriately and provide greater enrichment.
- Standards at A level in science subjects as seen in national data have shown a steady rise over the period of this report. In the schools visited, this improvement was associated with teaching which, increasingly, engaged students more actively in their learning. This development was less evident in the colleges visited.
- Science was good or outstanding in 15 of the 31 colleges where it was inspected; it was satisfactory in 11 and inadequate in five. No other post-16 curriculum area in colleges was judged to have such a high proportion of unsatisfactory provision.
- The introduction of the new science GCSEs in September 2006 resulted in a greater number of courses being provided to meet the needs of all students. In the schools surveyed, these have been successful, in the main, in allowing more higher-attaining pupils to study three separate sciences. This has contributed to the increased recruitment of students to A-level courses in the sciences.
- The availability of vocational courses had a positive impact on the motivation and achievement of students for whom academic programmes were less suitable. However, some schools had used these courses too extensively, entering students for vocational rather than academic qualifications and, as a result, restricting students' opportunities to study A-level sciences.
- More rigorous monitoring and tracking have provided a better basis for teachers to plan with individual students in mind. This development aligns with greater challenge for many students through more effective target-setting.
- Despite some positive initiatives, such as the Primary Science Quality Mark and the Association for Science Education's publication for primary schools 'Be safe', there has been insufficient professional development in science to tackle the lack of confidence among primary teachers, particularly in their understanding of scientific enquiry skills and the physical sciences.

- Lack of specialist training, and their normally short tenure in the role, limited the effectiveness of the science coordinator in developing teaching and raising achievement in some of the primary schools visited.
- Secondary teachers in particular benefited from attending courses at the network of Science Learning Centres, but too few of the schools visited had taken advantage of this high-quality provision.

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Royal Exchange Buildings
St Ann's Square
Manchester
M2 7LA

T: 0300 123 1231
Textphone: 0161 618 8524
E: enquiries@ofsted.gov.uk
W: www.ofsted.gov.uk

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