Secondary
National Strategy
for school improvement

Guidance

Curriculum
and Standards

Progression to post-16 science: interim report

LA strategy managers, science line managers, consultants, subject leaders and teachers

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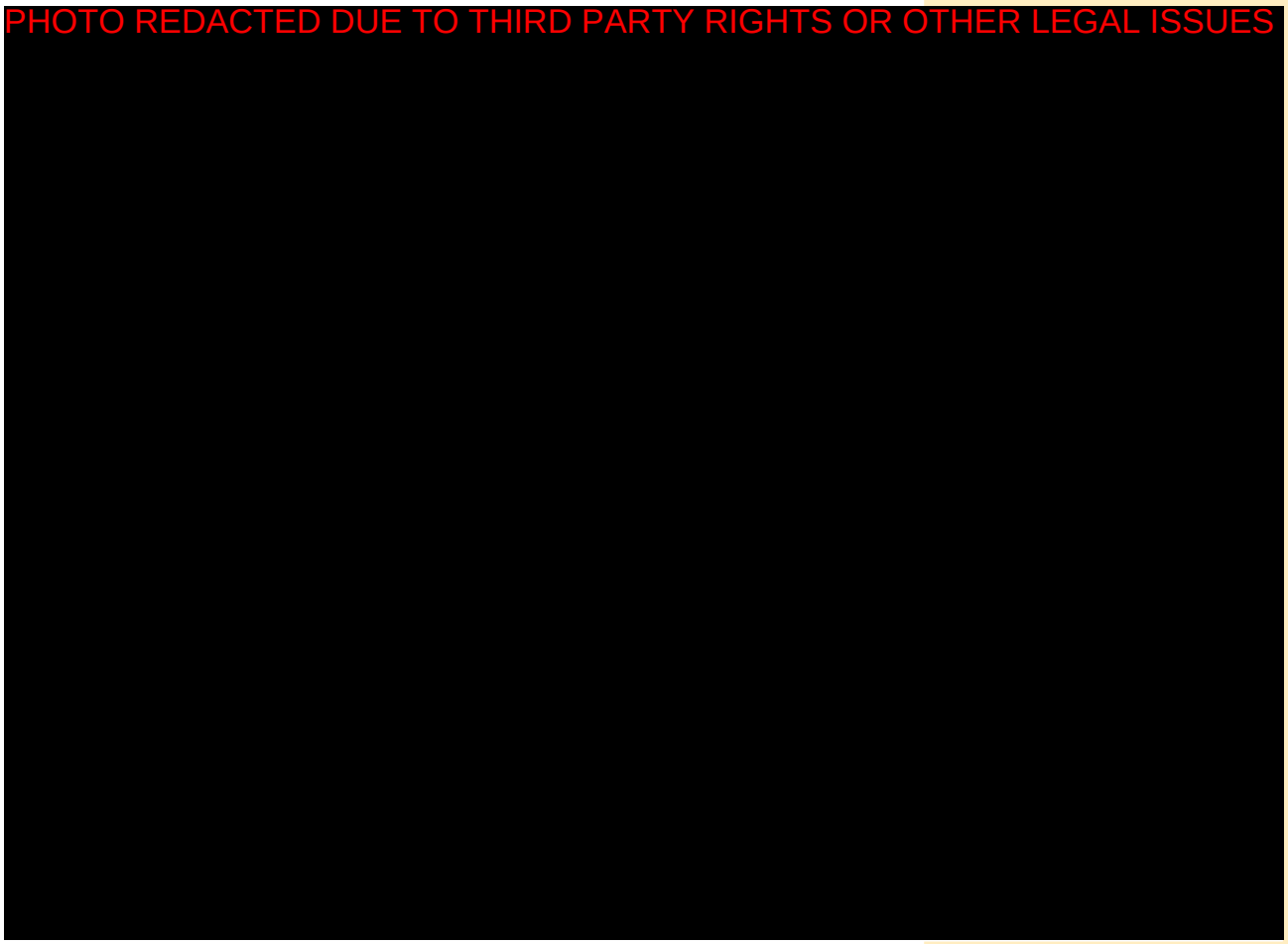

department for
education and skills

Creating Opportunity
Releasing Potential
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Interim report 22 March 2007

Progression to post-16 science – an enquiry into the factors that are influential in achieving high levels of take-up of science subjects

Aims of the enquiry

The enquiry aims to:

- identify the significant factors that influence young people's decision to pursue science studies post-16;
- provide case studies which show how these factors interrelate to give effective progression to post-16 science courses;
- describe the strategies used by schools to improve and enhance progression in science post-16, and to explain how and why these strategies have an impact.

Rationale

According to a report presented to the DfES school science board in February 2006, schools with certain characteristics and science departments with certain organisational factors were associated with higher than average take-up of science subjects post-16. For instance, take-up was seen to be higher in selective schools, in schools with favourable socio-economic factors and where attainment on entry is high. Setting by prior attainment, provision of separate sciences and specialist teaching also featured in schools where progression to post-16 science was higher than usual. There are also well-established patterns of take-up associated with gender, and with achievements in and enthusiasm for certain subjects.

In the original report considerable emphasis was placed on the fact that the factors identified could not be regarded as causal; neither could they be considered independently of each other. This interim report updates the initial findings from the current second phase of school visits. This phase of the post-16 project builds on the early findings by continuing to examine schools as case studies. By using a broader range of perspectives, in particular including that of the students, and a more comprehensive database, the project seeks to establish the common features of schools that correlate to high take-up post-16. The project also seeks to highlight the forces (e.g. parental support, pupil enthusiasm), factors (e.g. prior attainment), processes (e.g. links with higher education (HE), teacher continuing professional development (CPD), bridging courses) and policies (e.g. science provision at GCSE, specialist status) that contribute to high take-up.

Key questions are therefore:

- why do some pupils choose to study science A levels?
- why don't more pupils choose to study science A levels?

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Main findings to date

Common features of schools that correlate to high take-up post-16

Most of the schools in the sample of schools visited in spring 2007 are judged by Ofsted to be good schools with outstanding features or outstanding schools. Even where a school was judged to be satisfactory overall, certain features stood out as good. The features that stood out in all the schools (even if attainment and achievement were not particularly marked) were:

- the promotion of the personal development and well-being of the learners by the school;
- the curriculum, and the other activities provided by the school to meet the range of needs and interests of learners;
- the care, guidance and support given to ensure that learners are enabled to make use of their potential.

In addition, the following common features were identified from the school statistics and responses:

- pupil mobility is low;
- value-added statistics are good in both Key Stages 3 and 4;
- half of the students at the end of Key Stage 4 have level 2 functional literacy and numeracy; most schools have far higher levels than this;
- teaching in science is good or very good. Subject knowledge and understanding, and pedagogical skill of the teachers seem to be more significant factors than the structure of the curriculum and whether the separate sciences are taken at GCSE. In this sample, the evidence from school information on curriculum pathways indicates that the curriculum model provided for 14–16 -year-olds appears to make little difference to the uptake of post-16 science courses;
- in the schools providing 11–18 provision, A levels are taught by subject specialists.

Forces that contribute to high take-up of post-16 science

The following forces were all identified (from pupil and teacher interviews) as having an impact on the decision to study post-16 science courses:

- parental interest in, and support and enthusiasm for, science;
- pupil enthusiasm and pleasure in studying subjects that they perceive as being regarded as difficult and which as a result have credibility;
- teacher commitment, enthusiasm and 'professionalism': being quality-minded and 'client-centred';
- 'success breeds success' was a phrase used independently in three out of four schools visited to describe the influence of the achievements of other post-16 students on students selecting the courses they wish to study;
- reputation and market forces, both internally and externally. Departments with effective progression to post-16 courses take a proactive role in 'marketing' their subjects with pupils, and take a long-term view of developing pupils' interest in and enjoyment of science throughout their secondary science curriculum.

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Factors that contribute to high take-up of post-16 science

The following factors were all identified (from pupil and teacher interviews) as having an impact on the decision to study post-16 science courses:

- curriculum continuity and planning to ensure that pupils make progress in their learning each year;
- lively, experiential, colourful teaching of science in Key Stage 3 and (less so) in Key Stage 4;
- teaching that challenges, asks questions, is relevant, meaningful and purposeful;
- a curriculum enriched by visits, visitors and projects that bring the world of science into the classroom;
- good resourcing, effectively used and targeted at identified priorities. While improving the learning environment alone may not cause an increase in post-16 take-up, a poor learning environment may detract from the efforts made by effective teachers to motivate pupils to follow science courses.

Processes that contribute to high take-up of post-16 science

- Support for pupils' learning; knowing the pupils academically and personally and hence being able to provide appropriate support and stimuli to engage, motivate and develop pupils.
- CPD, integral to the daily workings of the departments and supporting the identified departmental priorities, rather than a series of professional development events which only enable development of a few individual teachers.

Policies that contribute to high take-up of post-16 science

- In many, though not all schools, success was attributed to participation in whole-school policies such as assessment for learning, progress tracking and intervention.
- Specialist status, where it applies, is influential though not essential. There is no causal link between gaining specialist science status and effective progression to post-16 science.

Future developments

During the coming year, the project will be extended to include a greater number of schools and will particularly consider the relatively low uptake of post-16 science by pupils with B grades at GCSE. In particular the project will:

- widen the student base from A*–A to A*–B and use this data to identify further schools to be visited;
- improve the enquiry tools; for instance including Year 11 and younger pupils in the interviews;
- examine the links between take-up and effectiveness post-16, looking at rates of attrition, attainment and contextual value added (CVA) in science subjects post-16;
- examine the extent to which science-based work opportunities in the locality influence uptake;
- explore students' pre-16 experience to investigate the influence of curriculum models (time allocation, subject allocation, teacher allocation) on take-up in science;

- seek more corroborative evidence for the interim findings to date;
- seek further examples of effective practice to illuminate the practicalities of increasing uptake of, and enhancing progression in, science from Key Stage 4 to Key Stage 5 and inform guidance to be published in 2008.

Methodology

From the original sample of about 1000 schools a subset of 24 schools was selected. The common feature of all of these schools was that greater than average numbers of pupils who had gained the highest grades in science GCSEs went on to pursue advanced level studies in chemistry, biology and physics. (Uptake in each subject was greater than the average deviation from the mean.)

The findings described in this interim report are based on the outcomes of visits to four schools, a further three schools that had returned the questionnaire but not yet been visited and three other schools from the subset of 24 that were visited during the initial inquiry. Schools were visited for half a day to find answers to the key questions by means of a visit to the science department and interviews with:

- the science subject leader;
- a recently-appointed science teacher;
- a group of about 12 upper and lower sixth science students.

These initial visits trialled the use of:

- a pre-visit electronic questionnaire (Appendix 1) – now available 'live' to all schools on the Internet;
- a question schedule for the students and a similar question schedule for the teachers.

The most recent Ofsted report and the DfES School Achievement and Attainment Tables were also scrutinised for each of the visited schools.

LA science consultants and secondary managers have been briefed on the project, and have facilitated arrangements by contacting headteachers and subject leaders to brief them in advance of the visits.

The next step will be to select more schools from the database and visit them in the summer term to identify where achievement as well as take-up is high in advanced level science, and where the patterns persist for several years.

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Case studies

Case studies describing the position in each of the schools visited so far are included in Appendix 2. The case study schools are:

School name	Gender and age range	Specialism	School type	
School A	Boys 11–16	Maths and computing	Voluntary aided	Comprehensive
School B	Boys 11–18	Science	Community	Selective
School C	Mixed 13–18	Science and humanities	Community	Comprehensive
School D	Mixed 11–18	Art	Community	Comprehensive
School E	Mixed 13–18	Art	Community	Comprehensive
School F	Mixed 11–18	Technology	Foundation	Selective
School G	Mixed 11–18	Art	Community	Comprehensive
School H	Mixed 11–18	Maths and computing	Community	Comprehensive
School I	Mixed 11–18	Science	Community	Comprehensive
School J	Mixed 11–18	Science	Foundation	Comprehensive

For each school, a pen portrait has been taken from the most recent Ofsted report with judgements, where available, on science provision and standards. Headline data is provided by the 2006 DfES School Achievement and Attainment Tables in tabulated form.

As well as this background information, the pupils are directly quoted explaining why they think their schools are successful in attracting students to post-16 science, corroborated (or not) by the views of the teachers and the responses to the questionnaires (the latter also in tabulated form). Specific and unusual strategies used by each school which are seen as influential are described.

The final paragraph in each case study summarises the key factors that influence high levels of take-up of science subjects post-16 in that school.

Evidence collected from student interviews during visits to case study schools

Groups of students were interviewed during the school visits and the broad answers provided are recorded below, not separated by school.

- *What curriculum are you following? (Subject combinations; number of courses.)*
- *What do you hope to do when you complete this course?*

- *Why did you decide you want to do this?*
- *Where did you get the information which helped you to make this decision?*

In urban and ethnically-mixed schools teachers were of the opinion that the interest of students in following medical science-related careers significantly influenced students' choice of A level subjects. The students spoken to, however, tended to have more diverse career aspirations and a significant proportion of lower sixth students had not yet decided.

The vast majority of students intended to study for a degree and far fewer had a vocation to be, for example, a pilot or to work in a hospital. Medicine and veterinary science were mentioned but not as much as might be supposed. Subjects included 'something with maths and physics'; forensics; geography; zoology/ conservation; chemistry; engineering; history; psychology; biomedical science; dentistry; chemistry; and sports science. The students explained that only a few of their friends planned to study medicine and for those who did it was not a life-long ambition. Ideas for jobs came from visits to local firms, for example pharmaceutical companies, from careers advice and from their own knowledge. In some schools parents were employed in scientific fields and this was influential.

- *What was your experience of science like at Key Stage 3? Key Stage 4?*
  - *Were all aspects of science the same at Key Stage 3? Key Stage 4?*
  - *What was a typical lesson like?*

Though responses varied, science lessons were usually remembered as fun and interesting with plenty of practical activities. The lessons were 'good' and 'enjoyable', with 'good teaching' and teachers who were 'engaging' and who 'helped you to understand'. They differed from primary science lessons.

Students recognised that the experience of science was influenced by both teachers and peers, and some saw the work getting increasingly 'serious' from Year 9 to Year 11. For some Key Stage 4 was seen as preparing for examinations all the time – with a tendency to 'learn stuff rather than understand it'. Some Key Stage 4 experiences did not sound positive and the reasons quoted included large classes (30 students), a lack of real intellectual challenge and too many students fooling about.

- *Have your expectations of the post-16 courses you selected been met?*
- *Would you make the same decisions if you were in Year 11 now?*

Overwhelmingly students' expectations were met or exceeded and they had no regrets. Opinions varied on whether the hard work was a surprise that was less than welcome, or a challenge to be faced and overcome. For one student it was a 'journey'.

- *What advice would you give pupils in Year 10 and Year 11 doing Double Award and separate science courses now?*

The advice was startlingly pragmatic. In general the advice was to work hard and see it through; keep up and ask for help if you need it. 'Go for it, you learn interesting ideas and new work.'

Strong warnings were given about avoiding science if you did not like it: 'Don't take the subject if you aren't interested. Interest in science is crucial to keep you motivated and allow you to cope with pressure'. In a similar vein, sixth formers felt that younger potential A level science students should ask older students 'what it's like' and be aware of the job opportunities that open up with qualifications in science.

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- *Is science seen as an important subject in this school (e.g. extracurricular)?*
  - *By students?*
  - *By teachers?*
  - *By parents?*

All students thought that science had a high profile in their schools. Furthermore, lots of extracurricular activities raised the profile outside lessons. Passionate and enthusiastic teachers who were approachable contributed to the standing of a subject. In these schools, parents and teachers were seen as supporting science.

Evidence collected from teacher interviews during visits to case study schools

- *Have staff received any training related directly to post-16 work (or post-16 progression in 11–16 schools)? If so, what form did it take and what was the impact? You might like to explore whether there is any perception of differences between teaching pre- and post-16 students and how this is supported and developed.*
- *Does collective sharing of departmental experience and expertise take place explicitly, implicitly, regularly, or infrequently? How is this approached within the department, for example, coaching, internal CPD?*

A marked feature of the responses was the extent to which science teachers talked positively about the opportunities to share practice and the value they place on the experience, described as 'vital'. Many talked of frequent department meetings in which 'admin is kept to a minimum and talk is important'. The last point was made by almost all schools.

Teachers talked of the value of lesson visits, observation and peer mentoring: 'I can talk to anyone. I can watch others teach, look at different styles. I can ask how to approach things. I can talk to anyone and get good answers'.

A surprising number of responses identified social areas as places where in-service education and training (INSET) took place as a result of passing exchanges of ideas and materials. Formal school-nominated department meetings were much less frequent and whole-day events even less so. The majority of subject-specific CPD seems to be 'in-house'. One school had subject specialist mentoring and meetings, made possible by the size of the department and the number of specialists in biology, chemistry and physics. Becoming an A level marker was seen as good professional development for potential A level teachers, and one school ensured that every teacher timetabled for the first time to teach sixth formers had the opportunity to do an external course in the term before starting to teach. Another school had a half-termly lunchtime forum for new sixth form teachers with the head of sixth form.

Where appropriate courses are available, staff in all schools are encouraged to attend and disseminate their expertise, but there were questions about the availability of suitable courses and opportunities for release.

- *Have resources changed appreciably and been used effectively (e.g. improved computer access, new text books)?*

All schools gave a resounding 'yes', and although most referred to the refurbishment of some laboratories which has 'led to a good learning environment with engaging pupil displays', others identified the real impact of simply investing in basic equipment so students could get lots of 'hands on' experience and which has meant 'we can do 24 sets of titration and reflux!' The addition of a science observation classroom 'helped sharing of expertise, e.g. pupil questioning' and 'the recent provision of a science ICT suite and projectors are also of considerable benefit' was a typical comment.

- *How is science regarded by the following groups? Parents; pupils; the senior leadership team; other teachers; the locality; technicians and teaching assistants?*

Most teachers reported that the subject is seen favourably and positively by parents, pupils and the community, and also as successful – 'it comes across through conversations at parents' evenings and through take-up'.

Senior leadership teams 'see science as important and a useful route to employment at all levels', and are 'pleased when the department improves'. Some departments are regarded particularly highly, being seen as innovative, progressive and prepared to take a lead; other departments express a concern, for instance that the press can adversely influence the way parents perceive what is happening in schools and that specialisms in other subjects may conflict with science interests.

One school described a monthly newsletter with a science section about events both past and forthcoming. 'Parents read it and know what is going on' and then 'Year 11 know about A level – it is a thread in all conversations'.

Appendices

Appendix 1: Progression to post-16 questionnaire

Appendix 2: Case study schools, including school statistics and pathways to progression

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