

Showcasing success in science education

■ Bob Ponchaud

The best place to start looking for answers to any issue in science education must surely be the classroom. No individual school or teacher has all the answers but between them teachers have a pretty good idea of what works and what doesn't. Equally, it is not always easy to identify success and what contributes to it. However, it is vital that success should be celebrated, attempts be made to understand the underlying factors responsible, and ideas shared to ensure good practice is spread more widely. It was in this spirit that The Royal Society included in its spring conference 'Increasing uptake of science post-16', a session dedicated to considering case studies of successful practice.

The schools showcased at the conference included Parkstone Grammar School (PGS) for Girls in Poole and two voluntary aided comprehensives, The Kings of Wessex Community School (KWCS), Cheddar, and The Thomas Hardy School (THS), Dorchester. This south-western cluster represents a sample of the schools that boast participation and performance rates in science that exceed the national average, and the conference aimed to explore why this was so. It turns out that while each of the case studies has its own unique formula for success, the variety of approaches adopted reveals much common ground and the promise of possible ways forward for others.

Difficult subjects: demanding but worth it

Students regard science subjects as hard, and with some justification as grade comparisons, such as those carried out by the Advanced Level Information System (ALIS) project*, suggest that science subjects are between one and half a grade more difficult than others. Simply to accept this, though, is defeatist and all of the case-study schools address this issue by portraying the sciences as 'demanding but worth it'.

At THS, science has a very high profile and the department works co-operatively with the English and mathematics departments to ensure that all key stage 4 students have the skills needed to access science assessments. Teaching focuses strongly in the first instance on assessment requirements, but students are challenged to achieve their potential regardless of ability. The 'can-do' culture that has been established has given staff and students the confidence to enrich science both within and outside the curriculum. In addition, the school has an extensive programme of enhancement activities including community science talks, e.g. by Johnny Ball on Einstein and Lord Robert Winston on Genetics. Drama and science have joined forces so that historical scientific characters have been seen negotiating the school corridors! *'In science, students are continually challenged to change their ideas and eventually 'knowing when you know' brings that special confidence, and reawakens curiosity and enjoyment.'* Mike Januszewski, Head of Science, THS

The combination of an emphasis on individual achievement and a broad programme of enrichment has been successful in giving students the confidence and desire to continue studying science subjects beyond key stage 4.

People matter: making science affective

The stereotypical view of science, still held by many, as objective, impersonal information pursued by isolated and inarticulate people relates poorly to student culture where social networking is hugely important. These perceptions are countered by the case-study schools providing a positive people-related view of school science.

Asked why they had chosen to study science, A-level students at The Kings of

Wessex School were clear that one of the reasons was that the teachers *'make science interesting and are interesting people, fully involved in school life'*. Some students have been so motivated that they have pursued science subjects post-16, even though these are not their strongest. The staff are enthusiastic subject specialists and regard the human face of subject specialism as an important factor in their success. *'The teachers are really confident and enthusiastic about 'their' subjects and we know we can go to any of them for help.'* Year 12 student at KWCS

Teaching: specialist teamwork

Subjects and topics are taught by specialist teachers wherever possible in each of the case-study schools and teaching to strengths is a dominant factor in curriculum and timetable design.

In all three schools, this generally involves the traditional tripartite division into biology, chemistry and physics regardless of which GCSEs the students are being prepared for, the belief being that this leads to a richer experience for students. Nevertheless, a very strong feature of the schools was a real sense of a team of teachers working together irrespective of their specialist qualifications and interests. This helps to guard against fragmentation in these large schools, which strong subject specialism might affect.

In the classroom, expectations are uniformly high and provide students with a challenging and secure learning environment. Beyond the classroom, all the schools have strong support networks for students.

The science department at KWCS has an organised pastoral system which includes half-term tutorials for all post-16 students. This combines with a 'never be afraid to ask' ethos and open access to all staff to provide comprehensive support for students.

'The door of the prep room is always open and it's always being knocked on at lunch times, break times – any time. We all think it's important that students get good guidance and support.'

Bethan Riddick, Head of Science, KWCS

Relevance: a good servant but a poor master

Curriculum discussion has long focused on how science may be made relevant to the lives of young people. However, no clear consensus exists about what constitutes 'relevance' and how this should be used to select curriculum content and influence pedagogy. Each case-study school uses the experience and interests of its science teachers to make connections between the curriculum framework and the world outside. In addition, effort is made to include topics that have their own fascination and intellectual appeal.

All the case-study schools are conscious of the importance of engaging students by forging links between the curriculum and their lives and interests. In particular, they value good careers and subject option advice and take an active part in providing information. For instance, THS includes science news and information on its web-based school TV, whilst KWCS has student focus groups to keep abreast of their peers' views.

Within the science curriculum itself, the teachers find ways of linking science to applications and issues but are cautious about using relevance as the main means of selecting what is to be taught. Many inherently interesting ideas, such as those of space science, are not relevant in the utilitarian sense. If it is to be relevant, make it interesting and exciting they suggest. Introducing a luminous gene into *E. coli* is, for example, right up-to-date and has a real 'wow' factor.

'Some of the most awe-inspiring ideas in science are not particularly relevant to your average teenager. Yet these are often the ideas that capture the imagination. Science can have a key role in setting free the imagination...'

Mike Petrus, Head of Science, PGS

Practical work: fostering the eureka moment

The debate about the purpose and effectiveness of experimental work continues but students still invariably cite practical activity as one of the features that attracts them to science.



Demonstrating good practice in science teaching: Mike Petrus briefs students at Parkstone Grammar School on setting up a simple calorimetry to measure the enthalpy of combustion of a fuel, before allowing them to perform the experiment.

All the case-study schools have a strong and continuing tradition of practical work pre- and post-16 across the sciences.

'Sometimes during practical work the penny just drops and you say to yourself – ah: so that's what it's all about.'

Year 11 student, PGS

Moments of realisation have to be facilitated and practical work at both key stage 4 and post-16 is valuable for learning at all the case-study schools. Teachers circulate and use questions to probe the students' understanding of what they are doing and why they are doing it, so the focus is on learning not just activity.

Students at KWCS all cited good practical work, during which they have the opportunity to interact with each other and the teacher on an individual basis, as one of their reasons for choosing to continue with science subjects. Their key stage 4 experience was clearly important, but their perception of what science subjects would be like post-16 was equally, if not more, important.

Concluding thoughts

It is naturally very difficult to establish causal connections between the approaches adopted by these case-study schools and their success in recruiting students into science post-16, but the common ground is remarkable. It appears that students are more likely to continue studying science post-16 if:

- There is a classroom success culture which recognises that science subjects are demanding but rewarding;

- Teachers can display their enthusiasm for their specialist subjects and are fully involved in school life;
- The delivered curriculum allows time for some aspects of science that are inherently interesting and challenging as well as relevant;
- Students receive good information about the value and flexibility of science qualifications;
- Students feel that they are supported and have ready access to science staff;
- Students are consulted regularly to find out areas of concern or difficulty;
- Practical work is seen by teachers and students as an important learning opportunity, not just an activity; and
- Science teachers work as a team providing consistent expectation and secure post-16 provision.

The Royal Society is keen to hear from schools that have used these strategies and others to achieve good progression and results in science. Please contact David Montagu (david.montagu@royalsoc.ac.uk) if you have a contribution to make. A full report of the conference will be available this summer. Again, contact David if you wish to receive a copy.

*The ALIS project is run by the Curriculum, Evaluation and Management Centre, University of Durham (www.cemcentre.org).

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