QCA Secondary Curriculum Review, Science KS3 Programme of Study

A response by The Association for Science Education

April 2007

Overview

The Association for Science Education (ASE) welcomes the opportunity to respond to the review of the Secondary Curriculum and in particular to the changes in the science curriculum for KS3. ASE has consulted widely with its members, who are drawn from all phases of science education, in order to provide a range of perspectives. In particular ASE's Council, 11-19 and primary committees have contributed to this response.

The Association embraces the ambition of the proposed KS3 programme of study for science to include more emphasis on the scientific process and developing scientific skills, and to provide less prescription of content. Together these changes should result in greater flexibility for teachers and learners (with often very varied backgrounds, experiences and interests) in science enabling them to contribute to the forward looking 'big picture' of the secondary curriculum.

ASE fully acknowledges and welcomes the many advantages in whole school approaches to the 'big picture' curriculum and to the common language (particularly the Curriculum Aims section) now proposed for all subject programmes of study. However, we would argue that the importance of the subjects offered in the curriculum should not be diluted in the name of commonality. In particular ASE would reiterate the importance of science for all as a core subject, as described admirably in the 'Importance of Science' section, and for the unique contribution it makes to the education of young people in the modern world.

In addition to ASE's own response we attach a copy of that produced by the SCORE partnership, which, as a member, ASE fully endorses. Both responses highlight strong concerns about the timescale for implementation of the KS3 changes and we propose that schools are invited to introduce the revised KS3 programme of study from 2008 on a voluntary basis, which then becomes compulsory in 2011 when the assessment arrangements are known.

The purpose and identity of KS3 science

The KS3 programme of study should continue to provide a sound basis of knowledge and understanding, in addition to the skills and processes required for progression to KS4. Importantly, however, the KS3 programme of study within the science curriculum should have its own identity, ideally providing a careful balance of new skills and (key) processes which does not compromise the level of content detail. This will enable teachers and learners to take advantage of the new flexibility to follow lines of interest which will allow them to explore, creatively and practically, the content in depth.

Without doubt, from the proposed 'Range and Content' section plus the helpful 'Curriculum Opportunities' section particularly, experienced and enthusiastic teachers will embrace the flexibility and enable this balance. However the superficial lack of coherence, depth and particularly of exemplification in the 'Range and Content' section may be interpreted by many less confident teachers and whole school management as 'little or no change'. Sufficient time and support for such teachers to understand, prepare for and implement these reforms will be required if they are to have the desired cultural change and long term impact.

Progression through Key Stages

Whilst the KS3 programme of study should retain its own identity, it is important to understand the identities and functions of the preceding KS2 and subsequent KS4 programmes of study and progression within and through them. This is not entirely clear within the documentation; particularly on the KS3 relationship to KS2 and on an increasingly shared terminology around How Science Works with KS4. Some teachers warn that the identity of KS3 may be lost by an overemphasis broadly on How Science Works at the expense of losing learner engagement by the time they reach KS4.

However, there is concern that many teachers are still grappling with the recent introduction of How Science Works at KS4 and its relationships between processes and content so KS3 does have a role in providing a range of concepts in developing learners' understanding of science before moving onto the next Key Stage.

Assessment and Level Descriptions

There is also a lack of clarity on expected learning outcomes and progression between and within Key Stages 2, 3 and 4; and little detail on how they are to be assessed. As is widely recognized, teaching and learning in schools is currently driven by summative assessment at the end of the Key Stages, often with negative impacts on learner engagement. We welcome the focus on assessment that is fit for purpose in the 'big picture' and progress by teachers in using formative and staged assessments but the lack of detail in the present documentation on assessment mechanisms and attainment suggests the level descriptions do not yet adequately support this.

In the spirit of the Review ambitions, with its greater emphasis on the scientific process, this should ideally be reflected in the level descriptions. At present the focus appears to be more on content (with three ATs) and less on process (with one AT). A better balance might be achieved with a total of only two ATs (one with a content focus and one with scientific process as the focus), and this would consequently result in a change in teaching emphasis.

Teachers would be better guided towards this different emphasis by more detailed level descriptions with a focus on skills which clearly exemplify what is meant by terms such as 'recognize', 'describe' or 'draw conclusions' in showing differentiation and progression pathways between and within the Key Stages.

Exemplification

Additional exemplification is required to clarify progression in knowledge and understanding between and within the Key Stages but this may be better provided to support the 'Range and Content' section. This proposed section superficially lacks detail, and whilst this is designed to encourage the flexibility and creativity in teaching and learning that the Review aspires to, some of the statements are ambiguous and open to misinterpretation particularly to non specialists (who often teach science at KS3) or inexperienced teachers. Clarification may be aided by providing a progression map of scientific ideas through the different key stages, showing for example what aspects of electricity, energy or biological variation should ideally be covered at different Key Stages.

Additionally newer areas within 'Key concepts', particularly on 'Cultural understanding' and 'Applications and implications of science' require exemplification if teachers are to effectively interpret and translate them into their teaching.

Although it is clear that further exemplification is required as outlined above, we welcome the moves away from providing an example scheme of work as this is often interpreted by teachers as statutory and discourages their own planning and ownership of their teaching. The plans for more detailed exemplification being available online, with the possibility of regularly refocusing the exemplification where appropriate to encourage different and up to date approaches to the

content and key concepts should be a valuable aid in supporting teachers' planning and encouraging wider approaches to their curriculum.

Timing of Review implementation

Whilst we wholeheartedly support the objectives of the Review and recognize that the documentation goes a long way towards achieving them, there will be the need to provide additional support and guidance on curriculum content, level and progression paths; and importantly to allow time for proper planning, piloting and evaluation for effective curriculum change.

With major other curriculum changes during 2007/8 for science teachers (including teaching the second year of new GCSEs, preparing to deliver separate award GCSE sciences, new A level courses and some science elements in the new diplomas from 2008), it is likely that there will be insufficient time and capacity to effectively deliver the desired outcomes of the Review.

APPENDIX 1 Additional comments

The Association has provided some minor specific comments on the Programme of Study as outlined below.

The importance of science

'It engages learners at many levels, linking direct practical experience with scientific ideas' may be rephrased to 'It engages learners at many levels, linking direct practical and other experiences with scientific ideas'

Key concepts

'There are a number of key concepts that underpin the study of science and how science works' may be rephrased to 'There are a number of key concepts that underpin the study of science and ideas and evidence within more detailed study of how science works as developed from KS3 towards KS4'.

The term 'Key concepts' is ambiguous when related to the four headings within this section. Whilst all are valuable, it is implied that all four should have equal weighting and time within the curriculum. Some clarity about balance between the four would be useful.

Key processes

'Assess risk and work safely in the laboratory, field and workplace' may be rephrased to 'Understand risk and work safely in the laboratory, field and workplace'. Some guidance may be needed to define 'workplace' and to support schools in providing this learning opportunity.

Range and Content

Organisms, behaviour and health

As there is no specific mention on plants (except in Level Descriptors), we suggest rephrasing 'Life processes are supported by the organization of cells into tissues, organs and body systems' to 'Life processes are supported by the organization of cells into tissues, organs and body systems in animals and plants'.

Extending the area of study

We welcome the inclusion of highlighting career opportunities in (and from) science. Teachers and schools may need clarification on how to provide 'direct experience of science in the workplace'.

APPENDIX 2 The Association for Science Education

The Association for Science Education is the largest subject association in the UK, with approximately 18,000 members including teachers, technicians and others involved in science education. The Association plays a significant role in promoting excellence in teaching and learning science in schools and colleges. Working closely with the science professional bodies, industry and business, ASE provides a UK-wide network bringing together individuals and organisations to share good ideas, tackle challenges in science teaching, develop resources and foster high quality continuing professional development.

The objects and purposes of ASE are clearly stated in its Charter of Incorporation as the promoting of education by the following means.

- *Improving the teaching of science;*
- *Providing an authoritative medium through which opinions of teachers of science may be expressed on educational matters; and*
- *Affording a means of communication among all persons and bodies of persons concerned with the teaching of science in particular and education in general.*

In a more modern context,

The Association for Science Education aims to promote excellence in science teaching and learning by:

a. Encouraging participation in science education and increasing both new membership and the retention of existing members.

b. Enhancing professionalism for teachers, technicians and others through provision of high quality continuing professional development and promotion of chartered status.

c. Working in partnership with other organisations, thus maintaining and strengthening its position in influencing policy and its reputation for delivering cutting edge initiatives for its members and, through them, to the wider science education community.

Further details of the ASE and its regional, national and international activities can be found on its web-site (www.ase.org.uk).

APPENDIX 3

SCORE Response to
The Secondary Curriculum Review
April 2007

The SCORE Partnership

This response to the Qualifications and Curriculum Authority Secondary Curriculum Review has been prepared by the SCORE partnership and therefore represents the combined views of the following organisations: Association for Science Education, Biosciences Federation, Institute of Biology, Institute of Physics, Royal Society, Royal Society of Chemistry, and the Science Council.

The SCORE partnership aims to bring collective action and a strategic approach to strengthening science education, and believes that the key to maximising the impact of its efforts, especially their influence on government, lies in a greater degree of collaboration and in having a sense of common purpose. Through this collective action, the partnership aims to increase its influence over the direction of science education in the years to come, in particular over teacher supply and retention, curriculum development, assessment, delivery of support to teachers and students, and strategies for reaching all young people regardless of age, background, level of ability, gender, ethnic origin and geographical location.

Association for Science Education www.ase.org.uk

Biosciences Federation www.bsf.ac.uk

Institute of Biology www.iob.org

Institute of Physics www.iop.org

Royal Society www.royalsoc.ac.uk

Royal Society of Chemistry www.rsc.org

Science Council www.sciencecouncil.org

Introduction

The proposed secondary curriculum is impressive in the extent of its ambition to transform teaching and learning in schools. The reduced prescription and flexibility this entails has the potential to enable schools to provide a curriculum that is more enriching, engaging and stimulating. This would be particularly welcome in science.

However, if these ambitions are to be realised there needs to be a clear understanding of the reforms and sufficient time and support for teachers to make these ambitions a reality in their own schools. We are not convinced that this is the case.

Content and progression

Superficially the changes to the KS3 programme of study (PoS) for science increase flexibility by reducing the level of detail about what is to be included within the curriculum. This follows a similar reduction in the level of detail that has taken place at KS4. However, at KS4 the PoS is interpreted through subject criteria which lead to GCSE specifications developed by awarding bodies; this is not the case at KS3 where teachers have to use the PoS to develop schemes of

work. We believe that the proposed PoS is not clear enough to enable teachers to easily develop schemes of work that will deliver the ambitions of these reforms.

There is a lack of clarity about the expected learning outcomes within KS3 and about progression from KS2 and to KS3. For example, progression in electricity is currently proposed to be as follows:

> ***KS2*** *to construct circuits, incorporating a battery or power supply and a range of switches, to make electrical devices work [for example, buzzers, motors], how changing the number or type of components [for example, batteries, bulbs, wires] in a series circuit can make bulbs brighter or dimmer, how to represent series circuits by drawings and conventional symbols, and how to construct series circuits on the basis of drawings and diagrams using conventional symbols.*
>
> ***KS3*** *electricity (this includes current and voltage in series and parallel circuits) in circuits can produce a variety of effects (this includes energy transfer in a variety of electrical devices, and magnetic effects)*
>
> ***KS4 (Core)*** *electrical power is readily transferred and controlled, and can be used in a range of different situations*

There seems to be some confusion between using ideas or theories as a context for delivering the concepts outlined in the PoS and teaching the theories in their own right. This lack of clarity means that there is considerable danger of repeating content that has been covered at an earlier key stage with the effect of demotivating students.

The level descriptors could help to clarify the situation, but looking at the statements where there is a reference to electricity in the examples used shows that the progression is not clearly defined:

> *Level 4: They recognise some applications and implications of science, such as the use of electrical components to make electrical devices.*
>
> *Level 5: They describe applications and implications of science, such as the ways sound can be produced and controlled, for example in musical instruments.*
>
> *Level 6: They explain the importance of some applications and implications of science, such as the use of unsustainable sources of energy.*
>
> *Level 7: They explain, using abstract ideas where appropriate, the importance of some applications and implications of science, such as the uses of electromagnets.*
>
> *Level 8: They describe and explain the importance of a wide range of applications and implications of science.*

An additional concern is that the much of the science teaching at KS3 in any one science (particularly physics but also, to a significant extent, in chemistry and biology) is undertaken by non-specialists (e.g. a biology specialist teaching chemistry) who will all too often have insufficient subject knowledge and background to ensure a stimulating variety in the contexts are used. It seems likely that these teachers will typically resort to the use of published schemes which are unlikely to fulfil the broader ambitions of the review.

The lack of clarity for teachers regarding the knowledge and skills students are expected to have at the end of KS3 may work against the intention of reducing prescription. Uncertainty regarding the content of KS3 tests may lead to teachers feeling obliged to include more rather than less content in their teaching in order to cover all eventualities. This uncertainty and inconsistency may also cause both gaps and duplications during progression to Key Stage 4.

It is obvious that if the secondary curriculum were not split into two key stages by national tests, smoother progression, and curriculum development to support that progression, would be much more straightforward. If the current situation remains, at the very least we should ensure that curriculum development of KS3 and KS4 occurs concurrently in the future.

Timing

It is disappointing that the government still does not seem to have accepted the fact that proper piloting and evaluation is essential for effective curriculum change. It would be much more cost efficient and beneficial for teachers and students to allow sufficient time for curriculum change.

We note that, in 2007/8, science teachers will be attempting to implement some or all of the following changes:

- Teaching the second year of new GCSEs
- Preparing to deliver separate award sciences from 2008
- Preparing for the new A level courses to be taught from 2008
- Preparing to deliver some science elements in the new diplomas

We do not believe that teachers will have sufficient time to deliver the outcomes that this review is intended to deliver; planning for cross-curricular links and providing different pathways through the curriculum requires time and coordination. The phased implementation does not really help here as the whole KS3 curriculum will have to be mapped out in at least broad outline before it can start to be taught.

Resources

We believe that publishers and others will not be able to provide high quality resources in the suggested timescale. The only option seems to be to repackage existing resources – again this is hardly like to lead the kind of personalised learning suggested in the ambitions for these revisions.

We are also concerned about the number of errors that are creeping into resources – the rush to have material available before teaching starts in September 2008 can only exacerbate this situation.

Assessment

We believe that teaching and learning in schools is driven strongly by the summative assessment at the end of key stages. We welcome moves to make greater use of formative assessment and staged assessments. However, for this to be successful there needs to be a shared agreement about attainment. At KS3 this shared agreement should be driven by the level descriptors; as noted above, we do not believe that the descriptors achieve this task.

We note that statutory assessment material for the new KS3 PoS may not be ready until 2011. It is not clear how schools that currently teach KS3 in two years (to allow more time for KS4) will manage the assessment of their students. We also note that DfES has just announced a pilot to trial changes to assessment, allowing students to take national key stage tests as soon as they are ready, rather than only at the end of the key stage.

Conclusion

We believe that there are considerable advantages in allowing schools to decide whether to pilot the KS3 changes from 2008 but not in insisting that all schools change KS3 until adequate specimen assessment material is available in 2011.

In addition, we believe that additional documentation needs to be produced giving guidance on curriculum content, level and progression paths. This must be clearly identified as non-statutory and not be as prescriptive as the current QCA scheme of work for Key Stage 3 Science.

We would also recommend that the Department for Education and Skills (DfES) and the Qualifications and Curriculum Authority (QCA) agree and publicise a best practice model of curriculum development - from initial research and consultation through to implementation and evaluating impact - which could be used as a quality standard for future change.