THE ROSE REVIEW

and the Association for Science Education

The essence of the ASE's response to the final report of the Rose review of the primary curriculum in England is set out by members of the group that produced it

Background

According to the tenets of good feedback we should identify 'two stars and a wish' in making our response to the *Independent review of the primary curriculum final report* (the Rose Report). Unfortunately in this case the balance of stars and wishes, in the Association for Science Education's considered opinion, is rather different. Nevertheless, our intention has been to avoid negative criticism and to propose positive solutions to the problems we perceived in the report's proposals and relevant associated documents.

The process of responding to these documents began as soon as they were published. The ASE called a meeting on 18 June to begin putting together a response. This meeting was attended by the chief executive and senior members of ASE staff, the chair of the ASE Primary Committee, the manager of SCORE (the organisation, based at the Royal Society, which brings together representatives of professional scientific organisations), a representative of NAIGS (the National Advisers and Inspectors Group for Science), the ASE President and ASE members with expertise in primary science.

Our chief focus was the document on *Scientific and technological understanding*, which sets out the basis and rationale for teaching in this area of learning. It was agreed that different members of the group would tackle different parts of the document. The process was intense and demanding, involving many revisions, further meetings and almost hourly exchanges of emails. What follows summarises the main points; the full response is available on the ASE website.

Extracts from the ASE's response

General points

The ASE welcomes several aspects of the proposed programmes of learning, such as the intention to provide an explicit statement of the importance of scientific and technological understanding, to identify progression, and reduce prescribed content. However, we consider that the proposals for making these changes do not meet the expectations set out in the report. We also find that the considerable advances made in the past two decades in the understanding of primary school science education and its role in pupils' primary education as a whole do not appear to have been

recognised in this document.

Across the world, research has shown that children form ideas about the scientific aspects of the world from their earliest years. These ideas are often in conflict with the scientific view and may impede the development of concepts and deter interest and motivation for further study. But it is possible to begin to develop more scientific ideas in primary school children through practical investigation and other forms of enquiry. There is clear evidence that a combination of scientific enquiry and thinking skills is essential in the development of these ideas and that reflection on how ideas are changed can be a basis for understanding the nature of science. Essential to this development is a clear notion of progression in both the *skills* used in enquiry and in design and technology, and the *ideas* of science that are developed through enquiry and used in technology.

Detail and presentation

We welcome the aim of reducing the detail in which the curriculum is set out. However, the device of having 'explanatory notes', which elaborate the main statements, is an unsatisfactory way of retaining a great deal of the detail that is in the existing National Curriculum. Teachers have made it quite evident to us that these two tiers of prescription make the document unwieldy to use and restrict their freedom. We have found it quite possible to incorporate essential items from the 'explanatory notes' into the main statements, making the progression clearer and more readily usable as a planning tool.

In several places in the report the curriculum is described as '*an entitlement of all children*'. This is to be applauded and ought to be reflected in the leading statements in the curriculum progression. This is why we have proposed that the leading statement for progression in skills should be '*Teachers should provide opportunities for children to...*', and for progression in knowledge and understanding '*Teachers should provide opportunities for children to use appropriate skills to develop knowledge and understanding of...*'. We strongly advise this change in wording as being more consistent with the spirit of describing the prescribed content as representing a national entitlement.

Curriculum progression: skills

We consider that the statements currently under the heading '*Across the area of learning*' should be restructured to give a greater sense of progression across the three phases and of connection to 'How science works' at key stage 3. In the case of the primary curriculum this should become 'How science, technology and design work'. We would want to work with colleagues from the Design and Technology Association (DATA) over a longer period of time to identify the headings suitable for including D&T. Meanwhile, to exemplify the structure and to give some idea of what we would like to see included for science we set out here (Box 1) some statements for two components:

- **raising questions and developing ideas;**
- **collecting and recording scientific evidence.**

The statements have been

Box 1 Examples of statements of progression in scientific skills

Teachers should provide opportunities for children to:

Raising questions and developing ideas

Early	Middle	Later
• explore, observe, show interest, notice changes, ask questions, talk about their ideas (E1, 13)	• explore, investigate, raise questions and suggest reasons or predictions based on their ideas (M1, 23)	• raise questions that can be answered by practical investigation or other forms of enquiry and decide the best approach to use (L1)

Collecting and recording scientific evidence

• collect simple data and information to answer questions (E1, 15)	• decide what information to collect and how to record it (E1, M3, 23) • use a range of equipment including sensors to gather data (36)	• decide how to make and record accurate measurements and detailed observations (L3) • choose equipment, including ICT, to make their work more effective and explain the reasons for their choices (L2)

reworded to match a revised lead statement, but are derived from the original statements, the progression statements and the explanatory notes, as indicated in brackets.

It would be logical to be able to map these skills to the Essential Skills in the curriculum framework and to the Level Descriptions. However, this is impeded by the lack of consistent threads across the various elements of the proposed revised primary curriculum, no doubt resulting from piecemeal changes and the prior publication of both the Early Learning Goals and the key stage 3 science curriculum. We regard this lack of continuity across different phases and lack of coherence within the parts of the primary curriculum as a serious flaw.

Curriculum progression: knowledge and understanding

We appreciate that the aim of setting out the programme of learning in terms of early, middle and later stages is to help teachers identify the point in progression that their pupils have reached. This enables them to identify the next steps and so ensure that ideas and skills are progressively developed. We consider, however, that the statements need some rearrangement in order to serve the intended purpose and to show how each relates to the major generalisations in science. We have identified (Box 2) these major generalisations as relating to:

- the nature of science, technology and design;
- living organisms and the environment;
- materials and how they can be changed;
- motion and forces;
- energy;
- the Earth and the solar system.

The addition of 'the nature of science, technology and design' fills a gap in relation to the development of knowledge and understanding of the nature of science and of technology (including design) and their interaction. The recognition of the differences between science and technology is essential to understanding how they interact, how science is advanced through technology and how technology uses the knowledge – particularly of materials, forces and energy – from scientific enquiry. We consider that this understanding can begin in the primary school. At present, however, we have included in Box 2 (opposite) only an example of statements relating to science, pending necessary discussion with design and technology colleagues.

Under each heading we would like to see the statements arranged so that clear progression in what is to be learned is set out. In order to do this, and to identify *the ideas* to be learned, it has been necessary to rephrase and remove the initial statements relating to how the content area is to be treated. That is, we removed words such as '*to identify, group and select...*', since these do not help in making clear the ideas to be developed, but rather suggest activities. In so doing, we are aware that the conceptual learning has been separated from the skills and that there may be a danger of this leading to their separation in children's experience, which is not intended. Indeed, it is for this reason that we have suggested a different presentation of the overall framework. But we consider that a statement of the curriculum should set out what pupils are to learn and not how to teach, and that other parts of the document and supporting materials will make clear that the knowledge and understanding is developed through investigation and other forms of enquiry. We also note that this presentation of knowledge and understanding is consistent with the key stage 3 curriculum for science.

The overall framework

Our suggestions for modification of the framework have arisen from our concern about science and technology education in primary schools. We agree that numeracy and literacy are key aims of primary education and propose that they should be represented in the overall aims, reworded as:

- numerate and literate individuals;
- confident and enquiring learners;
- responsible and engaged citizens.

Rather than a 'core' of skills (literacy, numeracy and ICT), the next layer of the framework would reflect the wider range of aims to be achieved through all the areas of learning, reflecting the full range of 'essentials for learning and life'.

Further action

The ASE would welcome the opportunity to work with Government and with key stakeholder organisations towards a curriculum that reflects the importance of science, technology and design and the role this area of learning must play in children's primary education.

The full response is available on the ASE website: **www.ase.org.uk**

Box 2 Examples of progression in ideas developed in science

Teachers should provide opportunities for children to use appropriate skills to develop knowledge and understanding of:

Early	Middle	Later
The nature of science		
• how some questions can be answered through a process of exploration and enquiry	• how ideas used in explaining things depend on the evidence available at a certain time	• the role of evidence in changing ideas, both historically and in their personal understanding
Living organisms and the environment		
• what plants need to grow (E12)	• how to look after plants (M14, 33)	• how plants are grown, and used, around the world (L15)
• how to look after themselves and other animals (E12)	• how to keep themselves and other animals healthy (M14)	• how key human body systems work and what can influence them (L14)
• differences and similarities between familiar living things (M12)	• the diversity of animals and plants, and how they depend on one another in a particular environment (34)	• the beneficial and harmful effects of micro-organisms (L16) • how animals and plants have evolved to suit their environment
• their local environment and how they can care for it (E13)	• the features of the local environment and what lives in it, and how to improve it (M15)	• the features of more than one environment, the interdependence of what lives in them, and how to take action to care for and protect these environments (L17)
Materials		
• familiar natural and manufactured materials and how they can be used (E4, E5, E6, 16, 17)	• suitability of materials for different purposes and how to change and use materials (M12, M13, 30) • how materials are grouped according to their properties, including solids, liquids and gases (M12, 28)	• reversible and non-reversible changes, including how to create new materials (48) • the impact of the manufacture, use and disposal of materials on the environment (L19, 47)
Motion and forces		
• how to make things move (E7) • simple mechanisms & structures (E8)	• the effects of different forces and how these can be used (M11)	• use and control combinations of forces (L11)
Energy		
• simple electric circuits and how electricity is used safely (E10)	• electrical conductors and insulators and how they are used to control the flow of an electric current in a circuit	• the effects of changes in electrical circuits and how these can be used (L9)
• sources of light and sound and how we sense them (E11)	• how shadows and sounds are made (M10)	• how the properties of light and sound explain how we see and how different sounds are made L10, 40)
• keeping things warm and cold (18)	• thermal conductors and insulators and how they can be used	• how energy can be conserved
The Earth and the solar system		
• day and night and the changing seasons	• how day and night are explained • weather patterns and seasonal changes • what the Earth is made of (M15, 34)	• daily and seasonal changes, and time measurement (45) • the Earth's place in the Solar System (45) • how the surface of the Earth changes over time