

Primary school science assessment

Report from a seminar held at the Nuffield Foundation on
18 September 2012

Introduction

This document summarises discussions from a seminar held at the Nuffield Foundation on 18 September 2012. The seminar followed the publication of a report entitled *Developing policy, principles and practice in primary school science assessment*¹ in July 2012. The report examines the need for a new assessment framework for primary science following the removal of national testing in science at Key Stage 2 in 2010 in England (2004 in Wales) and, subsequently, the current revisions of the National Curriculum in England.

The report was written by a working group led by Professor Wynne Harlen and comprising specialists in primary science education and assessment. Although assessment is still required in science in primary schools, evidence suggests it is not being used effectively to help learning or to report pupils' achievements. The report sets out explicit principles that should underpin decisions about the role of assessment and the methods of collecting data. It goes on to present the working group's proposed assessment framework which is designed to help learning (formative) and to summarise and report what has been learned (summative) in science within individual schools. For the purpose of monitoring national performance, the framework supports the case for a separate programme of testing using random samples of pupils.

Purpose and structure of the stakeholder seminar

On publication the report was circulated and seminar invitations were issued to wide range of stakeholders including teachers, teacher educators, government agencies, charitable foundations and learned societies. The numbers invited to the seminar were restricted in order to facilitate focussed discussions, but a wide range of views were represented.

The overall purpose of the stakeholder seminar was:

- to receive responses to the report and its proposed model for assessment in primary science;

¹ The working group and report were funded by the Nuffield Foundation, but the views expressed are those of the group and not necessarily the Foundation. The report is available to download from www.nuffieldfoundation.org/primary-science-assessment.

- to consider implications for its implementation in practice.

The seminar was held at the Nuffield Foundation on 18 September 2012. A list of members of the working group, the programme for the seminar and a list of organisations represented are attached to this report at Appendices 1, 2 and 3.

Discussion

Consideration of the report and its content was driven by three questions addressed to the participants:

- Do you agree with the principles for assessment, and if so to what extent does the proposed framework satisfy them?
- To what extent do you think the proposals will contribute to high quality teaching and learning in primary science?
- What do you consider to be the key challenges to implementing the framework successfully, and in what ways can these be addressed?

Overall response

It is important to stress that the overall response to the report, its principles and proposed model was very positive and there was strong agreement with the fundamental approach. In particular the focus on using assessment to improve learning was welcomed, as was the intention to maximise the use of a range of evidence with due regard for teacher workloads. There was also wide support for the separation of assessment in school and the measurement of national performance. A mark of the quality of the report and its contents was the level of discussion it generated from the participants, which is summarised below under each of the three questions.

Do you agree with the principles for assessment, if so to what extent does the proposed framework satisfy them?

‘Yes’ and ‘to a large extent’ were the short answers to this question. Participants acknowledged that emphasis on the development and use of learning activities that enable effective assessment was a key ingredient of the proposals. Well managed, this would reduce the need for onerous reporting requirements because the necessary evidence would be available from records kept as part of ongoing teaching and learning. The focus on what pupils know, understand and can do should also minimise the use of unhelpful labelling of individuals.

Specific suggestions for amending the principles included:

- improving learning and improving children’s experiences;
- Using the feedback loops in the model to help teachers develop more effective interventions to support children’s learning of particular ideas;
- some clarification of terms e.g. ‘understanding’ which may be open to an unhelpful range of interpretations.

To what extent do you think the proposals can contribute to high quality teaching and learning in primary science?

There was unanimous recognition that the proposals can contribute to high quality teaching and learning. But there was also a strong view that the effectiveness of the framework will depend on an effective curriculum and the clarity with which anticipated lines of progression are defined. There needs to be a balance of what pupils know, understand and can do. It was acknowledged, however, that this is not easy to achieve and would need further development.

In his reflections, Paul Black highlighted the importance of increased clarity of what was expected of children and, importantly, how it would be recognised when they had achieved 'it'. This would be helped by expressing the goals of pupils' work using examples, in different forms, of how intended learning would be demonstrated. This was referred to as the 'front loading' of assessment. Thinking about such examples, as part of curriculum planning, helps to empower teachers to build assessment into every part of teaching and learning.

Effective application of the principles and use of the framework should not be limited to assessment in science. Learning does not take place in isolated subject slots and pupils can demonstrate aspects of their learning in a range of contexts. The primary classroom offers opportunities for observing achievement in other 'subjects' during a science activity (or vice versa).

The principles and assessment framework also encourage greater involvement of pupils in their own assessment. Increased opportunities for peer and self-assessment will contribute to their awareness of, and responsibility for, their learning. This will help them to recognise not just what they have achieved but also what they need to do to improve.

What do you consider to be the key challenges to implementing the framework successfully and in what ways can these be addressed?

The original report did not set out to address the issues related to the implementation of the framework, so the purpose of this question was to ascertain some of the challenges that will need to be addressed in the next phase of development. The points raised reflected the complexity of the situation but several threads were identified.

1. *School cultures and context*

The framework will require a change of emphasis in the way many schools and teachers approach assessment. Good practice in the formative use of assessment is already evident in some schools, and this will provide a foundation for the implementation of the framework. But for other schools it will require a major cultural shift. In all schools these changes will require the commitment of the senior management team and for the principles to become part of the philosophy of the school's approach to teaching and learning. Such changes will take time and require frequent refinement in order to maintain the highest possible quality and standards.

Such change is often perceived as increasing workloads, but the framework would remove the need for some aspects of current practice and should improve the outcomes for pupils, teachers and the school. Whilst some things may involve more work, others will require less or none at all. In particular the framework encourages teachers to make better use of good learning activities and the knowledge they have of their pupils.

Teachers keeping good quality day-to-day records that provide evidence of pupils' learning and progress will require little additional material to support their judgements.

2. Aggregation of information

A fundamental premise of the framework is the use of the right type of information in the right amount at the right time. Teachers gain large quantities of information as they interact with individual pupils on a daily basis in their teaching. They constantly probe, assess, suggest and make judgements about what is the next thing to do in order to move pupils' learning forward.

The challenge is how to summarise these large quantities of information in order to provide the narrative report for parents, other teachers and schools. Protocols for the aggregation of data for different purposes will need to be developed, and this will require significant effort. What is very clear is that assessment should not become divorced from teaching and learning and must not result in children being given meaningless labels.

3. Ensuring consistency and dependability of assessment

At the heart of any system of assessment is the need to ensure the consistency, comparability and dependability of judgements against agreed criteria. Robust procedures for both intra- and inter-school moderation need to be developed in order to build a shared view of types of evidence and the interpretation of what it indicates in terms of pupil achievement and outcomes. An important part of the process for teachers is guidance, and confidence, as to how much evidence is required to support the judgements.

The development of a 'national portfolio' of illustrative evidence would aid the process but it should be evidence of achievement, not exemplary test questions or activities which would risk a return to 'teaching to the test'. An important ingredient in the process is to ensure public confidence in the assessment judgements made by teachers, but the essential ingredient is the confidence and ability of teachers to make the right decisions consistently.

4. Progression

One of the roles of assessment is to monitor children's progress in learning. In turn, this might be judged against a ladder of progression which indicates more sophisticated knowledge, understanding and capabilities in different aspects of a subject or domain. In theory the ladder of progression is set out in the curriculum or, perhaps, an attainment sequence with benchmarks against which progress might be judged.

Setting out the steps in progression is not easy for several reasons: learning is not linear, some topics in science are not met each year and at some stages some children appear to be going 'backwards'. However, it is essential that some clarity is brought to this through concrete examples of outcomes to illustrate the defined stages in the progression.

Although it sounds almost trivial, more thought needs to be given to the terminology that will be used to define the steps in learning. The term 'level' seems to be appropriate but given recent history, it has unattractive connotations.

5. *Transition issues*

The transitions between early years and primary, primary and secondary and beyond are in some respects a special case within the challenge of defining progression and ensuring progress for pupils. These transition phases are problematic, not simply because of the need to determine the expected progression in learning, but because there is usually a change of institution and culture. There is potential for a lack of trust in the information that is being provided about pupils as they move from one school to another.

The transition from early years to primary was seen to be less of a problem than the primary-secondary transition, although both are critical. Efforts must be made to include teachers in both phases in development in order to establish the type and quantity of information needed. This could be a combination of data on individual pupils alongside information on what has been covered and to what degree. One possibility is for primary and secondary teachers to work together to devise ways to enable secondary teachers to judge where they might start teaching any given topic.

6. *Relationship with assessment of other subjects*

The integrated approach to teaching and learning in primary schools means that the assessment framework cannot be considered in isolation from that used in other subject areas, most notably English and maths, which are subject to statutory testing. Initial responses to the proposals indicated that they are relevant across the whole curriculum. It was felt that it would be beneficial if the in-school proposals were implemented throughout the whole school.

Although a case can be made for introducing random sample testing to determine the national performance in English and maths, it was felt that with some adjustment the current arrangements were not incompatible with the proposed framework.

7. *Support for teachers*

Without question the implementation of the proposed framework will fail without the support of teachers and, just as importantly, without support for teachers putting it into practice. A programme of dissemination and CPD will be required to roll out the framework and provide the necessary training and support for teachers. Although there has been a reduction in local authority infrastructure, there are existing networks and organisations (e.g. the network of Science Learning Centres, teaching school alliances, the Association for Science Education (ASE), the AZSTT Primary Science Teacher College) that can provide CPD and support the moderation process. Ways of providing appropriate preparation will have to be explored including work with initial training providers.

8. *National performance measures*

The assessment framework includes a mechanism for measuring national performance. It proposes testing random samples of pupils using several different sets of test items from a bank. This has several advantages, not least reducing 'teaching to the test'. However, further consideration needs to be given to how the results of such a programme of testing could be used by schools to help them recognise how they relate to the national picture and to inform their practice.

In addition to comparing themselves with the national picture, schools would be expected to have robust processes in place to assure the quality and dependability of their judgements. In part this would be done through moderation procedures, discussed above, but it could also be built into Ofsted inspections, and aided by the publication of performance figures in the annual reports of individual schools.

Final thoughts

Without doubt the consensus of the seminar participants was that the principles and framework for assessment in primary science were well thought through and provide a very firm basis on which to build. Although there remain a series of major challenges to be addressed, the proposals were considered potentially viable and their implementation can draw on existing good practice.

The necessary changes would need time to be fully implemented and will require good communication with stakeholders and a sustained support programme for teachers and schools. Participants welcomed the initiative, which they believed should help redress the balance so that what is taught and assessed would be driven by children's learning and not simply by the content of external tests. It should also help to shift the ownership of, and responsibility for, assessment of children's learning back to teachers and schools.

In the light of these positive responses and subject to levels of funding available, the working group is planning to take the proposals further by engaging with other groups and piloting the ideas with teachers.

Appendix 1

The working group

Professor Wynne Harlen OBE (Chair), past president of the Association for Science Education (ASE); member of SCORE (Science Community Representing Education) Primary Committee; Primary School Quality Mark (PSQM) advisory group; and Wellcome Primary Science Specialist (PSS) programme external advisory group

Professor Derek Bell, Director, Campanula Consulting; College of Teachers; former CEO of ASE; former Head of Education at the Wellcome Trust; member of advisory board for PSQM

Marianne Cutler, ASE Director of Curriculum Innovation; member of SCORE

Anne Goldsworthy, Consultant; former Chair ASE Primary Committee; member of SCORE Primary Committee

Dr Angela Hall, Director of Science Education, Nuffield Foundation

Dr Christine Harrison, Co-Director of Assessment for Learning and Senior Lecturer in Science Education, King's College London; former member of ASE Council

Sally Howard, Senior Teaching Fellow, Primary Science, University of Warwick; member of ASE Council and Assembly; ASE Trustee; Teach First Primary Programme lead West Midlands

Brenda Keogh, Millgate House Education; member of ASE Primary Committee, SCORE Primary Committee, and PSQM advisory group

Liz Lawrence, Barking and Dagenham Local Authority Adviser; ASE Chair-elect

Stuart Naylor, Millgate House Education; member of ASE Council

Professor Michael Reiss, Pro-Director: Research and Development and Professor of Science Education, Institute of Education, University of London

Professor Dudley Shallcross, University of Bristol; Director of the AstraZeneca Science Teaching Trust

Jane Turner, Leader, PSQM award programme; Associate Director, Science Learning Centre East of England; member of ASE Primary Committee and ASE Assembly; Lead Science Curriculum Expert DfE Standards and Testing Agency

Appendix 2

Seminar programme

Tuesday 18 September 2012 from 0930 – 12.50
Nuffield Foundation, 28 Bedford Square, London WC1B 3JS

Agenda

0930 - Refreshments

1000 - Introduction and welcome (Dr Angela Hall, Nuffield Foundation)

1010 - Presentation of key ideas from the report (Professor Wynne Harlen, SCORE Primary Science Working Group and Professor Derek Bell, Campanula Consulting)

1040 - Questions and panel discussion (panel members - Professor Wynne Harlen; Professor Derek Bell, Jane Turner, Associate Director, Science Learning Centre East of England; Stuart Naylor, Millgate House Education; Anne Goldsworthy, SCORE Primary Science Working Group)

1100 - Group discussion on the framework

1145 - Feedback and discussion

1230 - Conclusions (Professor Paul Black and Annette Smith, ASE CEO)

Appendix 3

Organisations represented at the seminar

The Association for Science Education (ASE)
British Educational Research Association (BERA)
Cambridge Assessment
Campanula Consulting
Department for Education
Gatsby Charitable Foundation
Institute of Physics (IOP)
Millgate House Education
National Foundation for Educational Research (NFER)
Royal Society of Chemistry (RSC)
Science Learning Centre - East of England
Science Learning Centre - London
SCORE (Science Community Representing Education)
Sheffield Hallam University
Standards and Testing Agency (STA)
University of Bristol
Wellcome Trust

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