

Statement on the assessment of science learning 14–19

Summary

Assessment of science learning is a complex but crucial issue in improving our education system. The results of assessment allow: students to understand and manage their own development; teachers to respond to individual learners' needs; parents to make decisions about which school or college they would like their children to attend; colleges, universities and employers to identify and recruit future scientists; regulatory authorities to support particular institutions; and policy-makers to monitor and direct the health and progress of the education system in general. Our current assessment regime in science does not satisfy all these stakeholders, and is holding back students' and teachers' performance and creativity.

While the content and structure of science curricula for 14–19 year olds are rightly being developed to better accommodate the needs of all learners, less care has been taken to ensure that the assessment regime is similarly developed to be widely relevant and engaging, and a fundamental part of the training, support and professional development of science teachers. The way in which learning is assessed has a determining influence upon students' attitudes towards, and interest in, science at school and college. Without a sympathetic and supportive system of assessment, no curriculum can encourage the enthusiasm of young people for science or lay the foundations of the scientific and technological expertise upon which our future prosperity depends. The flow of enthusiastic young people into science and engineering careers is diminishing. At a time when critically few 16 year olds are choosing to continue to study science and institutions face crippling problems in recruiting and retaining talented science teachers, the role of assessment in science learning can neither be ignored nor allowed to continue to be unreasonably distorted by the many different public and political priorities placed upon it.

This statement is the result of work undertaken by the Royal Society to: reach agreement amongst a wide range of stakeholders in education about the key principles of a healthy assessment regime; reflect on successful innovation in other subjects and education systems; and represent how seriously the science community considers the consequences of continued delay in reform on the future for science and engineering. We recognise that many organisations have begun to make assessment more central to reform, but hope the Government and its agencies will act strongly upon our recommendations, particularly given the opportunities raised by the current consideration of a new framework for 14–19 education in England.

Background

In January 2003 a steering group of the Royal Society's Education Committee initiated a major research project into the assessment of science learning among 14–19 year old students. This project included three expert seminars, two open meetings and an in-depth exploration of issues and innovation relating to assessment in science education in the UK and overseas. The full report of the project, undertaken by the Science & Technology Education team at King's College London, is available at:
www.royalsoc.ac.uk/education/assessment/

Statement 16/04

June 2004

ISBN 0 85403 603 2

This report can be found
at www.royalsoc.ac.uk

Key principles

Based on the evidence given in the research report the Royal Society considers that:

- the success of 14–19 science learning programmes is dependent on equal investment in developing curricula, teaching strategies and methods of assessment;
- the overall burden of assessment on teachers and students in 14–19 science is now excessive;
- current 14–19 assessment procedures assess too narrow a range of skills within investigative work and the wider competences needed by future employers, and for many students record failure rather than instil a sense of their achievements and progress;
- there is a lack of transparency about the procedures currently used for 14–19 assessment, with teachers, students and parents all being inadequately informed about the processes involved;
- all stakeholders have the right to feel confidence in the reliability and validity of assessment methods, and to be knowledgeable regarding the limitations of any form of assessment;
- there is an overemphasis in 14–19 science learning on ‘teaching to the test’ – driven by the pressures of **summative** assessment, which seeks to report on the achievement of student cohorts through standardised examinations and coursework – at the expense of the genuine support for learning provided by **formative** assessment, which involves the constant and constructive interactions of young people and their teachers;
- teachers can and should be given a greater role in the assessment of students’ work, without an increase in overall workload;
- the validity of assessment in schools and colleges can be improved by using a greater range of styles and modes of assessment in both formal examinations and coursework.

Recommendations

The Royal Society recommends that:

- 1 the time spent on summative assessment in schools and colleges be reduced through the combined and co-ordinated actions of regulatory authorities, teachers and teacher trainers, educational researchers and all sectors of the education community;
- 2 greater use be made of formative assessment in schools and colleges in such a way that the information derived from such assessment be used as a means by which science students can monitor their own learning and progression, for example through the use of portfolios;
- 3 the Department for Education and Skills (DfES) ensures that ongoing and incremental innovation in assessment techniques for 14–19 science should be part of the terms of reference for the Qualifications and Curriculum Authority (QCA) and that

the examination system in schools and colleges should be flexible enough to encourage and support a modest element of innovation;

- 4 the QCA and the Awarding Bodies:
 - a encourage a broadening of the range of skills to be promoted by, and assessed in, 14–19 science, including those currently associated with the investigation of scientific ideas and evidence (Sc1), and via non-traditional methods such as oral and information technology-facilitated presentations;
 - b design summative assessments so that they help students to better assess their own progress and potential as well as positively demonstrate achievement at all levels;
 - c ensure that where there exist a variety of routes to gain a qualification, those routes should aim at common standards without a requirement to use identical assessment procedures;
 - d undertake more research into combinations for formative and summative assessment strategies in 14–19 science that accord a greater role to teachers in assessing their students’ work, that are reliable and valid, and that command credibility among students, teachers, parents, employers, higher education institutions and government;
- e commission more research to identify the contribution that a range of innovative assessment techniques, including the use of electronic technologies, can make to the scientific education of young people;
- 5 the Teacher Training Agency and providers of Continuing Professional Development (CPD) for science teachers in schools and colleges give immediate and sustained priority to the design and promotion of programmes that will support teachers’ expertise and confidence in formative assessment;
- 6 any reformed system of assessment at 14–19 should be adopted as policy only after thorough trial and evaluation with the involvement of practitioners, and with due regard to the time needed for the associated professional development of science teachers and dialogue with pupils, parents, universities and employers.

Members of the Royal Society Steering Group on Assessment of 14–19 Science Learning:

Professor Mick Brown FRS (Chair), University of Cambridge*; Ms Carol Gardner, Bishop of Hereford’s Bluecoat School; Mr Nick Hooper, Head Teacher, Cannock Chase High School; Professor Edgar Jenkins, University of Leeds*; Ms Becky Parker, former Head of Science at Simon Langton Girls’ School; Mr Birendra Singh, General Inspector Science, Barking and Dagenham LEA; Ms Carolyn Swain, Education Consultant; Mr Michael Terry, Curriculum Team Leader Science, Alexandra Park School; Mr Nick von Behr, The Royal Society (Secretary).

* Member of the Royal Society’s Education Committee

The Society welcomes any views on this statement which should be sent in the first instance to assessment@royalsoc.ac.uk. For more information on this or other aspects of the Royal Society’s education policy work see: www.royalsoc.ac.uk/education