

**Royal Society:
Vision for science and mathematics education 5-19**

Science Council response to call for views



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Background

The Science Council is an umbrella organisation of over 35 learned societies and professional bodies in the UK drawn from across science and its applications: a list of member organisations is attached. In addition to providing a mechanism for the sector to work collectively, the Science Council develops and leads collaborative projects working with member bodies and the wider community, including the Future Morph web site that is designed to provide information for young people, their parents and teachers about careers from studying science and mathematics. The Science Council awards the professional qualification of Chartered Scientist (CSci) and is now leading an initiative which aims to raise the profile and aspirations of technician and graduate scientists by developing new professional registers at these levels. Collectively our member bodies represent more than 350,000 individual members, including scientists, teachers and senior executives in industry, academia and the public sector.

Introduction

The Science Council welcomes the opportunity to input to the Royal Society's Vision project and acknowledges its ambitious scope. Our member bodies consistently identify education as one of their key areas of interest, with many members undertaking their own work to support 5-19 education. Over time we have produced a number of statements and consultation responses which, taken together, describe the Science Council's views on science and mathematics education. A number of themes and key issues emerge from these documents, each of these cuts across a number of the Vision areas of focus and are listed below with reference to the most relevant documents.

Key themes

- **Practical Skills**

The Science Council member bodies are very clear on the importance of practical skills which are central to science and also provide an opportunity to develop knowledge and understanding of key concepts. Our input to the 2011 House of Commons Science and Technology Committee Inquiry on the subject provides detail on this topic in relation to 5-19 education.

- **Importance of Mathematics**

All Science Council member bodies emphasise the importance of mathematical skills to their discipline. As stated in our response to the recent National Curriculum review, science and mathematics are intrinsically inter-linked. In 5-19 education it is essential that the two strands of science and mathematics work effectively alongside each other achieving coherence in the sequencing of topics.

- **Careers Awareness**

Science is now ubiquitous in modern life and young people need to understand the relevance of science and mathematics to their lives and their future careers, whether or not they go on to further study in these subjects. Various research^{1 2} has also shown that whilst many young people enjoy science they cannot visualise themselves working in science. Raising awareness of the variety of career opportunities available from studying science is part of the solution to increasing the numbers choosing science subjects and the Science Council has been very active on this issue, including running the Careers from Science project and the Future Morph website. Teachers and the school environment have a key part to play in raising careers awareness as testified by research by the Secondary National Strategy³ and the University of Warwick⁴ for the Department of Education. There are many careers focused enhancement and enrichment activities available and in addition to this the Science Council and others have produced resources to illustrate how examples from the world of work can easily be incorporated into everyday delivery of the curriculum.

The People and Skills section of our *Priorities for Science and Innovation Policy 2010-2015* paper, *Science and mathematics education for 5-19 year olds* position paper and submission to the Royal Society of Edinburgh's inquiry into barriers to women in STEM provide brief pointers on this topic.

- **Diversity**

The Science Council believes that access to science education should be available for all those with talent and commitment to ensure that the science workforce reflects society's diversity.

The Royal Society will be very aware of the gender disparity in many science subjects, particularly the physical sciences. The Institute of Physics, in particular, has undertaken research in this area⁵ and advises teachers to work to highlight the links between topic areas, to avoid fragmenting the curriculum and to show the progression of ideas. The vision for a high-performing 5-19 education system should incorporate such measures to address gender imbalance and other aspects of diversity.

- **Chartered Science Teacher**

The Chartered Science Teacher (CSciTeach) designation forms part of the Science Council's professional registers and was designed to embrace teachers as an important part of the professional science community. The Masters level designation combines requirements for pedagogy and knowledge of specialist subject. It recognises and rewards the high quality expertise and commitment to continual professional development of high performing science teachers. The designation recognises teachers who can demonstrate professional autonomy through self-evaluation, collegial activity, personal responsibility and leadership.

This professional designation is of relevance to your questions on both teachers and the workforce but also leadership and ethos.

¹ ASPIRES King's College London

<http://www.kcl.ac.uk/sspp/departments/education/research/aspires/index.aspx>

² Important but not for me, Jenkins and Nelson 2005 <http://dx.doi.org/10.1080/02635140500068435>

³ Progression to post-16 science, Secondary National Strategy 2009

http://dera.ioe.ac.uk/2509/1/sci_post16_rept_0046109.pdf

⁴ Good Timing, Centre for Education and Industry, University of Warwick 2011

⁵ Girls in the Physics Classroom: An action guide for teachers, Institute of Physics Dec 2006

- **Understanding of the Science Workforce**

In September 2011 the Science Council published research undertaken by TBR which examined the nature of the UK science workforce. The report showed that science has become increasingly important across all sectors of the UK economy and society with 5.8 million people now employed in science-based roles. The report takes account of the complexities of the economy, examining the science workforce across the whole economy rather than a narrow band of so-called science sectors. Through this and other work we are developing a more detailed understanding of the different roles and skills for scientists that are required now and will be required in the future in the various employment sectors.

Research from the UKCES shows that the expansion in demand for associated professional and technical staff will be over 2.2 million up to 2017. The report TBR produced for the Science Council shows that the science workforce is made up of roughly equal proportions of workers with non-graduate, graduate and postgraduate qualifications. To satisfy demand we will need to broaden the cohort choosing to study science by developing alternative routes to GCSEs and A levels drawing on practical and applied learning methods. The addition of Registered Science Technician and Registered Scientist to the Science Council's professional registers will help to give focus to these qualification pathways and support the progression opportunities and transferability they must offer.

- **Multidisciplinarity**

Our member bodies represent a wide range of subject disciplines and employment sectors: from across this broad spectrum there is a very clear message that modern science is a multidisciplinary activity built on a foundation of knowledge of the core sciences. The major challenges facing the world, for example, food security, climate change and water scarcity will demand a multidisciplinary approach to seek solutions. In addition, a host of new areas promising future innovation, such as bioengineering or biophysical chemistry, require a multidisciplinary approach. As such it is important that young people understand how biology, chemistry and physics interact, the connection to other sciences and the multidisciplinary nature of science. Sir Harry Kroto recently echoed this view when expressing concerns that nanoscience's potential to drive epochal advances in engineering, physics and biology was being hampered by the traditional academic boundaries dividing the subjects.⁶ It is clear that there is a need for multidisciplinary skills which will continue; education must respond to this.

We hope that our input will be of use to the project committee; we would be happy to meet to discuss the issues that we have raised or to provide further assistance.



Diana Garnham
Chief Executive

13th March 2012

⁶ Times Higher Education 24 February 2011 <http://www.timeshighereducation.co.uk/story.asp?storycode=415261>

Enclosed Science Council Statements and Reports

1. Science and mathematics education for 5-19 year olds – Position Statement, June 2007
2. Priorities for Science and Innovation Policy 2010-2015, March 2010
3. The current and future UK science workforce, TBR for the Science Council, September 2011

Submissions to:

4. Department for Education Review of 14-19 Vocational Education, October 2010
5. Department for Education Review of National Curriculum, April 2011
6. House of Commons Science and Technology Committee Inquiry: Practical experiments in school science lessons and science field trips, May 2011
7. Royal Society of Edinburgh Inquiry: Barriers to Women in STEM, August 2011
8. House of Lords Science and Technology Sub-Committee 1: Higher Education in STEM Subjects Inquiry, December 2011

**Member Bodies of the Science Council
February 2012**



1. Association for Clinical Biochemistry*
2. Association of Neurophysiological Scientists*
3. Association for Science Education**
4. British Academy of Audiology
5. BCS, The Chartered Institute for IT*
6. British Psychological Society*
7. Chartered Institution of Water and Environmental Management*
8. Energy Institute*
9. Geological Society of London*
10. Institute of Biomedical Science*
11. Institute of Brewing and Distilling*
12. Institute of Clinical Research*
13. Institute of Corrosion*
14. Institute of Food Science and Technology*
15. Institute of Marine Engineering, Science and Technology*
16. Institute of Materials, Minerals and Mining*
17. Institute of Mathematics and its Applications*
18. Institute of Measurement and Control*
19. Institute of Physics and Engineering in Medicine*
20. Institute of Physics
21. Institute of Professional Soil Scientists*
22. Institute of Science and Technology
23. Institution of Chemical Engineers*
24. Institution of Environmental Sciences*
25. London Mathematical Society
26. Mineralogical Society*
27. Nuclear Institute*
28. Oil and Colour Chemists' Association*
29. Physiological Society
30. Royal Astronomical Society
31. Royal Meteorological Society
32. Royal Society of Chemistry*
33. Royal Statistical Society
34. Society for General Microbiology
35. Society of Biology
36. Society for Cardiological Science and Technology
37. Society of Dyers & Colourists

* Licensed to award Chartered Scientist – CSci

** Licensed to award Chartered Science Teacher - CSciTeach