

Department for Education: Reform of the National Curriculum in England

Response by the Wellcome Trust

April 2013

KEY POINTS

- Every student should study all three core sciences - biology, chemistry and physics – until the end of Key Stage 4. The three sciences should be an inherent part of a “balanced and broadly based” curriculum, whether or not the school is following the National Curriculum. All schools, their governors, and Ofsted should be absolutely clear on this point.
- The development of hands-on practical skills is an essential part of science education and should be explicitly specified as an aim of the science curriculum and its assessment arrangements.
- We believe the ideal approach to introducing a new National Curriculum for science would be through phased implementation. We are concerned that the Department’s timescale is too tight and will not allow enough time for adequate preparation and quality training time. The Science Learning Centres need to be supported to provide such infrastructure for that training. .

INTRODUCTION

1. The Wellcome Trust is committed to supporting science education. We work to ensure all young people develop the science skills and knowledge necessary to live and work in an ever more technological age. We believe it is important to equip young people with the understanding necessary to make informed decisions about the impacts of scientific and technological developments on their lives, as well as engaging and inspiring some of them to continue studying science. This includes developing the next generation of scientists, and helping others move into careers that draw upon science skills.
2. We have been actively involved in debates on the National Curriculum in recent years, in particular facilitating a symposium in 2010 on 21 years of the National Curriculum for

science. The report of the symposium¹ sets out five key messages for consideration in the development of a new curriculum:

- i. the aims and purpose of a National Curriculum for science must be clearly articulated and adhered to
 - ii. the body of core knowledge should be clearly defined but not over-prescriptive
 - iii. assessment should be designed as an integral part of the National Curriculum development
 - iv. new developments should be carefully piloted and rigorously evaluated before being refined and rolled out nationally
 - v. implementation of a new National Curriculum must be carefully planned to ensure that all parties involved (including teachers, inspectors, parents and pupils) understand how it should be applied.
3. With regard to point (iii) above, we welcome the fact that DfE is trying to coordinate curriculum development at Key Stage 4 with the design of the associated qualifications. However, we are concerned that the same is not happening with the primary science curriculum. We urge DfE not to finalise the curriculum development before the processes of assessment and accountability for primary science are designed.
4. We are pleased to have the opportunity to respond to the consultation on reforming the National Curriculum in England. Having already been involved^{2 3} in various processes around the reform, this response will provide general, high-level points. In line with the Trust's interests, our response focuses on questions from the consultation primarily considering: the teaching of three sciences in school curricula, the importance of practical skills, and the risk factors for successful implementation – namely, time, training and resourcing.
5. Subject specialist organisations such as SCORE, ACME and the Learned Societies, are well placed to comment on the detail related to the programmes of study relevant to their areas of expertise. We urge DfE to also ensure that the programmes of study for different subjects are aligned, especially those across science and mathematics, and that they inform each other and equally prepare students to learn at the same level in both subjects. The programmes of study for science must contain the appropriate level of mathematics that reflects the true relationship between these subjects.
6. We are seriously concerned that the timetable for change has left no opportunity for new developments to be piloted and evaluated. Introducing a new national curriculum should warrant a phased implementation to gather some information on how the curriculum is being received by teachers, and how it is affecting pupils. This would enable a more

¹ Wellcome Trust (2010) Summary report of the seminar "Leading Debate: 21 Years of the National Curriculum for Science"
http://www.wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtx063344.pdf

² National Curriculum for science: Key stages 1 and 2

http://www.wellcome.ac.uk/stellent/groups/corporatesite/@policy_communications/documents/web_document/wtvm056000.pdf

³ Various meetings between the Trust, DfE and other parties

iterative process for improvement. However, realising that this is not the intention of DfE, we urge the Department to collect information on the impact of this curriculum as soon as possible following implementation, to inform improvements over time.

THE TEACHING OF BIOLOGY, PHYSICS AND CHEMISTRY

Question 1: Do you have any comments on the proposed aims for the National Curriculum as a whole as set out in the framework document?

Question 9: What impact - either positive or negative - will our proposals have on the 'protected characteristic' groups?

7. We believe that it is essential that every student should study all three core sciences - biology, chemistry and physics – until the end of Key Stage 4, whatever school they attend. Each of these sciences contains core knowledge that everyone should be familiar with to make informed decisions and to prepare for work in an increasingly scientific age. The sciences are becoming increasingly interdisciplinary, and the boundaries between them are rich areas for investigation and exploitation. Anyone wishing to progress in any particular scientific discipline post-16 will struggle to do so effectively without having studied the breadth of them up until that point.
8. Academies and Free Schools are not required to follow the National Curriculum and these schools continue to increase in number rapidly. These schools are still required to provide a “balanced and broadly based” curriculum. We believe that biology, chemistry and physics should be an inherent part of such a curriculum and that schools should have a statutory requirement, enforced through their funding agreement, to teach them. All schools, their governors, and Ofsted should be absolutely clear on this point.
9. If students are able to drop one of the sciences post-14, evidence⁴ suggests that the distribution of students will shift away from the physical sciences and that serious inequities between the genders are likely to result. In 2007-08, Northern Ireland released its schools from following a National Curriculum post-14. Thus students in Northern Ireland can, for example, choose to take one, two or three of biology, physics and chemistry GCSEs. This has led to a change in the distribution of science studied: in 2007 entries for biology, physics and chemistry GCSEs were fairly evenly spread across the subjects and genders. In 2012, there were 4241 entries in biology, 52% of which were female, but only 3000 entries in chemistry, 47% of which were female, and 2884 entries in physics, 38% of which were female⁵. We fear that any arrangements that do not explicitly include a requirement to study all three sciences in England (and this should include the option of triple science at GCSE) will lead to a similar impact on both the physical sciences and gender equity.

⁴ Institute of Physics (2012) It's Different for Girls
http://www.iop.org/education/teacher/support/girls_physics/page_41593.html

⁵ GCSE and Entry Level Certificate Results Summer 2012, Joint Council for Qualifications, August, 2012.
<http://www.icq.org.uk/examination-results/gcse/gcse>

PRACTICAL SKILLS

Question 2: Do you agree that instead of detailed subject-level aims we should free teachers to shape their own curriculum aims based on the content in the programmes of study?

10. We believe that the science-specific aims for the National Curriculum are useful and will encourage teachers to think more broadly about the value of what they are teaching and not just the content. Given that experimentation is the essence of science, gaining hands-on practical skills and expertise should be an explicit aim of the science curriculum. If students have only learnt how to think about experimental work but not how to perform experiments, then they have not learnt how to do science.
11. Amending the second bullet point from “develop understanding of the **nature, processes and methods of science** through different types of science enquiries that help them to answer scientific questions about the world around them” to include a practical component, such as the following phrasing, would be helpful.
 - develop understanding of the **nature, processes and methods of science and acquire the related practical skills** through different types of science enquiries that help them to answer scientific questions about the world around them.

IMPLEMENTATION

Question 11: What key factors will affect schools’ ability to implement the new National Curriculum successfully from September 2014?

Question 12: Who is best placed to support schools and/or develop resources that schools will need to teach the new National Curriculum?

12. Time, training and resourcing will be the key factors for success in implementing the new curriculum. Schools will struggle to implement the new National Curriculum successfully from September 2014 due to the enormous time pressure that they will be under if the current timetable is adhered to. It is regrettable that the timetable for change has left no opportunity for the proposed curriculum to be piloted, evaluated and optimised.
13. To allow adequate time for preparation, details of the new curriculum need to be ready at least a year in advance. Providers of initial teacher training and professional development need to have finalised their courses for September 2013; it is hard to see how this is achievable especially for the primary curriculum, where the proposals for assessment have yet to be revealed.
14. We believe that high-quality science-specific professional development will be critical to successful implementation of the new science curriculum. In 2003, the Government and the Wellcome Trust partnered to ensure that science teachers and technicians across

the country could access high quality professional development through the funding of a National and nine Regional Science Learning Centres, with a joint investment of £51 million. We are delighted that the collaboration continues ten years on.

15. Our joint expert review⁶ of the National Network of Science Learning Centres concluded that the quality of professional development delivered is outstanding and has positive impacts on teaching quality, pupil attainment and teacher retention. The National Centre offers residential courses primarily for heads of science with the Regional Centres offering courses aimed more at subject teachers who can gain enormously from expanding and updating their subject knowledge and also their science specific pedagogical skills. The Regional Centres are also often critical in engaging hard to reach schools. The Network will become all the more important in preparing for the new science curriculum.

16. We understand that the DfE wishes that new resources and initiatives to support the introduction of the new curriculum should be sector-led, with the relevant communities and experts identifying not just the needs for implementing the new curriculum, but also taking some responsibility for delivering them. For instance, the Primary Science Expert Group was established to identify and help to address initial teacher trainers' needs resulting from the new primary curriculum. It is vital that such expert groups are appropriately resourced to fulfil their functions.

⁶ Wellcome Trust (2012) Quinquennial Review of the National Network of Science Learning Centres
<https://www.education.gov.uk/publications/standard/publicationDetail/Page1/WELL-00120-2012>