

# Department for Education: Reformed GCSE subject content consultation

## Response by the Wellcome Trust

August 2013

### Key points

- Proposed changes to the GCSE curriculum offer real potential to improve the quality and rigour of these qualifications, and promote progression to A-level and further study.
- We welcome the inclusion of mathematics across the Department for Education's proposed science subject content. However, care must be taken to ensure that mathematical skills are an integral part of both GCSE science tiers.
- Practical work is an essential part of science training. Like mathematics, it should be embedded across the science curriculum with specific details on which experimental skills and strategies are included in each area. The current system of controlled practical assessment is deeply flawed: it consumes valuable teaching time and is vulnerable to widespread malpractice. We therefore agree with its removal and believe that it should be replaced with direct assessment<sup>1</sup>. The total contribution of direct and indirect practical assessment should remain at the current 25% weighting.
- Science teachers will need to participate in subject specific continuing professional development to help them prepare for changes across the biology, chemistry and physics GCSE curriculum; support them to undertake direct assessment of science practical work; and keep them up-to-date with developments in the field.

### Introduction

1. The Wellcome Trust has a long-standing commitment to making inspirational, high-quality science education available to all young people. This will help nurture the next generation of scientists and ensure that all students have the skills and knowledge they need to live in an increasingly technological age.
2. We are therefore pleased to have the opportunity to respond to the Department for Education's reformed GCSE subject content consultation. The proposed changes to science qualifications promote progression to further study, better embed mathematics, put more emphasis on practical work and provide more challenge for the most able students. We have included more detailed comments on the consultation questions relevant to the Wellcome Trust below.
3. We have also responded to the linked Ofqual consultation on GCSE reform and have enclosed a copy for information.

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<sup>1</sup> 'Direct assessment' is based on the direct assessment of candidates while they carry out practical science activities; indirect assessment involves written questions designed to assess knowledge and understanding of practical science.

## Consultation questions

### Mathematics

4. It is critical that mathematical skills are taught and assessed across the whole curriculum; such understanding is important in all aspects of life and future careers.
5. Science depends on good mathematical understanding and skills, from using probabilities in genetics to interpreting experimental data. We **warmly welcome the emphasis placed on mathematics in the proposed GCSE science subject content**, and that it is embedded in the vast majority of areas covered by the qualifications.

### Qualification structure and content

6. We note the recommendation in Ofqual's consultation that reformed GCSE science qualifications should be tiered. We welcome this as it would be extremely difficult to assess the necessary range of student achievement without the use of tiered examinations. However, **careful consideration must be given to the subject content of the foundation and higher tier, and both must include mathematics.**
7. The reformed GCSEs offer separate qualifications in biology, chemistry and physics, as well as a combined science double award, ensuring that an appropriate balance of all three sciences is studied at Key Stage 4. However, we would like clarity on what provisions will be made for those young people who would have previously studied for the single science GCSE because it was judged that they would struggle with the higher workload of two or three qualifications. These students must still be equipped with a basic understanding of science in order to live and work in an ever more technological age.

### Practical work

8. Practical work is a defining feature of scientific observation and inquiry, and must be an essential part of every young person's science education. Well planned and implemented practical work enhances learning and understanding of scientific concepts, explanations and processes. It engages and enthuses students<sup>2</sup>, and further develops skills that are valued by both higher education institutions and employers<sup>3</sup>.
9. We are therefore pleased that the proposed GCSE science subject content makes reference to experimental skills and strategies, but are concerned that it still lacks detail. The 2013 Gatsby Foundation and Wellcome Trust paper on science practical work<sup>4</sup> includes a list of practical skills that experts suggest science students should acquire by the end of Key Stage 4. We **recommend that these skills are included in the revised GCSE subject content.**
10. Furthermore, we **recommend that statements about relevant practical work are embedded throughout the science curriculum document** in the same way as

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<sup>2</sup> Wellcome Trust Monitor Wave 2 (2013)

[http://www.wellcome.ac.uk/stellent/groups/corporatesite/@msh\\_grants/documents/web\\_document/wtp053113.pdf](http://www.wellcome.ac.uk/stellent/groups/corporatesite/@msh_grants/documents/web_document/wtp053113.pdf)

<sup>3</sup> National Strategic Skills Audit for England, Skills for Jobs, Today and Tomorrow, UKCES (2010)

<http://www.ukces.org.uk/reports/skills-for-jobs-today-and-tomorrow-the-national-strategic-skills-audit-for-england-2010-volume-1-key-findings>

<sup>4</sup> Gatsby Charitable Foundation and Wellcome Trust Paper: Assessment of Practical Work in Science (2013)

<http://www.gatsby.org.uk/~media/Files/Education/Practical%20Science%20Policy%20Note.ashx>

mathematical skills. This would provide a clear overview of experiments that are relevant to each area of study, and further emphasise the critical role of practical work in science education.

11. It is vital that practical work is assessed as part of all science qualifications. We welcome the inclusion of both direct and indirect assessment of experimental skills in the proposed GCSE assessment objectives, particularly the 10% weighting of direct assessment. However, we recommend that the weighting of indirect assessment is increased from 10% to 15% as outlined in the Gatsby Foundation and Wellcome Trust paper on science practical work. **In total, direct and indirect practical assessment should retain the current weighting and contribute 25% to GCSE science qualifications.**
12. Section 5.2 of the consultation refers to the use of the current system of controlled practical assessment. We believe that this method is deeply flawed and leads teachers to focus on a narrow range of experiments. As outlined in the Gatsby Foundation and Wellcome Trust paper, we **recommend that teachers should be responsible for directly assessing certain practical scientific skills.** In the Addendum to the Gatsby Foundation and Wellcome Trust paper<sup>5</sup>, we suggest a model for the direct assessment of practical skills.

### Teaching and continuing professional development

13. The proposed curriculum is set out as a statement of the required knowledge and understanding of scientific facts and theories, leaving teachers to decide how to set science within an applied and social context. Teachers must ensure that they contextualise the science curriculum, linking it to related disciplines, its applications, its wider challenges and to prospective careers from science. This will enable students to better understand the vital role that science plays in society and help increase knowledge of the varied job opportunities in this field. Currently, 62% of 14- to 18-year-olds say they know 'not very much' or 'nothing at all' about careers in science<sup>6</sup>.
14. **Subject specific continuing professional development should be a regular part of good teaching practice.** This is particularly vital for increasing the quality of science education in schools; helping teachers to prepare for changes to subject content across biology, chemistry and physics GCSEs; supporting them to undertake direct assessment of science practical work; showing them how to contextualise their teaching; keeping them up-to-date with scientific developments; and equipping them with innovative techniques to explain contemporary science in the classroom.
15. We would be happy to discuss any of these points in more detail if it would be helpful.

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<sup>5</sup> Addendum to Gatsby Charitable Foundation and Wellcome Trust Paper: Assessment of Practical Work in Science (2013)

<http://www.gatsby.org.uk/~media/Files/Education/Practical%20Science%20Policy%20Note%20Addendum.ashx>

<sup>6</sup> Wellcome Trust Monitor Wave 2 (2013)

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