

GCSE Science: Consultation on Conditions and Guidance

Response by the Gatsby Charitable Foundation, the Nuffield Foundation and the Wellcome Trust

1 May 2015

Key points

- There is a lack of evidence to show that written examination questions can adequately reflect a student's hands-on practical skills in science. We encourage Ofqual to work with exam boards and others to gather this evidence, ensure it is rigorous, and share it more widely.
- We believe practical science skills should be reflected in a student's GCSE grade and we urge Ofqual to work towards this aim.
- Mathematical skills are important for biology and should be adequately reflected in the assessment at GCSE in order to meet subject content requirements.

Introduction

1. This response is on behalf of the Gatsby Charitable Foundation, the Nuffield Foundation and the Wellcome Trust.
2. Gatsby Charitable Foundation is a foundation set up by David Sainsbury to realise his charitable objectives in the areas of; plant science, neuroscience, public policy, arts, Africa and education. Its education programme focuses on strengthening science and engineering skills in the UK through a range of innovative programmes and partnerships.
3. The Nuffield Foundation is an endowed charitable trust that aims to improve social well-being in the widest sense. It funds research and innovation in education and social policy and also works to build capacity in education, science and social science research.
4. The Wellcome Trust is a global charitable foundation dedicated to improving health by supporting bright minds in science, the humanities and social sciences. It has a long standing commitment to making inspirational, high-quality science education available to all young people, spending around £12 million each year towards this aspiration.
5. The Gatsby Charitable Foundation, the Nuffield Foundation and the Wellcome Trust are working in partnership on a programme exploring how we can better enable all schools and colleges to engage their students with good practical work in science. This programme aims to track changes in practical work over time, to build a secure evidence base that can be used to inform science curriculum and qualifications reform, and to generate ideas for where and how practical science can be strengthened.

General points

6. We have only responded to the questions most relevant to our interests and expertise.
7. We believe that practical science skills should be reflected in a student's GCSE grade and therefore do not support the changes to practical skills' assessment in

reformed science GCSEs. We urge Ofqual to work towards the aim of re-introducing a measure of hands-on, practical skills within GCSE science grades.

Consultation questions

Do you have any comments on our proposed Condition and requirements for tiering in new biology, chemistry and physics GCSEs?

8. With respect to the proposals for tiering, we are interested in how the 15% of questions drawing on students' practical experiences will be tiered. We encourage further exploration of how this content can differentiate between foundation and higher tier students and would welcome more information on this.

Do you have any comments on our proposed Condition and requirements for assessments in new biology, chemistry and physics GCSEs?

9. There should be transparency from Ofqual about how it arrived at the minimum proportion of marks for the assessment of mathematical skills in each of the subjects, including details of the evidence considered in the decision-making process. In particular we would like to know the rationale for according the different weightings to the assessment of mathematical skills across physics, chemistry and biology. Biology requires the application of a significant level of mathematical skill, from preparing experimental solutions, to data measurement, its representation and analysis. In addition, the increasing availability and use of "big data" means that the mathematical skills of biologists are ever more important. We are concerned that if the mathematical content of the GCSE subject is not adequately reflected in the assessment then students will not be sufficiently prepared for further study and careers. A [SCORE report](#)¹ on the assessment of mathematical content for A levels shows how previous biology qualifications have lacked sufficient mathematical content. This report may be helpful when determining an appropriate level of mathematical content.
10. The [Department for Education's subject content](#)² for single sciences shows that a similar amount of mathematical skills are required for each of biology (19 skills), chemistry (18 skills) and physics (20 skills). This similarity in the mathematical content of the three subjects is not reflected in the proposals for assessment. There needs to be full transparency for the rationale for this, including details of the evidence considered in the decision-making process.

Do you have any comments on our proposed Condition covering practical work in new biology, chemistry and physics GCSEs?

11. The consultation states that "[Ofqual] will require the exam boards to design their exams so that students who demonstrate they have learned from undertaking practical activities are rewarded for this". We assume that Ofqual means exam boards will be required to design exams which validly assess practical skills i.e. students would not be able to do well in those questions if they did not possess those skills at the required level. We would like to know how the exam boards will identify whether they have achieved this. Our understanding from recent correspondence with Ofqual is that in fact there is no evidence that performance on written questions

¹ Mathematics within A-level science 2010 examinations, SCORE, 2012

² Biology, Chemistry and Physics GCSE subject content, Department for Education, 2014 (Appendix 3)

can reflect practical abilities in this way. It would be very helpful if further work in this area – whether from Ofqual or the exam boards - can be shared with interested parties to improve stakeholder confidence on exam validity. We are exploring options for research that might strengthen evidence and understanding about how practical skills may be assessed using written exam questions. We have contacted Ofqual to discuss this.

12. We welcome the fact that Ofqual is proposing to take steps to ensure students undertake practical work in science. However, it is important that measures to punish malpractice on the schools' part do not unfairly penalise individual students. There should instead be consequences for the school, such as, omitting or reducing students' science grades from school performance measures, alerting Ofsted, and direct investigation by the exam boards. This is an emerging issue as practical skills are no longer quantified and included in the grade, and will be an issue for other subjects with similar changes.
13. We also suggest that awarding organisations could require schools to submit a register of attendance to support their statement that practical work has taken place. This would enable awarding organisations and Ofqual to identify schools that are under-performing and provide data that can be correlated with other performance measures.

Do you have any comments on our proposed Condition and requirements for assessments in new combined science GCSEs?

14. We are concerned about the proportion of marks allocated to mathematical skills across the science GCSEs (see above). Given the weighting for the combined science GCSE are taken from the single science assessments, the same concerns apply for the combined science.

Do you have any comments on our proposed Condition covering practical work in new combined science GCSEs?

15. Our concerns about practical science in Combined Science GCSE are the same as those for the single sciences. Please refer to our answer above for more information.