

Response to the DfE on GCSE and A Level Reform

Response prepared by the Education Policy Advisory Group on behalf of the Royal Statistical Society.

What best describes you as a respondent?

Other.

Learned society and professional body.

The Royal Statistical Society (RSS) is one of the world's most distinguished and renowned statistical societies. It is a learned society for statistics, a professional body for statisticians and a charity which promotes statistics, data and evidence for the public good.

We respond only to questions 4c, 4d, 5c and 5d on Mathematics at this time, however we do also have an interest in the statistical content of other subjects in schools, including Geography and Computer Science. For these we would recommend our report *A World Full of Data* (2013) which reviews the treatment of statistics across AS and A-Level subjects other than Mathematics (<http://www.rss.org.uk/uploadedfiles/userfiles/files/A-world-full-of-data.pdf>).

4 Is the revised A level content in each of these subjects appropriate in view of the issues raised in ALCAB's reports? Please consider:

- whether the content reflects what students need to know in order to progress to undergraduate study

Please provide evidence to support your response.

4c. Mathematics

Yes / **No** / Not sure

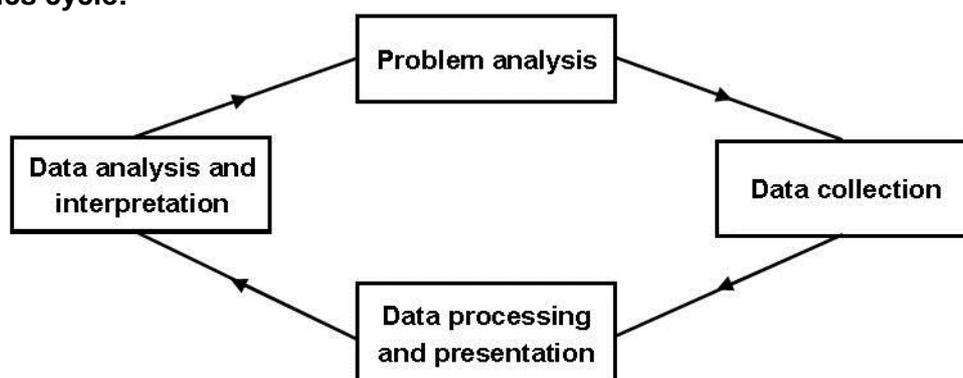
To outline some of the principles from which we respond to this consultation, statistics is not simply a branch of mathematics. It is a distinct activity, which is fundamentally about information, numerical data, and about applying quantitative skills to real problems. Basic data handling and quantitative skills should be an integral part of the taught curriculum across most A level subjects. We should also put resources into making sure the new mathematics A levels, and Core Maths for



those who don't wish to take A level mathematics, deliver appropriate statistical skills. In particular, we should ensure that all students learn to handle and interpret real data using technology.

The statistics cycle (below) promotes a way of understanding the world that is transferable across a range of subjects and situations, and is important to address this in full across the range of study routes that young people pursue.

The statistics cycle:



The consultation has a strong emphasis on progression into Higher Education. In response to this we would like to highlight that the same statistics content is not suitable for all the undergraduate courses for which statistics is needed. The prescription of 100% of content of AS and A-Level courses is therefore of modest concern to us, as there is no longer the flexibility to promote certain modules as preparation for particular undergraduate courses. In addition to the needs of statistics departments, we see different needs for quantitative skills in other subjects, across the scientific, technology engineering and mathematical (STEM) disciplines (including Computer Science), and in 'Q-Step' centres for the social sciences. Statistical learning in schools should offer welcome preparation for each of these disciplines. It is necessary to address statistical literacy across the range of routes that students take into higher education: for example whether they are pursuing mathematics AS or A-Level, 'core maths', A-Level sciences, business studies, geography, economics, or history. Each pathway must address quantitative skills appropriately.

On subject content, following ALCAB's recommendations, we especially support the new requirement to interpret at least one real, large set of data. For statistics, non-exam assessment is a key component of valid assessment, and so it is important to specify these skills to such an extent that all schools engage with data in the classroom and over a lengthy period of time. We welcome the emphasis in the new Mathematics specification on problem-solving, interpretation and testing, and there is much to welcome too in the removal of tedious calculations and drawing of diagrams. The specification also clarifies technology use to a greater extent than has been the case previously.

In A03 (P33 and P34) however, with respect to the statistics cycle, we would like to point out that students should be able to "interpret the outcomes of a modelling process in real world terms and recognise the limitations of a model" suggests that any examination should include model fitting to real data with analysis and interpretation. However this does not allow for any aspect of data



collection, feedback between model fitting and data editing, which are part of the data analysis cycle. The same shortcoming is shared in the AS Level specification.

We also agree with the concern expressed by MEI (Mathematics in Education and Industry) that specifications of the use of data and the use of technology could go further and be made clearer. For example and in particular, specifications should set out *how* large data sets should be provided. We think that this would assist practitioners in their teaching of practical interpretative skills, and that this assistance is needed given the new absence of coursework. In the absence of this guidance, it may be that awarding organisations and schools are not prompted to support the formative teaching of data analysis in their own approach to the final exam, and take more of a ‘tick-box’ approach over time. We also support MEI’s call for the piloting of exam question formats. It is necessary to see what works best both to prompt formative data assignments and to assess the results of these robustly.

4 d) Further mathematics

Yes / **No** / Not sure

We share some of the concerns raised by others in the mathematics community – for example by ACME and by MEI – that participation in both Mathematics and Further Mathematics may fall due to the shift from a modular to a linear structure with an exam at the end of the course. We would regret losing Further Mathematics participation under this model, as for advanced statistics it is important to prepare, in a breadth of ways, the most advanced end of the mathematics cohort, in addition to supporting more fundamental quantitative skills across other subjects. We welcome however the ongoing flexibility to choose different Further Mathematics specialisms, especially as this flexibility is no longer proposed for Mathematics.

5 Is the revised AS qualification content in each of these subjects appropriate? Please provide evidence to support your response.

5 c) AS Mathematics

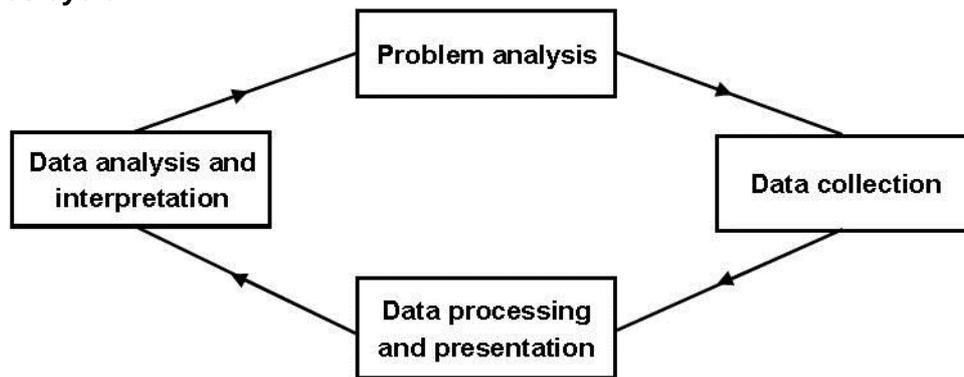
Yes / **No** / Not sure

We welcome the inclusion of hypothesis testing in AS Mathematics. We are concerned however that the statistical problem-solving cycle (see below) is not specified in its entirety. In A03 (P33 and P34, with respect to the statistics cycle, students should be able to “interpret the outcomes of a modelling process in real world terms and recognise the limitations of a model”. This suggests that any examination should include model fitting to real data with analysis and interpretation. However this does not allow for any aspect of data collection, feedback between model fitting and data editing, which are part of the data analysis cycle. Statistical literacy is so important – for higher education, employment and for good citizenship – that we would like to see it having a bigger role in all post-GCSE pathways.





The statistics cycle:



In addition to this we think that there is a general need to pilot and support the new co-teaching of AS-Level alongside A-Level in schools, given that the AS Level will no longer contribute toward A Level grades, and that this is a significant change.

Response submitted by Olivia Varley-Winter, Policy and research manager, on 22 September 2014.

