ROYAL STATISTICAL SOCIETY

DATA | EVIDENCE | DECISIONS

Response from the Royal Statistical Society (RSS) to the Department for Education consultation on reformed subject content for teaching from September 2017

Please insert an 'X' into one of the following boxes which best describes you as a respondent.

X	**Subject Association**

Please specify:

The Royal Statistical Society (RSS) is a learned society and professional body for statisticians and data analysts. We are one of the world's leading organisations to promote the importance of statistics and data, and have done so since we were founded in 1834. One of our six strategic goals from 2014-2018 is Education and Statistical Literacy, which focuses on the development of statistical literacy in society, so that people's understanding of data, risk and probability can inform their daily decision-making. Our Education Policy Advisory Group advises RSS' consultation responses with this goal in mind.

1. **Is the revised GCSE content in each of these subjects appropriate? Please consider:**

- **whether there is a suitable level of challenge**
- **whether the content reflects what students need to know in order to progress to further academic and vocational education**
- **whether the amount of content in the qualification is appropriate and, if not, whether you have any suggestions for removing or adding content**

Please provide evidence to support your response under the relevant headings:

1 a) Astronomy

X	**Yes**		**No**		**Not Sure**

Comments:

We agree broadly that the Astronomy GCSE content document reflects what students need to know. The assessment of observational work (page 14) has a helpful focus on analysis and evaluation of data; it is encouraging that this section is worth 20% of the whole assessment. It would also be desirable to have some fieldwork element to this assessment, this relates to the use of statistics because data will be a product of some observational work.

The amount of content is appropriate but the summary of mathematical content could improve. In particular, the appendix seems to under-represent the mathematical content. The earlier sections pull out the relevant mathematics from each part of the content and this form of presentation seems the most helpful. The appendix does not match the content throughout the document. For example evaluation of data does not feature at all in the appendix.

1 b) Business

	Yes	X	**No**		**Not Sure**

Comments:

For business GCSE, the quantitative skills are helpfully stated in business contexts prior to the appendix at the end. Regarding whether the content reflects what students need to know: it is surprising that there is nothing about uncertainty and risk. It is important for learners to understand the problems inherent in using past data to plan for the future, and to know that findings from data analysis are not necessarily causal or conclusive.

1 c) Economics

	Yes	X	**No**		**Not Sure**

Comments:

The quantitative skills are helpfully stated in context for GCSE economics. Regarding the content, we have the same reservation as for the Business GCSE which is that there is nothing about uncertainty and risk. There is interpretation and use of economic data but it is also important to understand the problems inherent in using past data to plan for the future, and that findings from data analysis are not necessarily causal or conclusive.

1 d) Geology

X	**Yes**		**No**		**Not Sure**

Comments:

GCSE Geology has the following in the content "• evaluate methodology, evidence and partial data sets, and resolve conflicting evidence" – it is good to see inclusion of this, and it may also be relevant to include it among the mathematical skills in the appendix.

1 e) Engineering

	Yes	X	**No**		**Not Sure**

Comments:

Some small adjustments would give us more confidence in the mathematical content of the qualification. In the Engineering GCSE's content specification, the mathematics is out of context in

an appendix. It would be better to also see earlier sections that pull out the relevant mathematics from each part of the content. Dealing with errors in measurement is very important in most branches of engineering, as is dealing with variability for manufacturing and construction.

The new GCSE Engineering requires determining the slope of a graph – it is also important that they know what this slope means. Although the appendix starts with saying that the mathematical skills should be applied, it should be more explicit that this means more than just doing the relevant calculations but also being able to use and interpret the results.

1 f) Psychology

☐	**Yes**	☒	**No**	☐	**Not Sure**

Comments:

The new GCSE Psychology includes evaluating experimental designs, and this could also be included in the mathematics appendix. However there is nothing explicit about variability and reliability here. It is important for students to understand that samples (particularly the small samples that are pretty common in psychology) will give variable results with implications for the reliability of conclusions.

1 g) Sociology

☐	**Yes**	☒	**No**	☐	**Not Sure**

Comments:

The research methods section in GCSE sociology is a useful and appropriate way to state the statistical requirements. However there is nothing explicit about variability and reliability in the requirements. It is surely important for students to understand that samples will give variable results with implications for the reliability of conclusions.

3. **Is the revised AS and A level content in each of these subjects appropriate? 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 under the relevant headings:

2 a) Design and Technology

X	**Yes**		**No**		**Not Sure**

Comments:

There is an impressive amount of mathematics and statistics to be included in the GCSE Design and Technology. The Final section (h) covers aspects of uncertainty.

2 b) Environmental Science

	Yes	X	**No**		**Not Sure**

Comments:

We welcome the DfE's requirement that a minimum of 10% of the Environmental Science A Level should include Level 2 mathematical skills, to be applied in the context of the subject. Past examination papers at A level have often allowed learners to opt out of doing quantitative elements. [1] If mathematical and statistical skills are not compulsory, they may not be prioritised for teaching in the classroom. The quantitative elements of university courses are also increasing, and learners need to be prepared for those courses. [2]

From our joint review with the Advisory Committee on Mathematics Education of selected reformed A level subjects, the RSS would like to stress that to follow up mathematical requirements (in Environmental Science as for other subjects), the development of high quality assessment will be very important. [3] We therefore welcome that the DfE is continuing to provide additional guidance

[1] Nuffield Foundation (2012), *Mathematics in A level assessment: A report on the mathematical content of A level assessments in Business Studies, Computing, Economics, Geography, Psychology and Sociology*; SCORE (2012), Mathematics within A level Science 2010 Examinations.

[2] Hodgen, J. McAlinden, M. & Tomei, A. (2014), *Mathematical transitions: a report on the mathematical and statistical needs of students undertaking undergraduate subjects in various disciplines*, The Higher Education Academy;
Advisory Committee on Mathematics Education (ACME) (2011) *Mathematical Needs: Mathematics in the workplace and in Higher Education.*

[3] RSS & ACME (2015), *Embedding Statistics at A level: a report on statistical requirements and assessment across A level courses in Biology, Business, Chemistry, Geography, Psychology and Sociology.*

on new mathematical and statistical requirements. According to our review, the purpose of guidance should include ensuring that assessment is authentic and at the appropriate level, and that requirements are applied consistently across awarding organisations.

A further observation that we (the RSS) would like to make is that some of the required 'subject principles' for the A Level in Environmental Science (listed below) imply a requirement for statistical problem solving. In our view, requiring direct assessment of practical work or fieldwork would be appropriate to support this. This would be likely to lead to more consistent approaches across awarding organisations. It would also bring the assessment approach more into line with other scientific subjects, such as Biology and Geography.

Selected subject principles

"• use appropriate methodology, including information and communication technology (ICT), to answer scientific questions and solve scientific problems"; "• undertake experimental and investigative activities, including appropriate risk management, in a range of environmental contexts"; "• evaluate methodology, evidence and data, and resolve conflicting evidence to: • make judgements and reach conclusions • develop and refine practical design and procedures".

With regard to the subject content, the mathematical skills, listed in Appendix 2, do not distinguish mathematics and statistics, so the awarding organisations can fulfil the requirement for mathematical skills in a variety of ways. For statistics, we welcome the breadth of coverage of data handling, including the requirement to construct graphs and not just interpret them; appropriate sampling for analysis, e.g. 'analyse random data collected by an appropriate means'; measurement of dispersion e.g. 'understand why standard deviation is a useful measure … e.g. for comparison of different data sets with different means'; and consideration of uncertainty: 'identify uncertainties in measurements with the use of simple techniques to determine uncertainty when data are combined … e.g. estimating total population using sub-samples in a preliminary study'.

Our concern is that these (appropriate) content requirements should be followed up in the assessment approaches and that the guidance should be more geared toward this.

2 c) History of Art

No response

2 d) Music Technology

No response

2 e) Philosophy

No response

[Response ends]

Submitted by RSS' Policy and Research Manager, 7 September 2015