

Response from the Royal Statistical Society to Ofqual regarding GCSE, AS and A level statistics

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 key strategic goals for 2014-2018 is for society to be more statistically literate, so that people's understanding of data, risk and probability can inform their daily decision making, leading to better outcomes. Our Education Policy Advisory Group has advised RSS' response to this consultation with this goal in mind.

Your details

To evaluate responses properly, we need to know who is responding to the consultation and in what capacity. We will therefore only consider your response if you complete the following information section.

We will publish our evaluation of responses. Please note that we may publish all or part of your response unless you tell us (in your answer to the confidentiality question) that you want us to treat your response as confidential. If you tell us you wish your response to be treated as confidential, we will not include your details in any published list of respondents, although we may quote from your response anonymously.

Please answer all questions marked with a star*

Name*

Olivia Varley-Winter

Position*

Policy & Research Manager

Organisation name (if applicable)*

The Royal Statistical Society

Address

12 Errol Street,
London

EC1Y 8LX

Email

o.varley-winter@rss.org.uk

Telephone

0207 294 3928

Would you like us to treat your response as confidential?*

If you answer yes, we will not include your details in any list of people or organisations that responded to the consultation.

Yes No

Is this a personal response or an official response on behalf of your organisation?*

Personal response (please answer the question “If you ticked ‘Personal response’...”)

Official response (please answer the question “If you ticked ‘Official response’...”)

***If you ticked “Official response from an organisation/group”, please respond accordingly:**

Type of responding organisation*

Awarding organisation

Local authority

School or college (please answer the question below)

Academy chain

Private training provider

University or other higher education institution

Employer

Other representative or interest group (please answer the question below)

School or college type

- Comprehensive or non-selective academy
 - State selective or selective academy
 - Independent
 - Special school
 - Further education college
 - Sixth form college
 - Other (please state below)
-

Type of representative group or interest group

- Group of awarding organisations
- Union
- Employer or business representative group
- Subject association or learned society
- Equality organisation or group
- School, college or teacher representative group
- Other (please state below)

Nation*

- England
- Wales
- Northern Ireland
- Scotland

Other EU country: _____

Non-EU country: _____

How did you find out about this consultation?

Our newsletter or another one of our communications

Our website

Internet search

Other

May we contact you for further information?

Yes No

Consultation questions

GCSE statistics

Question 75: To what extent do you agree or disagree that GCSEs in statistics should be assessed entirely by exams?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Please give reasons for your answer:

The proposed exam setting cannot validly assess key aspects of the subject content. Supporting reasons and proposals are set out below.

1. Statistics is an important area of study within mathematics but it's also a crucial tool for subjects ranging from biology, medicine and engineering through to the environmental sciences, geography, psychology and sociology. Assessment should address statistics' applied aspects, and this is reflected in the Assessment Objectives (below).

Assessment objective		Weighting
AO1	Use and apply the terminology, notation and methodologies necessary at each stage of the statistical enquiry cycle.	20%
AO2	Apply standard statistical techniques for the collection and visualisation of data, and the calculation of summary statistics.	30%
AO3	Reason, interpret and communicate the results found through the application of techniques used in the statistical enquiry cycle.	25%
AO4	Critically assess the reliability and validity of statistical methodologies and the conclusions drawn through the application of the statistical enquiry cycle.	25%

For example:

- AO1 requires learners to “use and apply the terminology, notation and methodologies necessary at each stage of the statistical enquiry cycle”

- AO2 requires learners to “use and apply standard statistical techniques for collection and visualisation of data”.
- Each of the four AOs refer to the statistical enquiry cycle. The cycle cannot be assessed in full in a written exam. In particular, the ‘data processing and presentation’ stage, set out in the draft subject content published by the DfE, explicitly requires the use of appropriate technologies to organise and process data, to generate diagrams and visualisations, and to generate statistical measures to compare data. Further to this, performance at sourcing appropriate data for statistical inquiry could only be partially assessed.

In light of this, we strongly advise that the requirement for practical investigations and statistical enquiry must be assured by Ofqual, and that this requires adjustment from the current proposals.

2. Assurance of applied assessment objectives should be in keeping with approaches for other reformed subjects. We consider accepted models for non-exam assessment below to indicate our preferred approach.

- Non exam assessment weighted with at least 20% of marks.
We know that the weighting of statistics coursework proved problematic when it was part of GCSE Mathematics; it was seen as an add-on to the rest of mathematics and too often treated as such. The same need not be the case for GCSE Statistics where coursework (to develop knowledge of practical data analysis and investigations) is central to the subject. Compared to Mathematics, the uptake of Statistics is relatively low, so it will be possible to establish models of good practice, including dealing with possible plagiarism and undue help within schools.

It is not unusual for subjects to have practical requirements and in our view it is only surprising that this has not yet been recognised in the reform process for Statistics. We note that coursework remains required and weighted in certain other reformed GCSEs including Computer Science (20% of marks), Modern Foreign Languages (oral assessment - 25%), Engineering (40%) and Design and Technology (50%). Coursework is also proposed for certain other subjects being consulted on for 2017, such as Electronics (20%). The conditions and regulations for these subjects, where they are agreed, permit practical tasks set either by teachers or by exam boards. Exam boards are required to “demonstrate that whatever approach is used they have implemented sufficient controls and are providing appropriate support to teachers.”

This would be our preferred regulatory approach, and we advise assuring this through a substantial non-exam requirement, with a weight of 20% to 25% in the grades that students receive. The 20% minimum would offer the subject the same level of practical assessment as Computer Science and Electronics. This is to enable meaningful assessment of the statistical enquiry cycle including the use of appropriate software for this.

- Non marks based approaches.
Non marks-based approaches are being introduced for practical work in science (Biology, Chemistry and Physics), for fieldwork in Geography, and for speaking in English Language. The non-exam elements will be assured by Ofqual, for example by statements from

schools, but performance will not carry weight in the final grading of these subjects, which is determined 100% by the exam.

This would not be our preferred approach as it would mean that key aspects of subject knowledge are not reflected in students' grades. This would disadvantage candidates who excel in aspects of applied statistics that the written exam cannot assess, in particular, the aspects of AO1, AO2 and the statistical enquiry cycle referred to above.

3. Assessment of practical work making use of data, and/or statistical investigations, will help to ensure that approaches to statistics in England are in keeping with how the subject is taught elsewhere in the world. It would help to prepare students for similar approaches to learning at A Level, where we also recommend assessment of practical work should take place. A recent review of post-16 statistics by Cambridge Assessment, spanning the UK, Alberta (Canada), Hong Kong, Singapore, Victoria and New South Wales (in Australia), has found that across these jurisdictions outside of the UK, statistics is predominantly taught in a practical way, involving the handling and collection of real data.¹ In England too, industry and universities show strong interest that students should work more with real data in school and should develop practical quantitative skills. This growing requirement at the higher levels of study was taken account of in the *Report of the ALCAB Panel on Mathematics and Further Mathematics*, which recommended that work with data should be included in statistics within A Level mathematics, and represented in assessment.²

We would advise assuring this through a substantial non-exam requirement, with a weight of 20% to 25% in the grades that students receive.

Question 76: To what extent do you agree or disagree that GCSEs in statistics should be tiered?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Please give reasons for your answer:

¹ P. 32 in Munro, J. (2015) 'Statistics and Mechanics: Comparing the Applied Mathematics of international Mathematics qualifications', *Research Matters: A Cambridge Assessment Publication*, 20, pp. 27-34 (PDF). Available from: <http://www.cambridgeassessment.org.uk/Images/255867-research-matters-20-summer-2015.pdf> (Accessed: October 2015)

² The A level content advisory board (ALCAB) (2014) *Report of the ALCAB Panel on Mathematics and Further Mathematics* (PDF), p. 8. Available from: <https://alevelcontent.files.wordpress.com/2014/07/alcab-report-on-mathematics-and-further-mathematics-july-2014.pdf> (Accessed: October 2015)

Question 77: To what extent do you agree or disagree that we should adopt a similar approach to tiering in GCSE statistics as we have for GCSE mathematics?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Please give reasons for your answer:

Question 78: To what extent do you agree or disagree that the proposed assessment objectives are appropriate for GCSEs in statistics?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Please give reasons for your answer:

Question 79: To what extent do you agree or disagree that the proposed weightings of the assessment objectives are appropriate for GCSEs in statistics?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Please give reasons for your answer:

We have proposed in our answer to Question 75 that a non-exam component has to be required and assured. This may affect the weighting across the Assessment Objectives.

Question 80: Do you have any further comments relating to the assessment of this subject?

AS and A level statistics

Question 81: To what extent do you agree or disagree that AS qualifications in statistics should be assessed entirely by exams?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Please give reasons for your answer:

In comparison to AS/A Statistics pre-reform, the proposed assessment objectives (below) have shifted substantially to address the applied nature of statistics. We are supportive of this shift and believe that the requirement for practical work using data should be given much more thorough treatment, through appropriate and assured approaches. These will not be tested so fully where statistics is represented elsewhere in the curriculum (within mathematics and within other subjects). It is important that appropriate assessment approaches are selected and developed in this case. The RSS and the Advisory Committee on Mathematics Education have found in a review of several reformed A level subjects that the statistical elements of exam materials 'will not help learners to develop competence and confidence in applying statistical methods or interpreting results'.³ The RSS therefore considers that non-exam assessment must play a key part in AS and A Level Statistics.

The retention of coursework has not been unusual within the reform process for other subjects, and our reasoning leads us to advocate it for Statistics.

- Other reformed AS / A Level subjects are to award marks for non-exam assessments addressing practical aspects, including for example computer science (20% marks), modern foreign languages (30%, for spoken language skills), and design and technology (40%). A non-exam element for AS and A Level statistics would be in keeping with this approach.
- The qualification is relatively low stakes for schools and colleges, and this reduces the incentive for plagiarism within coursework (a recognised concern especially for high-volume and high-stakes subjects such as GCSE maths). The smaller size of the subject cohort means that oversight of internal assessment should not be problematic.
- Given that the assessment objectives for AS and A Level statistics are not markedly different to those at GCSE, we suggest that between 20% and 25% of marks for practical work would be appropriate. Given the size of AS and A Level qualifications, this could

³ Royal Statistical Society & Advisory Committee On Mathematics Education (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* [PDF]. Available from: <http://www.acme-uk.org/media/32719/embedding-statistics-at-a-level.pdf>

accommodate various forms of practical work including statistical investigations or projects, and the form of practical work will require some definition.

Assessment objective		Weighting	
A level		A level	AS
AO1	Use and apply the terminology, notation and methodologies necessary at each stage of the statistical enquiry cycle.	20%	20%
AO2	Apply standard statistical techniques for the collection and visualisation of data, and the calculation of summary statistics.	30%	30%
AO3	Reason, interpret and communicate the results found through the application of techniques used in the statistical enquiry cycle.	25%	25%
AO4	Critically assess the reliability and validity of statistical methodologies and the conclusions drawn through the application of the statistical enquiry cycle.	25%	25%

Question 82: To what extent do you agree or disagree that A levels in statistics should be assessed entirely by exams?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Please give reasons for your answer:

The reasoning is the same as for the AS Level, and relates to the assessment objectives and the requirement to assess applied aspects of the subject including the use of technology. Please refer to reasons given in response to the previous question.

Question 83: To what extent do you agree or disagree that the proposed assessment objectives are appropriate for AS and A levels in statistics?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Please give reasons for your answer:

Question 84: To what extent do you agree or disagree that the proposed weightings of the assessment objectives are appropriate for AS qualifications in statistics?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Please give reasons for your answer:

We have proposed that a non-exam component has to be required and assured. This may affect the weighting across the Assessment Objectives.

Question 85: To what extent do you agree or disagree that the proposed weightings of the assessment objectives are appropriate for A levels in statistics?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Please give reasons for your answer:

We have proposed that a non-exam component has to be required and assured. This may affect the weighting across the Assessment Objectives.

Question 86: Do you have any further comments relating to the assessment of this subject?⁴

⁴ Please note that any comments relating to the subject content should be directed to the DfE.

The Royal Statistical Society broadly welcomes the retention, redevelopment and specifications proposed for GCSE, AS and A Level Statistics, however we have asked here for concerns to be addressed regarding the examination and coursework elements. We are also responding to the DfE's consultation on subject content.

Submitted by RSS' Policy and Research Manager, 5 November 2015