Department for Education

Consultation Response Form

Consultation closing date: 5 November 2015
Your comments must reach us by that date

Additional Reformed GCSE and A level subject content consultation

Version 2 02/10/2015

If you would prefer to respond online to this consultation please use the following link: https://www.education.gov.uk/consultations

Information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information regimes, primarily the Freedom of Information Act 2000 and the Data Protection Act 1998.

If you want all, or any part, of your response to be treated as confidential, please explain why you consider it to be confidential.

If a request for disclosure of the information you have provided is received, your explanation about why you consider it to be confidential will be taken into account, but no assurance can be given that confidentiality can be maintained. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as binding on the Department.

The Department will process your personal data (name and address and any other identifying material) in accordance with the Data Protection Act 1998, and in the majority of circumstances, this will mean that your personal data will not be disclosed to third parties.

Please tick if you want us to keep your response confidential.	
Reason for confidentiality:	

Name: Charlie Stripp	
Please tick if you are responding on behalf of your organisation.	✓
Name of Organisation (if applicable): Mathematics in Education and Industry	
Address: Monckton House, Epsom Centre, White Horse Business Park, Trowbridge, Wiltshire BA14 0XG	

If your enquiry is related to the DfE e-consultation website or the consultation process in general, you can contact the Ministerial and Public Communications Division by e-mail: consultation.unit@education.gsi.gov.uk or by telephone: 0370 000 2288 or via the Department's 'Contact Us' page.

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

[ ] school	[ ] academy	[ ] college or further education institution
[ ] teacher	[ ] organisations representing school teachers or lecturers	[ ] subject associations
[ ] parent	[ ] young person	[ ] higher education establishment
[ ] employer/business sector	[ ] local authorities	[ ] awarding associations
[x] other		

Comments:

MEI is a charity and a membership organisation. It is an independent curriculum development body for mathematics. It is a major provider of mathematics teaching and learning resources, and of mathematics CPD for secondary school and post-16 mathematics teachers.

MEI developed and manages the DfE-funded Further Mathematics Support Programme. MEI plays a key role in the management of the National Centre for Excellence in Teaching Mathematics. MEI was responsible for developing, and provides resources and CPD for, a suite of GCE Mathematics qualifications and two Core Maths qualifications run by OCR; this includes an AS qualification in Statistics.

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:

1a) Ancient History

☐ Yes	☐ No	☐ Not Sure

Comments:

1b) Classical civilisation

☐ Yes	☐ No	☐ Not Sure

Comments:

1c) Electronics

☐ Yes	☐ No	☐ Not Sure

Comments:

1d) Film studies

☐ Yes	☐ No	☐ Not Sure

Comments:

1e) Media studies

☐ Yes	☐ No	☐ Not Sure

Comments:

1 f) Statistics

☐	Yes	✓	No	☐	Not Sure

Comments:

The aims and objectives are very good. They promote statistics as:

- a subject in its own right, related to but not a subset of mathematics;
- a practical subject, answering questions about the real world using real world data;
- relevant to study of other subjects and in everyday life;
- a subject which uses technology.

The references to the statistical enquiry cycle, and its setting out in Appendix 3, are welcome. They should help to ensure that statistics is about solving problems, and not an artificial collection of techniques.

The overall impression given by paragraph 8, the detailed subject content, is that there is too much material for a practical GCSE course. The content contains long lists of techniques, calculations and definitions which must be learned and applied. The intentions seem good, but there is a real risk that students and teachers will not have sufficient time to develop these ideas in the context of solving real problems in a practical way. These are concepts which need to come from experience, for example dealing with the difficulties of collecting an appropriate set of data, and there needs to be sufficient space for this to happen.

The detailed subject content should be trimmed down significantly, with consideration given to the coherence of the course. Concepts, techniques and calculations should be restricted to what students might reasonably expect to encounter in their practical work, or to be closely related to that work.

The probability content is incoherent and should be revisited. It seems that notations for conditional probability and independence are introduced (E4) but not the concepts themselves. Calculating probabilities from the binomial distribution is expected (D8), but not the underlying probability work from tree diagrams. The binomial and Normal distributions are introduced, but very little of the foundation work connecting empirical frequency distributions and probability distributions. There is a passing reference to risk; this either needs to be strengthened – it is an important topic – or omitted.

Section D5 requires the calculation of the regression line but the formula given on page 11 to 12 is the general formula for any straight line and so is only useful if students are given a graph of the regression line, or draw one by eye, and are asked to find its formula. This involves no understanding of regression and so would be better replaced by “line of best fit” rather than “regression line”. It is also bizarre that calculator values

of the correlation coefficient are allowed but not equation of regression line using calculator functions.

Section E2 expects learners to 'compare experimental data with theoretical predictions to identify possible bias within the experimental design'. This is laudable, but ignores the more likely possibility that, if there is a mismatch between experimental data and the theoretical predictions, then it is because the wrong model has been selected. The same issue arises in E10 in the context of the binomial distribution; it is bizarre that this is required of all students whereas only more highly attaining students actually calculate binomial probabilities (D8).

We consider that the following content should be in bold type in square brackets, only required to be studied by more highly attaining students:

- B2 'know the importance of reliability and validity with regards to collected data'
- B2 'including level of control'
- D3 ' variance and standard deviation'
- D4 'by calculation of moving averages'
- E4 the formula which includes conditional probability
- E10 'know the characteristics of a binomial distribution'

We believe that removing these more challenging topics from the experience of lower attaining students will take nothing away from the coherence of their course, and will allow them proper time to succeed at the practical and theoretical aspects of the course.

2. 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.

2a) Accounting

☐	Yes	☐	No	☐	Not Sure

Comments:

2b) Ancient History

☐ Yes	☐ No	☐ Not Sure

Comments:

2c) Archaeology

☐ Yes	☐ No	☐ Not Sure

Comments:

2d) Classical civilisation

☐ Yes	☐ No	☐ Not Sure

Comments:

2e) Electronics

☐ Yes	☐ No	☐ Not Sure

Comments:

2f) Film studies

☐ Yes	☐ No	☐ Not Sure

Comments:

2g) Law

☐ Yes	☐ No	☐ Not Sure

Comments:

2h) Media studies

☐ Yes	☐ No	☐ Not Sure

Comments:

2i) Statistics

☐ Yes	✓ No	☐ Not Sure

Comments:

The aims and objectives are less satisfactory for AS/A level statistics than for GCSE.

- The first bullet point, about applying formulae, is rather an uninspiring start for a set of aims for a qualification. If it must be in the list, let it be in a less prominent position. Important though it is, it is certainly not at the heart of what any proper statistics qualification is about.
- The fifth bullet point, about multivariate data, is not reflected in the detailed content – perhaps it is touched on in the requirement that the disaggregation of a population by different characteristics should be compared but this is not made explicit and there is nothing else about multivariate data; either this bullet point must be abandoned or the content must have a section on multivariate data. Our recommendation is to remove the aim as there is not sufficient space in the course for a proper study of this topic.
- This section needs to reflect the ways in which this qualification moves on from GCSE statistics and GCSE mathematics.
    - One key difference is the introduction of formal hypothesis testing in the analysis and interpretation part of the statistical enquiry cycle. Of course the use of these tests influences the question asked, the nature of the sampling and every part of the cycle. The aims need to reflect these differences.

- Another key difference is the greater emphasis on the use of probability models; the aims should emphasise modelling.

The references to the statistical enquiry cycle, and its setting out in Appendix 4, are welcome. They should help to ensure that statistics is about solving problems, and not an artificial collection of techniques. The statistical enquiry cycle does reflect progression from GCSE, and does include reference to hypothesis testing, but does not really reflect the impact of these tests on other parts of the cycle, for example the nature of the hypothesis and the type of sample required for successful use of a significance test.

Comments on the detailed subject content.
A1.4 second bullet point; is this restricted to discrete probability distributions? Calculus is not expected in this qualification.

A1.4 fourth bullet point; which properties of a continuous distribution are intended? Possibly just the way in which probabilities are represented by area, or more than this – things like skewness? Needs to be more specific.

A1.7 second bullet point; does 'relationship between exponential and Poisson distribution' refer to the exponential distribution being a model for waiting times between events in a Poisson process? Or is it something else? It would be helpful to be explicit as to what is meant.

A1.7 third bullet point; how do candidates find exponential probabilities? Are they meant to integrate? This is not possible without any understanding of calculus which is not in the subject content. Note that the formula for exponential probabilities is wrong (formula for A2.2) – the exponential distribution is continuous so $P(X=x)$ is meaningless.

A2.1 first bullet point; this seems strangely worded. Perhaps ' calculate and use conditional probabilities, including the use of Bayes'…'

A2.2 second bullet point; writing this as two bullets - one about mean and one about variance - might avoid the awkward use of brackets as well as allow the distinction to be made that the result for means does not require independence

A2.2 third bullet point; 'evaluate' is not the correct verb here. It is not clear what is meant.

A2.4 third bullet point; MEI considered at some length including bootstrapping in our A level Further Mathematics specification, but were not able to write enough sufficiently different questions about it. (It would be a different matter if appropriate technology were permitted in the exam.) Are the authors of this confident that they can? Moreover, the formula given for a bootstrap confidence interval is the same as for a Normal or t-distribution confidence interval – or perhaps this is just mislabelled as it appears in the formula for A2.5?

A2.6 first bullet point, fourth sub-bullet point; does a test for the difference between two binomial proportions rely on the relationship between the binomial and Normal distribution, which is not included in the content?

A2.8 first bullet point; is this testing the goodness of fit of a distribution? Which distributions?

A2.10 the following statement about effect size is difficult to interpret “know that effect size is more useful when only interested in the status of the sample, not the population”

A2.11 It is surprising that there is no test for the significance of a correlation coefficient, given the sophistication of some of the other tests in the content. It is also surprising that there is not apparently a mention of effect size in the context of bivariate data.

Appendix 1
A1.1 outliers. Other definitions for outliers are also used, including outside $\mu \pm 2\sigma$.

A1.4 Needs to be clear that these formulae apply to *discrete* random variables

3. Do you think that any of the proposals have the potential to have a disproportionate impact, positive or negative, on specific students, in particular those with 'relevant protected characteristics'? (The relevant protected characteristics are disability, gender reassignment, pregnancy and maternity, race, religion or belief, sex and sexual orientation.)

   Please provide evidence to support your response.

☐ Yes	☐ No	☐ Not Sure

Comments:

4. How could any adverse impact be reduced and how could the subject content of GCSEs and/or A levels be altered to better advance equality of opportunity between persons who share a protected characteristic and those who do not share it?

   Please provide evidence to support your response.

Comments:

Thank you for taking the time to let us have your views. We do not intend to acknowledge individual responses unless you place an 'X' in the box below.

Please acknowledge this reply.	
E-mail address for acknowledgement:	

Here at the Department for Education we carry out our research on many different topics and consultations. As your views are valuable to us, please confirm below if you would be willing to be contacted again from time to time either for research or to send through consultation documents?

✓	Yes		No

All DfE public consultations are required to meet the Cabinet Office Principles on Consultation

The key Consultation Principles are:

- departments will follow a range of timescales rather than defaulting to a 12-week period, particularly where extensive engagement has occurred before
- departments will need to give more thought to how they engage with and use real discussion with affected parties and experts as well as the expertise of civil service learning to make well informed decisions
- departments should explain what responses they have received and how these have been used in formulating policy
- consultation should be 'digital by default', but other forms should be used where these are needed to reach the groups affected by a policy
- the principles of the Compact between government and the voluntary and community sector will continue to be respected.

If you have any comments on how DfE consultations are conducted, please email: consultation.unit@education.gsi.gov.uk

Thank you for taking time to respond to this consultation.

Completed responses should be sent to the address shown below by 5 November 2015

Send by post to: Send by post to: Bethany Caines, Floor 2, Sanctuary Buildings, Great Smith St, Westminster, London SW1P 3BT

Send by email to: 2017qualsreform.CONSULTATION@education.gsi.gov.uk