Advisory Committee on Mathematics Education

ACME's response to the Department for Education informal consultation on the characteristics of 'Core Maths'

February 2014

1. ACME

The Advisory Committee on Mathematics Education (ACME) is an independent committee, based at the Royal Society and operating under its auspices, that aims to influence mathematics education strategy and policies with a view to improving the outcomes of mathematics teaching and learning in England and so secure a mathematically enabled population.

2. This response

On 6 January 2014, the Department for Education published a policy statement on the introduction of Level 3 qualifications for post-16 students who do not choose to progress into AS/ A level mathematics.[1] ACME published a statement on its website on 6 January responding to this policy statement.[2] When ACME was invited by the Department for Education to contribute to its informal consultation, it circulated its 6 January statement to the Joint Mathematical Council of the United Kingdom, its Outer Circle and other mathematics organisations, inviting comment on ACME's statement and encouraging the sharing of responses amongst mathematics organisations.

3. Background and context

In December 2012, ACME published two documents setting out proposals for new post-16 mathematics qualifications: *Post-16 mathematics: increasing provision and participation*[3] and *Post-16 mathematics: planning for success*[4]. In order to build on these proposals, the Department for Education asked ACME in spring 2013 to convene an expert panel on to look at post-16 qualifications. The expert panel on core mathematics met between July and September 2013 and published its report on 8 October 2013.[5] The remit of the panel was to draft clear guidelines to inform the development of new Level 3 mathematics qualifications. The report of the Expert Panel aimed to inform the Department for Education's technical guidance on which qualifications counted as 'Core Mathematics'.

The Department for Education's January 2014 policy statement sets out the proposed purpose, design process and characteristics of 'Core Maths' qualifications, including

[1] https://www.gov.uk/government/publications/16-to-18-core-maths-qualifications.
[2] http://www.acme-uk.org/news/news-items-repository/2014/1/acme-statement-about-core-mathematics
[3] http://www.acme-uk.org/media/10520/20121217acme_post_16_strategy.pdf.
[4] http://www.acme-uk.org/media/10523/20121217acme_post_16_planning.pdf.
[5] http://www.acme-uk.org/media/13699/final%2007october2013,%20expert%20panel%20on%20core%20mathematics%20report.pdf.

expectations of size, content, grading and assessment.[6] ACME welcomes the introduction of the new qualifications and, in principle, supports the breadth of measures outlined in the Department for Education's statement. In general the measures are consistent with the recommendations made by ACME on post-16 mathematics qualifications.[7]

The policy statement says that 'alongside AS/A level maths and comparable maths certificates, new qualifications will count against a proposed level 3 maths school and college performance measure and the maths component of the TechBacc if they meet certain requirements'. ACME looks forward to the publication of technical guidance on the characteristics of qualifications that will count in performance measures to be published in spring 2014.

4. Outline timeline

A timetable for the reform in the policy statement outlined the design and development, introduction and trialling and consolidation periods for the new 'Core Maths' qualifications. The timetable for moving from design to trialling and consolidation may be overambitious, which puts at risk the realisation of the aims of new mathematics qualifications. The new qualifications will need to be refined in their early years of development. ACME believes that the feedback from the experience of the early adopter schools and colleges should be part of the development process of qualifications. There must be space for modification in the light of these experiences and ACME suggests that initial accreditation should be for at least a three year period to enable this.

These new qualifications offer great potential to increase the mathematical skills of young people. However, the development of new qualifications is only one part of the shift needed to increase participation in post-16 mathematics. Government, schools and colleges, higher education institutions, employers and mathematics organisations must all support the qualifications to ensure that they are recognised and valued.

5. Purpose

The expert panel on core mathematics emphasised that new qualifications should be 'clearly distinct from, and complementary to, AS and A level Mathematics, and be motivating for students for whom the current GCE qualifications are not the right choice at 16'.[8] The policy statement from the Department expresses the same aim. 'Core Maths' qualifications should be taken alongside both vocational qualifications and A levels and will help prepare students for the wide range of careers and HE programmes that now require confidence and familiarity with mathematics.

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[6] http://www.acme-uk.org/news/news-items-repository/2014/1/acme-statement-about-core-mathematics.
[7] http://www.acme-uk.org/policy-advice/policy-projects/post-16-mathematics.
[8] https://www.acme-uk.org/media/13699/final%2007october2013,%20expert%20panel%20on%20core%20mathematics%20report.pdf, p. 6.

6. Grading

The new 'Core Maths' qualifications need a different grading structure to other Level 3 qualifications. The expert panel on core mathematics recommended that grades of pass, merit and distinction. Their reasoning included that:

- this would provide a clear difference between grading of Core Mathematics and AS and A level qualifications, thus emphasising the different nature and purposes of the new qualifications
- the emphasis on passing in the proposed different grading structure would provide recognition that Core Mathematics qualifications should mainly be about encouraging the largest possible number of candidates to develop their mathematical competencies
- users are unlikely to find a finer system of grades more helpful, as it would be hard to establish clear meanings for a large number of outcomes
- a different grading structure will make it less likely for higher education and employers to allocate identical meanings to Core Mathematics grade as to those associated with existing GCE grades.[9]

Having a common grading structure across awarding organisations would support consistency of qualifications and would ensure that different qualifications can be recognised as part of a set or group of qualifications. ACME advocates a joint approach to grading by the awarding organisations.

7. Content

The content and assessment of 'Core Maths' qualifications need to reflect the purpose of the qualification. ACME regards it as essential that awarding organisations avoid overloading these qualifications with additional content, since their principal purpose is to develop fluency in using and applying the techniques that students have already covered. The Expert Panel described these new qualifications as Level 3 post-16 qualifications, designed for students with a GCSE at grade C or above. They suggested that 'Core Mathematics should give students the opportunity to develop and use the mathematical knowledge, skills and understanding that they have gained in previous study and to engage critically with mathematics by developing problem solving in realistic contexts'.[10]

The policy statement suggests that 'the higher tier of GCSE mathematics should be used freely in Core Maths courses … The higher tier of revised GCSE content, published on 1

[9] *Ibid*., p. 15.
[10] https://www.acme-uk.org/media/13699/final%2007october2013,%20expert%20panel%20on%20core%20mathematics%20report.pdf, p. 6.

November 2013, should be reflected, including content for higher attaining students including content for higher attaining students in bold'.[11] The Expert Panel made the suggestion that the Foundation Tier of GCSE Mathematics is regarded as assumed knowledge, while the higher tier of GCSE Mathematics is specified as part of the content to be covered by the course.

In the policy statement, the Department for Education suggests that 'all students should cover this content, but we also expect courses to include more challenging material, some of which may be optional – for example, the use of calculus'. However, the Expert Panel highlighted that the content of new Level 3 qualifications 'should contain a very limited number of mathematical techniques found in existing Level 3 mathematics qualifications'.[12] They stated that:

> Core mathematics qualifications must, however, be of Level 3 standard, and this standard is to be provided by the rigour that is required in relation to problem solving, making connections in mathematics and use of technology.

When content is added to 'Core Maths' qualifications, the Department for Education and awarding organisations must take into account that various post-16 mathematics qualifications are distinct in purpose and content.[13] ACME's view, like the expert panel on core mathematics, is that formal calculus should not be included in awarding bodies' content specifications for these qualifications. Calculus is a defining feature of AS and A level Mathematics and its introduction into new qualifications will blur the differences between AS/A level Mathematics and 'Core Maths'. Including formal calculus will risk both the uptake of the new qualification among the target cohort of students and the uptake of mathematics AS and A levels. ACME strongly recommends the introduction of calculus is re-considered.

We agree that the Department for Education should set out a requirement for evidence to be provided by awarding organisations that qualifications are designed with input from Higher Education and employers. Awarding organisations should make information freely available about the structures that they create for consulting with individuals and organisations from Higher Education and business and industry.

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[11] Please see ACME's advice on GCSE reform and the new GCSE Mathematics: http://www.acme-uk.org/policy-advice/current-areas-of-focus-for-acme/gcse.

[12] https://www.acme-uk.org/media/13699/final%2007october2013,%20expert%20panel%20on%20core%20mathematics%20report.pdf, p. 9.

[13] See http://www.acme-uk.org/news/news-items-repository/2013/12/department-for-education-consultation-on-'new-a-levels-subject-content' and http://www.acme-uk.org/media/14317/final%20acme%20response%20-%20new%20a%20level%20regulatory%20requirements.pdf.

8. Size

The policy statement indicates that a 'Core Maths' qualification should be 'about half' an A level and designed to be taken over two years. ACME is concerned that the description of the size is not precise enough and that this could lead to too much variation between qualifications. The new mathematics qualification must be one that is attractive to and valued by higher education institutions. The size of the qualification offered by awarding organisations needs to be clearly understood by the Universities and Colleges Admission Service (UCAS) and higher education institutions. The UCAS Tariff system allocates points for entry to higher education. Course providers use the UCAS Tariff to make comparisons between applicants with different qualifications. The size of the qualification must be clear for UCAS tariff points to ensure as much comparability as possible between the qualifications offered.[14]

Both ACME and the Expert Panel envisaged a qualification that was significantly smaller than half an A level and designed to be taken over two years. This proposal was made in order to facilitate as many students as possible taking the qualification alongside a full A level or vocational programme and to maintain students' participation in mathematics until the age of 18. A smaller qualification requires less teaching time and hence fewer teaching staff, making successful take up more likely. A smaller qualification also differentiates more clearly between AS Mathematics and 'Core Maths'. ACME considers that a smaller qualification will avoid the major risk of decreased uptake of A levels and poor understanding of the new 'Core Maths' qualification.

The current GCSE Mathematics course requires between 120 and140 guided learning hours. ACME believes that the 'Core Maths' qualification should require fewer guided learning hours than GCSE Mathematics.

9. Assessment

In the policy statement, the Department for Education suggests that 'at least 80 per cent of the final grade of Core Maths qualifications should be determined through external assessment. This does not preclude the use of coursework or other non-examination methods that are assessed externally, though we require the large majority of external assessment to be based on examination'.

The Expert Panel considered that a new qualification required a different approach to assessment to that used in AS/A level Mathematics and recommended a significant amount of internal assessment to enable students to demonstrate that they can solve a wide variety

[14] A new UCAS Tariff system is under development which uses measures of qualifications size and grading and maintains existing relationships between grades within and across UK benchmark qualifications, see http://www.ucas.com/members-providers/qualifications#tariff.

of problems in a sustained and deep manner.[15] ACME welcomes the inclusion of internal assessment in these guidelines, and looks to the awarding organisations to use effective approaches to external assessment that will encourage teachers to emphasise modelling and problem solving in their teaching. Possible assessment strategies could be common with some A levels (e.g. the proposals for practical assessment in science) or vocational subjects. Notwithstanding ACME thinks the right balance between externally assessed examinations and internal assessment is still not optimal. Only having a small amount of internal assessment, ACME believes, might mean that sustained and deep engagement with problems cannot be fully realised.

The external assessment that is developed must drive appropriate teaching approaches and set out different types of questions to those asked at GCSE, AS or A level.

New 'Core Maths' qualifications will not be compulsory and therefore must be attractive to students and schools and colleges. This challenge will be made significantly greater by expanding the content and length of the new qualifications, and by adopting a largely traditional approach to assessment.

[15] https://www.acme-uk.org/media/13699/final%2007october2013,%20expert%20panel%20on%20core%20mathematics%20report.pdf, p. 13.