

GCSE Mathematics: An overview of the Advisory Committee on Mathematics Education's advice

In recent years, the Advisory Committee on Mathematics Education (ACME) has consulted and reflected upon many aspects pertaining to the Key Stage 4 curriculum in mathematics and its assessment. ACME has produced a number of documents, which have had input and broad agreement from its Outer Circle, a range of independent experts and also from the wider mathematics education community. This paper draws together **key advice from ACME's position statements, policy reports and consultation responses.**

Aims for Key Stage 4 mathematics

- Learning in Key Stage 4 should build on the range of mathematics in Key Stages 1-3 of the National Curriculum, developing fluency in skills and techniques, improving mathematical reasoning and supporting the development of transferable problem solving skills.
- Throughout Key Stage 4 students should use and enjoy mathematics which they recognise as relevant and empowering, and should make significant progress in both competence and confidence, so that they are well-equipped to continue learning mathematics post-16.
- Assessment at 16 should recognise mathematics knowledge, skills and understanding of the range of young people, and should lead to a small range of recognised and valued mathematics pathways in post-16 education, employment or training.

ACME's advice

Valued outcomes

- High quality learning and assessment at GCSE are predicated on young people reaching Key Stage 4 with confidence and inclination to engage in mathematics. Key Stages 1-3 curricula should support deeper learning through slightly slower curriculum coverage in Key Stages 1 and 2, and clear progression and link-making into Key Stages 3-4.
- Young people should reach 16 with fluency in standard techniques and problem solving skills in addition to being well-equipped for mathematical functioning in a 21st century technology-rich world. Appropriate technology should therefore be used to enhance the teaching and learning of mathematics.

An appropriate curriculum for all

- The Key Stage 4 curriculum should explicitly subsume, deepen and build on earlier curricula, and should be consistent and coherent with emerging post-16 mathematics pathways. It should be aspirational, high quality and appropriate to the needs of all learners, privileging deep learning and encouraging engagement and perseverance with mathematical problems.
- The 5-16 mathematics curriculum should include an explicit 'enhanced interpretation' for the most able young mathematicians, as described in ACME's paper *Raising the Bar* (2012). All mainstream schools should provide access to such a curriculum which would be available for about 30% of the cohort. It is critical that the experience of such an enhanced curriculum is

integrated with the core curriculum: this is consistent with the literature on deep learning. Additionally, sequential provision risks rigid and inequitable access.

- All young people, including those who find mathematics most challenging, should enjoy the range of mathematical ways of working, as described in *Mathematical Needs* (2011), and access an appropriate interpretation of the curriculum, with certification which values their achievements.
- Substantial, coherent and good quality professional development should be available to support significant changes to the curriculum, whenever those occur, as recommended in *Mathematics education and CPD* (2010).

Key Stage 4 assessment

- At the moment, a Key Stage 4 qualification is a certificate of achievement in the Key Stage 4 curriculum. It measures what a student can do in mathematics at a particular point in time. In the long term, this purpose should be reassessed as it might not be necessary to have high stakes assessment at 16 for all, as set out in ACME's response to the Department for Education consultation on Key Stage 4 qualification reform (December 2012).
- It is possible to create a more valid GCSE assessment that better measures and rewards what is valued in mathematics: problem solving, mathematical reasoning, conceptual understanding and fluency
- Assessment at the end of Key Stage 4 should build on lessons learned from the current single and linked pair of GCSEs.
- An additional certification should be available that is based on harder problems on core curriculum content. This should be accessible for about 20% of the cohort.
- Given that assessment at 16 will continue to be high-stakes, extended assessment, possibly in the form of 2 or 3 x1.5 hour papers in each of 'methods' and 'applications' as described in ACME's response to the Department for Education Consultation on Key Stage 4 Qualification Reform (December 2012) could provide a useful way forward.
- ACME has proposed that in the medium-term, a single suite of expert-developed assessments should form the basis for assessment at 16, with providers competing largely on delivery.
- Appropriate innovative assessment practices should be trialled over time.
- To ensure credibility and fitness for purpose, it is essential that monitoring and regulation of GCSE standards over time takes place, including comparisons with existing qualifications.

Key Stage 4 accountability

In ACME's response to the Department for Education consultation on secondary accountability (May 2013), it is recommended that:

- performance measures should support full engagement with mathematics to age 16 by including only performance in examinations taken at the end of Year 11
- floor threshold performance measures in English and Mathematics should be replaced by average point score measures, to better support and value high aspirations for the range of students.
- over time, accountability measures should be enhanced to include valued long-term outcomes, such as attitudes, quality of learning pre-16, participation and progression post-16 and transferability of learning to other contexts.