

‘New A level Regulatory Requirements’, Ofqual consultation 17 January 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

2.1 The consultation seeks views on the proposed changes to AS/A level qualifications, in particular looking at how they are designed, assessed and regulated. Much of the Ofqual consultation relates to subjects other than mathematics. However, some parts refer to all subjects or general regulatory matters that are relevant to mathematics. These issues are discussed in this response.

2.2 This response is informed by ACME’s Outer Circle of advisers, which includes a range of mathematics education experts and teachers. It also draws upon extensive engagement with learned societies and other organisations in recent months. In addition, ACME provided extensive advice on A level in 2012 and 2013.¹ ACME also submitted a recent consultation response to the Department for Education ‘New A levels: subject content consultation’.²

3. Summary

3.1 As well as reflecting upon questions posed in the consultation on AS/ A level qualifications, in this response ACME also sets out some critical issues about the A level reform process and the risks of this process for the uptake of AS/ A level Mathematics and Further Mathematics.

3.2 In summary, this response comments on:

- priorities and objectives of AS and A level qualifications in mathematics
- the need to improve the validity of assessment at A level
- the need for flexibility within AS/ A level Mathematics and Further Mathematics
- concerns with the timescales and transparency of the A level reform process
- detrimental impacts that reform could have upon the uptake of AS and A level Mathematics and Further Mathematics.

4. AS and A level qualifications

4.1 Post-16 mathematics

4.1.1 Mathematics is a key subject for post-16 students. The Government has acknowledged the importance of mathematics and has committed to developing policies to ensure that more students do more mathematics post-16.³

¹ <http://www.acme-uk.org/news/news-items-repository/2013/5/review-of-a-level-subject-content>.

² <http://www.acme-uk.org/news/news-items-repository/2013/12/department-for-education-consultation-on-'new-a-levels-subject-content'>.

³ <https://www.gov.uk/government/speeches/michael-gove-speaks-to-the-royal-society-on-maths-and-science>.

4.1.2 **Mathematics in the post-16 education landscape differs significantly from all other subjects**, in that students have a greater choice of courses available, with the option to take AS/ A level Mathematics and Further Mathematics, and from 2015, 'Core Mathematics' qualifications will also be available.

4.1.3 **The risks and potential opportunities associated with reforming the structure of AS/ A level qualifications need to be carefully and methodically set out and shared with the mathematics community.** This analysis should inform detailed strategic plans for reform.

4.2 A level mathematics qualifications

4.2.1 In ACME's view, the **purpose of A levels, including mathematics, is to provide rigorous, coherent, academically-focused courses of study for young people between 16 and 19 that will help them to further their knowledge, skills and understanding.**⁴

4.2.2 Ofqual's international comparison study of post-16 mathematics qualifications found that A level Mathematics compared favourably with qualifications in other countries and A level Further Mathematics was the broadest and deepest qualification reviewed.⁵

4.2.3 ACME recognises that there is always room for improving in the suite of A level qualifications. Nonetheless any reforms need to be justified, especially in a situation where the qualifications are already well-regarded internationally, there is a positive trend in uptake by students and where an increased number of young people need mathematics at higher education or in the workplace.

4.2.4 While much of the reform thus far has focused on content, there is broad agreement that the 'core' content of A level Mathematics is acceptable. It is the **validity of assessment for post-16 advanced mathematics qualifications that raises greater concerns.**⁶

4.2.5 **Assessment, rather than the specification, frames the way in which students are taught in the classroom.** Current assessment arrangements do not always foster the skills that higher education institutions and employers need, such as confidence with unfamiliar problems and multi-step unstructured tasks.

- Ofqual should ensure there is a sufficient range of assessment instruments to ensure validity of the assessment. This must be informed by stakeholder expectations and needs.
- Awarding organisations must develop examinations which fully assess the content set out in GCE specifications, including generic skills such as mathematical writing, argument and proof.

4.2.6 **Improving the validity of the assessment of A level Mathematics is not a short term process and rather requires a much longer timescale, somewhere between five and ten years.** The process of reform should be incremental in nature.⁷

⁴ <http://www.acme-uk.org/media/10163/acme%20response%20to%20ofqual%20consultation%20on%20a-level%20-%20final%20submitted.pdf>, p. 6.

⁵ <http://webarchive.nationalarchives.gov.uk/+/http://www.ofqual.gov.uk/news-and-announcements/83-news-and-announcements-news/899-comparison-of-international-qualifications>.

⁶ <http://www.acme-uk.org/media/11319/positionstatementalevelmay2013.pdf>.

4.3 A level and higher education

4.3.1 A level Mathematics is a key facilitating subject for entry to higher education courses.

4.3.2 The design of A level Mathematics should be driven not solely by the needs of undergraduate mathematics, but also by the broader needs of science, engineering and other higher education subjects such as geography and economics. While the range of such stakeholder subjects narrows for those taking AS/A level Further Mathematics at AS and A level,⁸ AS Further Mathematics also benefits many students who do not intend to read for mathematics degrees.

4.3.3 In the consultation document, higher education staff are said to believe that undergraduates do not have sufficient mathematical skills. As noted above, ACME believes that this is principally a problem of structure and assessment rather than of subject coverage. Improving the validity of assessment, as mentioned in Section 4.2.5, would improve the mathematical skills and preparedness of undergraduates.

4.4 AS Mathematics and Further Mathematics

4.4.1 Mathematics qualifications at AS and A level are important components of the drive towards all young people studying some form of mathematics post-16.

4.4.2 AS Mathematics is an important qualification for those students who do not choose to continue to A level Mathematics or who do not choose to do 'Core Mathematics'.⁹ AS Mathematics has a distinct role in providing a minimal introduction to calculus set in a full mathematical context.

4.4.3 **AS Mathematics supports the transition of students to higher education in a range of subjects by widening students' mathematical skills.** Higher education institutions have also noted the importance of AS qualifications determining entry to courses.¹⁰

4.4.4 **AS Further Mathematics is a crucially important qualification that is essential to enabling students to take on more mathematics in a gradual way.** The cohort taking A level Mathematics and AS Further Mathematics is much larger than that taking full Further Mathematics A level, and provides higher education, especially the physical sciences, with students who have received a mathematics education of internationally-excellent breadth and depth.

4.5 AS and A level qualifications: the importance of flexibility and transferability

4.5.1 ACME has written a detailed piece on the relationship between AS and A level in response to the 2012 Ofqual consultation.¹¹

4.5.2 The decision has been made that AS qualifications will no longer contribute towards the final grade of an A level qualification.¹² **ACME has expressed the view that decoupling AS**

⁷ <http://www.acme-uk.org/media/11308/briefingalevelapril2013.pdf>.

⁸ <http://www.acme-uk.org/media/10163/acme%20response%20to%20ofqual%20consultation%20on%20a-level%20-%20final%20submitted.pdf>, p. 6.

⁹ <https://www.gov.uk/government/publications/16-to-18-core-maths-qualifications>.

¹⁰ <http://www.russellgroup.ac.uk/russell-group-latest-news/154-2013/5450-aslevel-reform/>.

¹¹ <http://www.acme-uk.org/media/10163/acme%20response%20to%20ofqual%20consultation%20on%20a-level%20-%20final%20submitted.pdf>, p. 8.

Mathematics from A level Mathematics is likely to affect participation in mathematics post-16 negatively.¹³ ACME regrets this development.

4.5.3 The best way to ensure that the current levels of participation in AS and A level Mathematics and Further Mathematics are maintained or increased is for AS examinations to contribute to the student's overall A level grade, as was set out in a previous ACME paper.¹⁴ ACME also advised that even if the qualification no longer contributed to a student's A level grade, the AS in mathematics should continue to provide material that may be regarded as the first half of the A level.¹⁵ **AS qualifications must be co-teachable with A level qualifications.** ACME believes that the **co-teaching of the current applications modules between the qualifications is one of the strongest contributing factors behind the increases in students taking the mathematics qualifications, and, especially Further Mathematics** (See 4.5.5 below).

4.5.4 **ACME argues for the continuing transferability between AS/ A level Mathematics and Further Mathematics, which should enable the gradual extension of students' commitment.** The present structure is very helpful for those who are not sure about their chosen path, providing them with reasonably accessible stepping stones.¹⁶ Changes proposed would remove those stages and many students who would currently opt for A level mathematics may well no longer do so. **As noted above, the risks and potential opportunities with reforming the structure of AS/ A level qualifications need to be carefully and methodically set out and shared with the mathematics community.**

4.5.5 AS Further Mathematics is a crucially important qualification that must be fostered carefully to ensure that the supply of mathematically literate undergraduates and young workers is to be at least maintained. AS Further Mathematics is essential to the idea of students taking on more mathematics in a gradual way, and to taking on mathematics of a particular kind. The different needs of these students provide a curriculum imperative that demands a structural response for the qualification. ACME considers that, **beyond any agreed core content, AS Further Mathematics should embrace an appropriately wide range of combinations of 'units' with different mathematical content.** All such 'units' should also be permitted to contribute to A level Further Mathematics.

4.5.6 **A contributing factor of the recent growth in take-up of Further Mathematics has been the fact that students have been able to extend their commitment to the subject gradually.** For instance they can begin by taking the components that make up the AS qualification, but can then build upon this foundation and undertake the full A level if they find that they are coping well with the demand of the subject. An AS in Further Mathematics taught alongside A level Mathematics in either a student's first or subsequent year of advanced level study enables students to also take modules in Further Mathematics in time.

¹² <http://www.acme-uk.org/media/11308/briefingalevelapril2013.pdf>.

¹³ <http://www.acme-uk.org/media/11319/positionstatementalevelmay2013.pdf>, p. 6.

¹⁴ <http://www.acme-uk.org/media/11308/briefingalevelapril2013.pdf>.

¹⁵ <http://www.acme-uk.org/media/11319/positionstatementalevelmay2013.pdf>, p. 6.

¹⁶ Hodgen, J., Marks, R., & Pepper, D. (2013). *Towards universal participation in post-16 mathematics: lessons from high performing countries*. London: The Nuffield Foundation.

4.5.7 The Government has invested in the Further Mathematics Support Programme (FMSP).¹⁷ The FMSP takes advantage of the modular structure of AS and A level qualifications and seeks to make AS and A level Further Mathematics available to a wide cohort of students, including those not readily identifiable as high achieving students.

4.5.8 More details on the risks of reform for the uptake of mathematics qualifications are set out in Section 8 below.

5. A level reform processes

5.1 The reform of A level has resulted in subjects being reformed within two timescales, with different actors responsible for providing expertise and review, as set out in more detail below. The reform of the National Curriculum, GCSEs and the development of core mathematics qualifications also are following different reform processes, resulting in subsequent inconsistencies, mismatches of content and expectations.

5.2 Professor Mark Smith was tasked by Ofqual with producing a report¹⁸ looking at

- the changes thought to be needed to the content of A level subjects¹⁹ and
- the possibility of these changes being introduced by 2015.

5.3 The report, published in July 2013, recommended that the reform of A level Mathematics and Further Mathematics be delayed until 2016.²⁰ **ACME welcomes this recommendation, but is concerned that the pace of reform will hinder a coherent approach to post-16 mathematics and integration with other A levels with mathematical content.**

5.4 Mathematics and Further Mathematics were the only subjects for which a delay in reform was recommended. ACME previously recommended that subjects which are closely linked should be reformed within the same timescale.²¹ It is **disappointing that the sciences and other subjects with substantial mathematical or quantitative elements are being reformed earlier and within substantially different structures.**

5.5 Rushed reform processes will not allow the time to produce good quality textbooks and other teaching materials or to allow for classroom testing of new teaching materials with students and teachers.

6. Roles of organisations and individuals in the A level reform process

6.1 ACME regards transparency and the use of appropriate advice and expertise in all aspects of qualification development as essential to ensuring the most effective outcomes. The process is not yet sufficiently transparent, advice is not being sought widely enough and the reform processes across subjects do not adequately take account of other processes.

¹⁷ <https://www.gov.uk/government/news/25m-to-help-boost-number-of-pupils-studying-further-maths-a-level>

¹⁸ <http://ofqual.gov.uk/files/2013-09-06-smith-review-of-specification-content-july-2013.pdf>.

¹⁹ Biology, chemistry, mathematics, physics, psychology, sociology, history, art and design, business studies, economics, English, computing and geography.

²⁰ <http://ofqual.gov.uk/qualifications-and-assessments/qualification-reform/a-level-reform/>.

²¹ http://www.acme-uk.org/media/9589/acme_standingcommitteejune2010.pdf.

6.2 Awarding organisations

6.2.1 **During 2013 awarding organisations played a central role in the reform process of A level content for the majority of subjects.** Their recommendations fed into the report by Professor Smith.²² Although awarding organisations have an important role to play in any reform process, it is essential that reform processes are transparent and involve a range of other organisations, as set out in Section 7 below.

6.2.2 In the case of subjects to be reformed by 2015, awarding organisations were also given the role of translating Professor Smith's recommendations into subject criteria and developing content where gaps were noted.²³ **ACME is concerned with the extent to which awarding bodies are involved with the drafting of the subject criteria by which they are then regulated.**

6.3 Higher education

6.3.1 ACME welcomes the engagement of higher education in reviewing A level qualifications.²⁴ This should occur along with the engagement of other key stakeholders, including learned societies, teachers and employers. For subjects being reformed by 2015, awarding organisations have used higher education reference groups to inform their decision-making.

6.3.2 **The Department of Education asked the Russell Group to review the content for A level Mathematics and Further Mathematics** (and Modern Languages). To do this, the Russell Group set up the A level Content Advisory Board (ALCAB).²⁵ The newly formed A level Content Advisory Board (ALCAB) will provide advice to the Department for Education about the content of A levels mathematics qualifications to inform their decisions. It is important that the content review takes into account students' mathematical progression and seeks continuity with the reform of GCSE and the development of core mathematics qualifications.

6.4 Subject experts

6.4.1 The reform landscape for mathematics is complicated and has been shifting in recent months. ACME understands that additional advice will be commissioned by the Department for Education from a small group of experts, chaired by Charlie Stripp (MEI and NCETM). They will look at the structure of A levels and to develop draft GCE Criteria for Mathematics and Further Mathematics.

6.4.2 ACME understands that the Department for Education will make the final decision about the content and structure for the A level Mathematics suite of qualifications.

6.4.3 **ACME would like an up-to-date description of the A level Mathematics reform process and the roles of the organisations and individuals involved to be made publicly available.**

ACME is committed to engaging with ALCAB and others involved in the reform of A level Mathematics and Further Mathematics.

²² <http://ofqual.gov.uk/files/2013-09-06-smith-review-of-specification-content-july-2013.pdf>.

²³ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/253023/A_level_Subject_Content_Con_sultation.pdf, p. 6.

²⁴ <http://ofqual.gov.uk/files/2013-09-06-smith-review-of-specification-content-july-2013.pdf>

²⁵ <http://alcab.org.uk/>.

7. Coherent reform processes: national subject committees

7.1 There is a need for greater coherence in reform and Section 6 outlines some of the issues that have resulted in a lack of coherence in reform.

7.2 **Qualification reform should be transparent, founded upon expertise and evidence and incremental in nature. It should be integrated, taking into account interlinked subjects and looking across all stages of learning.**

7.3 **ACME supports the development of a subject committee for each of the key A level subjects, which has broad stakeholder representation and is underpinned by a suitable funding model.**²⁶ These committees would also have a role in all curriculum and assessment development work, from the primary curriculum, to GCSE and post-16.²⁷ Such committees would ensure that there is continuity across phases of education and qualification development.²⁸

8. Risks of reform for AS/ A level Mathematics and Further Mathematics

8.1 **ACME is very concerned that the reform processes could be detrimental for the uptake of AS/ A level Mathematics and Further Mathematics.** ACME has already set out the several interdependencies that need to be taken into account when considering the reform of mathematics qualifications.²⁹

8.2 Curriculum 2000 involved modest changes to the core content of A level Mathematics, alongside a reduction in the level of challenge of other subjects. Coupled with the general expectation that students would study four rather than three subjects in their first year, AS Mathematics pass rates fell significantly.³⁰ This had the effect of encouraging the belief among young people and centres alike that A level Mathematics was a high risk and inaccessible subject for all but a 'clever core' of students.³¹ Uptake of mathematics courses decreased greatly, with a downstream impact on university mathematics departments. A level Further Mathematics also suffered a decline in numbers opting for the subject.³² **There is a clear danger that a collapse of mathematics A level participation could happen again.**

8.3 Currently, **Mathematics and Further Mathematics at AS and A level are both growth subjects.** In England, the number of students taking A level Mathematics has risen by 72% since

²⁶ <http://www.acme-uk.org/media/10163/acme%20response%20to%20ofqual%20consultation%20on%20a-level%20-%20final%20submitted.pdf>.

²⁷ The professional bodies in the sciences, Society of Biology, Institute of Physics and the Royal Society of Chemistry are establishing curriculum committees, which will be responsible for developing a comprehensive view of an appropriate school science curriculum, from primary to university entrance, on behalf of each society, including developing content for qualifications, providing guidance information on appropriate assessment models and defining essential skills for progression to higher education.

²⁸ http://www.acme-uk.org/media/9589/acme_standingcommitteejune2010.pdf .

²⁹ <http://www.acme-uk.org/media/11319/positionstatementalevelmay2013.pdf>, p. 4.

³⁰ <http://www.acme-uk.org/media/3896/rises%20in%20a-level%20mathematics%20-%20some%20preliminary%20thoughts%20by%20acme.pdf>.

³¹ Matthews, A. & Pepper, D. (2007), Evaluation of participation in A level Mathematics: Final Report, London: Qualifications and Curriculum Authority.

³² <http://www.acme-uk.org/media/3896/rises%20in%20a-level%20mathematics%20-%20some%20preliminary%20thoughts%20by%20acme.pdf>.

2003, and the numbers taking A level Further Mathematics has increased by 152%, with significant growth also seen in those taking AS Further Mathematics.³³ This success should not be jeopardised by reform.

8.4 The Government set out 'a new goal for the education system so that within a decade the vast majority of pupils are studying maths right through to the age of 18',³⁴ and to ensure that the numbers taking AS and A level Mathematics and Further Mathematics steadily increase. **There is a real danger that changing the content, structure or assessment (or all three) without adequate reflection may provoke a very substantial decline in take up, particularly of AS and A level Further Mathematics.** Every effort should be made to ensure that steady year-on-year improvement in numbers of those taking AS and A level Mathematics and Further Mathematics continues.

³³ In 2012, about 9.95% of all A level entries were for mathematics (85, 741 candidates). AS Mathematics had 11% (148, 550 candidates), <http://www.jcq.org.uk/media-centre/news-releases/entry-trends-2012-a-as-aea-tables> . See more detail on developments since Curriculum 2000 in a previous ACME response: <http://www.acme-uk.org/media/11319/positionstatementalevelmay2013.pdf>.

³⁴ <https://www.gov.uk/government/speeches/michael-gove-speaks-to-the-royal-society-on-maths-and-science>.