

MEI position paper on the 2015 reform of GCSE Mathematics

Background

There had been growing concern about the previous GCSE Mathematics and its fitness for purpose. GCSE Mathematics qualifications were widely perceived to be suffering from grade inflation and a loss of rigourⁱ (Gove, 2013) and were felt by many to have become predictable and uninspiring for both students and teachers. GCSE Mathematics from 2015 was intended to offer an opportunity to 'get out of the rut', allowing schools and teachers to reconsider how best to teach mathematics at this level.

The reforms proceeded in three stages:

1. The Department for Education published the new *Subject content and assessment objectives for GCSE Mathematics* guidance in November 2013ⁱⁱ.
2. Ofqual published *GCSE Mathematics: Decisions on Requirements and Guidance* in June 2015.
3. Awarding organisations developed specifications and specimen papers, which were accredited by Ofqual in summer 2015.

Teaching of the new GCSE Mathematics content began in September 2015 and the new GCSEs will be assessed for the first time in June 2017. Over this academic year, the first year of teaching of the new GCSE Mathematics programme, several concerns have emerged that need to be addressed if the reforms are to succeed.

Key changes

- The Department for Education's subject content document for the new GCSE Mathematics states that "All students will develop confidence and competence" with the new content (Department for Education, 2013). This means:
 - There are substantially increased expectations of students. "The new mathematics GCSE will be **more demanding**" and "The new mathematics GCSE will demand **deeper and broader mathematical understanding**."ⁱⁱⁱ(Gove, 2013).
 - The Department for Education has stated: "... we anticipate that schools will want to **increase the time spent teaching mathematics**"ⁱⁱⁱ(Gove, 2013) .

[our emphasis in bold]

- The reforms include significant assessment changes, in particular a new nine-point grading system and increased emphasis on the assessment of problem solving.

MEI's Concerns

MEI strongly supports the Department for Education's aims for the new GCSE Mathematics to raise aspirations and improve the standard of mathematics education, but believes that realising these aims will require far more than just changing the curriculum.

- Ofqual's regulation of the new GCSE Mathematics qualifications must ensure that they are assessed in a way that reflects the spirit of the new curriculum.
- The reforms have taken place in a very short time frame. Schools and teachers need support to adapt their teaching to the demands of the new GCSE Mathematics qualifications.
- There is a serious shortage of specialist mathematics teachers and the increased demand of the new curriculum has exacerbated this. Adequate investment is needed to ensure that schools and teachers can access the resources and professional support they need to implement the new GCSE Mathematics qualifications successfully.

If these points are not addressed the changes will not have the intended outcome and could make matters worse:

- If the new qualifications are not regulated effectively, experience suggests that there will be a tendency for the awarding organisations to try to minimise the effects of the changes, which will undermine the intention of the reforms and reduce their impact.
- If the demand of the qualification is increased without ensuring schools have the capacity to provide the necessary quality and quantity of teaching:
 - students will not be properly prepared for the examinations.
 - students will not be given the opportunity to develop the mathematical fluency, reasoning and problem solving skills needed to succeed in a modern economy;

Recommendations

GCSE Mathematics at Key Stage 4

The increased aspirations for GCSE Mathematics are welcomed. The reformed GCSE should make a successful transition to level 3 mathematics post-16 a realistic possibility for more students. Both the newly introduced level 3 Core Maths qualification and the new A level Mathematics, for first teaching from 2017, have been designed to follow on from the new GCSE Mathematics. Furthermore, the new A level Mathematics is not intended to be more demanding than the current version, so students who achieve a level 2 pass in the new, more demanding, GCSE should be well prepared to progress to A level Mathematics.

Recommendation 1: The increased content and demand has significant and continuing implications for mathematics departments. School leadership should ensure mathematics departments have adequate preparation time and resources to implement the changes.

Recommendation 2: In recognition of the importance of mathematics education, GCSE Mathematics is double weighted in secondary school performance measures. However, there is wide variation in the amount of lesson time schools allocate to mathematics. Schools should provide equal access to mathematics learning and at least 140 hours teaching time per year should be allocated to mathematics for all students in years 7 to 11, bringing England into line with other developed countries.

Recommendation 3: Ofqual's management of the assessment of the previous GCSE Mathematics undermined confidence in the system. The new GCSE Mathematics qualifications must be regulated effectively. Ofqual should require the Awarding Organisations to show that their assessments meet the requirement that, to achieve a level 2 pass, students must fulfil the aims of the National Curriculum by demonstrating their ability to use mathematics fluently, to reason mathematically and to use mathematics to solve problems.

Recommendation 4: As part of all secondary school inspections, Ofsted should carry out a review of the school's implementation of the new GCSE Mathematics. This should include reviewing how the mathematics department is being supported by senior management to adapt to the new curriculum and how much time students spend learning mathematics.

GCSE Mathematics post-16

GCSE Mathematics taken at the end of Key Stage 4 is intended to equip students with the basic mathematical skills needed for work and life, and to prepare them for more advanced mathematical study. The large majority of those students who fail to achieve a level 2 pass at the end of year 11 have no need or desire to undertake more advanced mathematical study, but it is vital for them to master the basic mathematical skills needed for work and life, as set out in the aims of the National Curriculum^{iv}. There is strong evidence^v that the current policy of requiring far more students to resit the same GCSE Mathematics qualification that they failed at the end of Key Stage 4 is not working, so that the mathematical needs of many students are not being met. MEI's recently published discussion paper on level 2 Functional Skills Mathematics^{vi} refers to this issue and the need for a post-16 GCSE Mathematics.

Some students with a level 2 pass from a foundation tier GCSE Mathematics will want to progress to AS Mathematics post-16. A suitable pathway is needed for these students, to enable them to extend the mathematics they learned at GCSE to provide a secure foundation from which they can study AS Mathematics.

Recommendation 5: The needs of these students can be met with a different post-16 qualification, focused on those aspects of the GCSE Mathematics curriculum that are needed for everyday life and future study and/or employment in fields that do not require advanced level mathematics. This qualification must have equivalent status with employers and universities as a level 2 pass in GCSE Mathematics taken at the end of Key stage 4. The best way to achieve this would be to develop a 'mature' version of GCSE Mathematics. The limited content of such a GCSE could be recognised by limiting the maximum grade to that equivalent to a level 2 pass in the Key Stage 4 GCSE Mathematics.

Recommendation 6: For post-16 students with a level 2 pass on Foundation tier GCSE Mathematics who wish to progress to AS Mathematics, a qualification should be developed to act as a bridge between the two qualifications.^{vii}

Teacher Support

The government has already identified a need for more mathematics teachers and has taken some measures to meet this need. The increased expectations of the new GCSE Mathematics place increased demands on the teaching profession.

Recommendation 7: All secondary school students should be taught by a specialist mathematics teacher. To achieve this, Government must take measures to retain current mathematics teachers and offer them the professional development they need to teach the new curriculum effectively, and to recruit sufficient numbers of new specialist secondary mathematics teachers.

Grading

There is a lack of clarity about the new 9 - 1 grading structure and widespread concern around what the benchmarks will be in terms of school league tables and student requirements for employment and further study. There is uncertainty about whether a level 2 pass (currently grade C or above) will be grade 4 or above in the new system or, perhaps in the future, grade 5 or above. This will cause confusion for employers and further education institutions and unfairness for students taking the exams in different years.

Recommendation 8: The DfE should ensure that details of the new 9 - 1 grading system and its relationship to current GCSE Mathematics grades are communicated clearly and urgently to all stakeholders, including schools, students, parents, carers, universities and employers.

Recommendation 9: The DfE should state clearly its intentions for the GCSE grade required to achieve a level 2 pass and ensure that this is communicated clearly and urgently to all stakeholders, including schools, students, parents, carers, universities and employers.

Recommendation 10: To support the national priority to increase participation in advanced level mathematics education, schools should strongly encourage any student who achieves a level 2 pass in GCSE Mathematics to take either Core Maths or AS level Mathematics. Students with a level 2 pass who intend to pursue higher education courses and/or careers in disciplines that make significant use of mathematics, or who particularly enjoy mathematics, should be encouraged to take A level Mathematics and to consider taking AS or A level Further Mathematics.

Preventing centres from 'gaming the system'

For the previous GCSE Mathematics, many schools and colleges entered grade C/D borderline students for the Higher Tier paper. This was because experience suggested that it is easier to train students to accumulate sufficient marks to pass the (very low) grade C threshold on the Higher Tier paper than it is to teach them to achieve a good enough understanding of basic mathematics to meet the (far higher) grade C threshold on the Foundation Tier paper. This 'gaming' of the examination system has been hugely damaging. Those who have scraped a grade C on the Higher Tier are likely to understand very little mathematics that will be of use to them for work, life or further study and will carry forward into adult life a very negative attitude to mathematics. The new GCSE Mathematics could have solved this problem had it been structured differently; if the higher and foundation tiers shared a common paper that determined the level 2 pass, all students who achieved a level 2 pass would have done so on the same basis. Unfortunately, this opportunity was not taken, so 'gaming' entry behaviour by schools and colleges is still possible.

Recommendation 11: Ofqual should take decisive steps to ensure that the new assessment structure for GCSE Mathematics addresses this concern. There must be no advantage (real or perceived) in terms of likely grade outcome from entering borderline level 2 students for the Higher Tier paper.

References

- ⁱ Gove, M. 2013. *Education Secretary Michael Gove gives an oral statement to the House on curriculum, exam and accountability reform..* [Online]. 7 February, Oral Statement to Parliament, England. [Accessed 7 June 2016]. Available from: <https://www.gov.uk/government/speeches/curriculum-exam-and-accountability-reform>
- ⁱⁱ Department for Education. 2013. *Subject content and assessment objectives for GCSE in mathematics.* London, England. [Accessed 7 June 2016]. Available from: <https://www.gov.uk/government/publications/gcse-mathematics-subject-content-and-assessment-objectives>
- ⁱⁱⁱ Gove, M. 2013. *Reformed GCSEs in English and mathematics.* [Online]. 1 November, Written statement to Parliament, England. [Accessed 7 June 2016]. Available from: <https://www.gov.uk/government/speeches/reformed-gcse-in-english-and-mathematics>
- ^{iv} Department for education. 2014. *Mathematics curriculum programmes of study: key stage 4 National curriculum in England.* [Accessed 7 June 2016]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/331882/KS4_maths_PoS_FINAL_170714.pdf
- ^v Department for Education. 2016. *Level 1 and 2 attainment in English and maths by students aged 16-18: academic year 2014/15,* England. [Accessed 7 June 2016] Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525119/English_and_maths_SFR_2016_FINAL.pdf
- ^{vi} MEI. 2016. *Level 2 Functional Skills Mathematics, an MEI discussion document,* England. [Accessed 7 June 2016]. Available from: <http://www.mei.org.uk/files/pdf/L2-Functional-Skills.pdf>
- ^{vii} OCR. 2002. *OCR INTERMEDIATE FREE-STANDING MATHEMATICS QUALIFICATION IN FOUNDATIONS OF ADVANCED MATHEMATICS (MEI),* England. [Accessed 7 June 2016]. Available from: <http://www.ocr.org.uk/qualifications/free-standing-maths-qualification-fsmq-foundations-of-advanced-mathematics-mei-6989/>. This qualification was developed to provide a link from Foundation-tier GCSE Mathematics to AS Mathematics for the previous mathematics curriculum and could be developed/updated for this purpose.