

A new mathematics GCSE curriculum for post-16 resit students

Executive summary

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Executive summary

Increasing numbers of post-16 students in England resit GCSE Mathematics, but there is widespread concern that the GCSE Mathematics qualification does not meet the needs of the majority of these students. This raises the question: *What mathematics curriculum would be appropriate for these students?*

In consultation with key stakeholders and drawing on national and international research, MEI undertook a project to develop an alternative mathematics GCSE curriculum that is better suited to the needs of the majority of students who have not achieved a level 2 pass in GCSE Mathematics by age 16.

The project has shown that a new mathematics GCSE qualification could be developed for post-16 students that would meet the project's aim. The proposed new qualification would focus on the maths needed for everyday life and work, while retaining the currency and rigour of foundation tier GCSE Mathematics. It would have the same level of demand as foundation tier GCSE Mathematics and so would be limited to GCSE grades 1 to 5.

Background

Educational policy in England¹ requires full-time students aged 16–18 who have not achieved grade 4 or higher in GCSE Mathematics to continue studying mathematics. Students who achieved grade 3 at age 16 are required to study for GCSE Mathematics.² This policy was introduced following a report by Professor Alison Wolf,³ which found that *'English and Maths GCSE (at grades A*–C) are fundamental to young people's employment and education prospects.'* Unfortunately, the GCSE Mathematics resit success rate is very low. Almost 180,000 students resat GCSE Mathematics in summer 2019 but only 22.3% achieved a level 2 pass (grade 4 or above).⁴ Those who do not achieve a level 2 pass by age 18 are seriously disadvantaged in the employment market.⁵

16–18 year-olds with grade 3 or below in GCSE Mathematics often lack confidence in mathematics and the prospect of 'more of the same' is very de-motivating.⁶ As a result, many do not improve their performance and can be left with a lasting sense of failure and a reinforced negative attitude towards mathematics.⁷ This may prevent them from future engagement with learning and using mathematics. These negative attitudes can be transmitted to their families and others and may last a lifetime. Much effort and money is being spent on a system that gives many young people a negative experience of mathematics education that is detrimental to them as individuals and to our society as a whole.

¹ Education and Skills Funding Agency (2019). [Guidance: 16 to 19 funding: maths and English condition of funding](#)

² From 2019/20, students with grade 2 and below in GCSE Mathematics at age 16 can achieve level 2 Mathematics post-16 either by taking GCSE Mathematics or by taking Functional Skills Mathematics level 2.

³ Wolf, A. (2011). [Review of Vocational Education – The Wolf Report](#)

⁴ Joint Council for Qualifications (2019). [GCSE \(Full Course\) Results Summer 2019](#)

⁵ Wolf, A. (2011). [Review of Vocational Education – The Wolf Report](#)

⁶ Higton, J., Archer, R., et al. (2017). [Effective practice in the delivery and teaching of English and Mathematics to 16–18 year olds](#). DfE.

⁷ Johnston-Wilder, S., Lee, C., et al. (2015). [Developing mathematical resilience in school-students who have experienced repeated failure](#)

The project

The project ran from December 2018 to December 2019. Curriculum content and exemplar examination papers were written, informed by reviews of national and international evidence, and a small-scale feasibility study was conducted with key stakeholders to establish whether the proposed curriculum and assessment would be fit for purpose and practicable.

How and what should post-16 GCSE Mathematics students learn?

Four key themes emerged from our review of evidence:

Motivation and confidence

Students required to resit GCSE Mathematics understand the importance of gaining a GCSE qualification in mathematics but are hampered by their lack of confidence in mathematics. Applying mathematics to contexts from everyday life is motivating for students, and the value they attach to being able to do this enables them to develop resilience.

Progression

Student progress is measured using the points system in the post-16 mathematics progress measure.⁸ Nationally, the average progress points score from post-16 students resitting GCSE Mathematics is close to zero, with most students who achieved grade E or below at age 16 making negative progress by age 18.

Relevant content and skills

The ability to use basic mathematics in complex situations is needed in employment, as well as personal life. This includes the use of digital tools such as online calculators and spreadsheets.

The qualifications landscape

The GCSE brand is highly valued by employers and higher education institutions (HEIs), so for an alternative post-16 mathematics qualification to have credibility, it should be a GCSE.

A review of qualifications at a similar level to GCSE Mathematics, from England and other countries, was conducted. This included consideration of qualification structure and content.

These reviews, together with our experience of drafting exemplar teaching resources, were used to inform the development of the curriculum. To determine the mathematical content, we started by compiling a list of quantitative skills all adults should possess. This included contexts from the 'General life and personal interest' section from the foundation tier GCSE context grid⁹ and the 'Essentials of Numeracy for All' poster¹⁰ from National Numeracy. The Essentials of Numeracy were defined by National Numeracy working with employers, unions, charities and maths experts such as Cambridge Maths.¹¹ Once we had a list of skills, we grouped them into four themes to provide four teaching units in the outline curriculum, as outlined in the following table. The associated mathematical content is detailed in Appendix 2 of the main report and in the draft curriculum document.

⁸ DfE (2019). [16 to 18 accountability measures: technical guide](#)

⁹ MEI (2017). [Contextualisation Toolkit](#)

¹⁰ National Numeracy (2013). [The Essentials of Numeracy for All](#)

¹¹ www.nationalnumeracy.org.uk/essentials-numeracy

Financial understanding	Working with measures and shape
<ul style="list-style-type: none"> • Understanding discounts in the sales • Understanding household bills • Estimating the cost of weekly food shopping • Splitting a restaurant bill • Shopping around for the best mobile phone deal • Comparing prices for differently sized packages • Budgeting for a holiday or major purchase • Personal budgeting • Managing a budget at work • Understanding interest rates when saving and borrowing 	<ul style="list-style-type: none"> • Being able to read a measuring scale • Knowing your height and weight • Converting between imperial and metric units • Buying enough paint to decorate a room • Using shapes in designing a garden or craft project • Making and interpreting measurements to decide whether a piece of furniture or household appliance will fit in a given space • Understanding a map or scale drawing • Understanding measurements relating to personal fitness and health • Giving the right quantity of medicine to children
Planning activities	Understanding quantitative information
<ul style="list-style-type: none"> • Estimating time needed for tasks • Planning a schedule • Understanding staff shifts on a rota • Planning a meal or party for a large number of people • Giving and following directions • Understanding journey times • Understanding a map or scale drawing • Understanding timetables 	<ul style="list-style-type: none"> • Recording numerical information accurately so others can understand • Making sense of statistics in the news • Interpreting the results of an opinion poll and understanding why different polls may produce different results • Understanding results of elections • Understanding food labels • Understanding statistics relating to personal fitness and health • Understanding risk in the news in relation to health

Outline quantitative skills for a new post-16 GCSE Mathematics qualification

It would be helpful for teaching and examining the proposed curriculum if all contexts which could occur in examinations were listed; the lists in this table are not sufficiently detailed to be exhaustive but they indicate the kinds of skills which students would develop.

How should the proposed GCSE be assessed?

Many of the qualifications reviewed for this project are either modular or have a stepping-stone qualification at a lower level. That is not the case for GCSE Mathematics. Although, theoretically, Functional Skills Mathematics level 2 can be used as a stepping stone, this is not what Functional Skills qualifications are designed for. Moreover, there is no evidence that Functional Skills Mathematics level 2 is being successfully used as a stepping stone to GCSE Mathematics.

The proposed assessment structure for the post-16 mathematics GCSE is shown in the table below.

	Paper 1	Paper 2	Paper 3
Style	Multiple choice questions assess basic skills. Questions may be in context or context-free. Results reported to centres for diagnostic purposes.	A mixture of short and long questions, all set in realistic contexts.	A mixture of short and long questions, all set in realistic contexts.
Time	1 hour	1.5 hours	1.5 hours
Number of marks	40	80	80
% of total qualification	20%	40%	40%
Calculator allowed?	Yes	No	Yes
Availability	Twice a year ¹²	November and June	In same series as Paper 2

Proposed assessment structure for a new post-16 GCSE Mathematics qualification

Paper 1 is designed to be taken early, as a stepping stone to the whole GCSE. It would allow students to receive prompt feedback and experience success; students would be allowed one resit opportunity for Paper 1.

Papers 2 and 3 are taken at the end of the course and assess the whole curriculum content. As part of this development project, we wrote exemplar papers; these are included as Appendix 3 in the main report.

Comparing the demand of the proposed post-16 mathematics GCSE with GCSE Mathematics

No More Marking Ltd¹³ are national experts in the use of comparative judgement in assessment.¹⁴ They compared the difficulty of the exemplar papers with the summer 2017 GCSE (9 to 1) Mathematics assessments and with the AQA Functional Skills Mathematics level 2 specimen papers.¹⁵ The GCSE Mathematics papers are a natural set of qualifications for comparison with the exemplar papers for the new curriculum because the new curriculum is designed as an alternative to the current GCSE Mathematics for post-16 students.

¹² Papers could be automatically compiled based on defined parameters and available online in a one-week window to allow for centres not having enough computers for all candidates. Alternatively, a paper-based assessment, available at two sittings, could be used with an online bank of practice questions for diagnostic assessment.

¹³ www.nomoremarking.com/

¹⁴ No More Marking was used by Ofqual to compare GCSE (9 to 1) Mathematics papers; see [GCSE maths: Final research report and regulatory summary](#) (2015).

¹⁵ Barmby, P., & Wheadon, C. (2019). *A comparative judgement study of MEI GCSE exam items*. No More Marking Ltd.

The comparative judgement found that the difficulty of exemplar Papers 2 and 3 for the new curriculum was in line with foundation tier GCSE Mathematics papers. Paper 1 is easier than foundation tier GCSE Mathematics papers; this is in line with its design as a diagnostic paper to be taken early in the course to check whether students have the basic skills in place to enable them to succeed. The comparative judgement found that Functional Skills Mathematics level 2 was harder than foundation tier GCSE Mathematics.

What about Functional Skills Mathematics qualifications?

An alternative level 2 mathematics qualification for post-16 students already exists – Functional Skills level 2. The national policy has recently changed to allow students with grade 2 and below in GCSE Mathematics at age 16 to achieve level 2 Mathematics by taking Functional Skills Mathematics. Moreover, a programme to reform Functional Skills qualifications has led to new versions available for first teaching from September 2019.¹⁶ This raises the question of whether the new Functional Skills Mathematics removes the need for any alternative GCSE qualification.

A recent survey conducted by Pye Tait¹⁷ shows that a greater proportion of employers consider Mathematics and English GCSE to be essential when recruiting for entry and admin roles, compared to those who consider Functional Skills Mathematics and English essential.

The dominance of the GCSE brand is very well established and is easily understood by employers and HEIs. It seems unlikely that the reformed Functional Skills Mathematics will provide the credibility needed for employers and HEIs to change their selection criteria. Consequently, Functional Skills qualifications can be seen as having a lower currency by students, and this is likely to reduce their motivation.

The dominance of the GCSE brand was confirmed by findings in an article in *FE Week* in November 2019:

Colleges claimed they did not want ‘to limit our learners’ progress’ and highlighted ‘the strong emphasis that employers and education establishments put on GCSEs’ as part of their reasoning.

*Criticism was also directed towards the alternative Functional Skills qualification for its ‘cliff-edge pass or fail’.*¹⁸

The comparative judgement conducted by No More Marking¹⁹ confirms that, as a level 2 qualification, level 2 Functional Skills Mathematics is more demanding than foundation tier GCSE Mathematics, which allows students to demonstrate achievement at level 1 or level 2.

¹⁶ Ofqual (2018). [Decisions on Functional Skills Qualification reform – English and mathematics](#)

¹⁷ Pye Tait Consulting (2019). [Perceptions of Vocational and Technical Qualifications: Wave 2](#)

¹⁸ Mersinoglu, Y.C. [‘Why colleges are choosing GCSE resits over alternatives’](#), *FE Week*, 15 November 2019

¹⁹ Barmby, P., & Wheadon, C. (2019). *A comparative judgement study of MEI GCSE exam items*. No More Marking Ltd.

Conclusions, recommendations and next steps

This project shows that the proposed new GCSE has the potential to improve mathematics learning for resit students and to recognise this through a rigorous, credible post-16 mathematics GCSE qualification. The proposed stepping stone, Paper 1, would improve student confidence and the contextualised content would increase student motivation and resilience, leading to higher success rates.

Success in this qualification would give young people the competence and confidence in the fundamental mathematics they need to function as effective citizens. It would also prepare young people for further programmes of study, including Core Maths and vocational courses, that do not require prior learning of abstract mathematics. The proposed qualification is suitable for the government to adopt as a means for young people to achieve the level 2 maths requirement of 16–19 study programmes and T level programmes.

In order to make a success of an alternative GCSE, employers and HEIs would need to understand its purpose so that parents, teachers, schools and colleges could be confident in choosing it as an option for students.

Main recommendation

A new mathematics GCSE should be developed for post-16 students that focuses on the maths needed for everyday life and work. It should be clearly branded as a GCSE qualification and afforded equal status to a GCSE Mathematics qualification at the same grade, both for progress measures and for entry to employment or higher education.

The findings set out in the report should be considered by the DfE, Ofqual and the awarding bodies to inform the development of the new GCSE; this may require changes to regulation or to usual assessment practices at GCSE.

The new mathematics GCSE should have the following features:

- It should be limited to foundation tier (grades 1 to 5) and available to post-16 students only.
- It should have higher grade boundaries than foundation tier GCSE Mathematics to ensure that students gain the qualification by demonstrating the ability to succeed in the mathematics they are likely to encounter in life and work, rather than by merely achieving a minimal number of marks.
- It should incorporate a stepping-stone assessment element that can be taken before the final assessment, to test basic skills and provide a more supportive pathway for students who have experienced limited success with mathematics. This stepping stone should attract points in the post-16 maths progress measure. The whole GCSE should have the same progress measure points as GCSE Mathematics.
- It should exclude content from foundation tier GCSE Mathematics that is not directly relevant to everyday applications but should include a small amount of additional content that is not included in foundation tier GCSE Mathematics, such as risk, financial applications and the basic use of spreadsheets to perform quantitative tasks. This aligns with the skills students need in daily life and is consistent with feedback received from employers.

Next steps

- The outline curriculum content and proposed assessment structure in this report should be used as the basis for a post-16 GCSE, limited to foundation tier.
- Development should be overseen by the DfE and Ofqual, as usual for GCSE qualifications, but with changes to regulations where needed. These would include enabling:
 - the qualification to be for post-16 students only
 - the first paper to be sat early and count towards the full GCSE.
- The title of the GCSE should make it clear that it covers the mathematics needed for adults to possess the quantitative skills needed in daily life. Possible titles include GCSE Core Maths, GCSE Numeracy.
- The content of the GCSE should be based on the outline curriculum and contain sufficient detail to enable teachers to know what they need to teach (and what is not included).
- The contexts for assessment questions should be drawn from those included in the final subject content.

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