

# The Impact of GCSE Maths Reform on Progression to Mathematics Post-16

## Introduction and background

Since GCSEs in English and in mathematics are a prerequisite for most post-16 courses, and for many training programmes and jobs, they are taken by almost all young people. In February 2013, the Secretary of State for Education in England announced his intention to reform GCSE qualifications “to ensure they are rigorous and robust, and give students access to high quality qualifications which match expectations in the highest performing jurisdictions” (Gove, 2013).

For mathematics, in particular, the new GCSE would “focus on ensuring that every student masters the fundamental mathematics that is required for further education and future careers,” and, in particular, it would “be more demanding” and “provide greater challenge for the most able students” (Gove, 2013). The new GCSE in mathematics had a revised content framework and aimed to better prepare students for progression to future education and employment. Key changes to the qualification were a greater emphasis on problem-solving and more demanding content, together with a new grading scale from 9 to 1 (with 9 being the highest grade). The first examinations were in summer 2017.

This research article from Cambridge University Press and Assessment looks at the impact of the reforms on progression to, and performance in, post-16 mathematics. The report references a large number of research articles, which, in the interests of brevity, are not fully referenced here, but can be found in the full report.

### Existing research

- Prior to the GCSE reform, there were longstanding concerns about how well the GCSE in mathematics prepared students for progression to AS and A level study in the subject.
- Drawing on interviews with students, Hernandez-Martinez et al. (2011) reported that the GCSE in mathematics was inadequate preparation for many students with pass grades (especially grade C, but increasingly also grade B) for AS level study, with algebra being mentioned as the key problem. Similarly, Noyes and Adkins (2016) showed that the numbers (and proportions) of GCSE Maths grade C students completing any advanced mathematics were relatively small. Around 99 per cent of students achieving a grade C in 2010 did not complete any advanced mathematics over the following 3 years.
- Rushton and Wilson (2014) carried out a survey of teachers to identify the areas of mathematics that were problematic for students who had just completed the GCSE and wanted to study the subject further at A level. Although teachers felt that students were prepared adequately for AS and A level courses in most areas of mathematics, they also identified other areas (e.g., algebra) where GCSEs were considered not to prepare students well.
- Changes to GCSE Maths aimed to encourage students to better manage the transition to the A level. However, the number of entries in A level Maths fell by around 3.5 per cent in 2019-20.
- Howard and Khan (2019) conducted interviews with A level Maths teachers with experience in teaching students who had studied the legacy GCSE in mathematics and students who had studied the reformed GCSE. Teachers were generally positive about the extent to which the reformed GCSE prepared students for A level and most commented that the reformed GCSE prepared students at least as well, if not better, than the legacy GCSE.
- Humphries et al. (2017) carried out a small qualitative study involving a sample of teachers (in 12 schools) who were engaged in delivering the new GCSE.

Participating teachers expressed the view that “students sitting the reformed mathematics GCSE would be leaving Key Stage 4 with more mathematical knowledge than previous cohorts”, and that this would apply across all attainment levels.

- However, although there was general agreement that the new GCSE prepared students well for A level, there were concerns about how the weaker students (those with a grade 5 or 6) would feel about their abilities in mathematics.

### The current research

- Data for this study was gathered from the National Pupil Database (NPD). The NPD is a longitudinal database for children in schools in England, linking pupil characteristics to school and college learning aims and attainment. It holds individual pupil-level attainment data for pupils in all schools and colleges who take part in the exams.
- Students who achieved a GCSE Maths between 2014 and 2017 were followed up for 2 years and data for their level 3 qualifications in the 4 exam sessions before the end of Key Stage 5 were included. For example, students who achieved a GCSE Maths in 2015 were followed up in 2016 and 2017 and their AS and A level results identified.
- The GCSE grades awarded in the period of study belonged to two different grading scales: A\*–G for the legacy qualifications, and 9–1 for the reformed GCSEs in 2017. For some of the analyses in this study, the GCSE Maths grades pre- and post-reform were converted to a common numerical scale using the Department for Education’s conversion values.
- The average GCSE and equivalents point score per entry, which ranges from 0 to 9, was used to divide students into three approximately equally sized groups: low attainment, medium attainment, and high attainment.

## Key findings – progression

- Progression to A level Maths increased post-reform to 11.3 per cent. However, this could be the continuation of a trend already present pre-reform. Progression to A level Maths had been increasing year on year in the 3 years prior to reform.
- Progression to Core Maths (1% in 2017) and A level Further Maths (1.8%) also increased post-reform, but it is worth noting that progression to both qualifications continued to be low in absolute terms.
- For A level Maths and A level Further Maths, progression increased post-reform for all students. The increase in progression rates was, however, higher among those who achieved at least grade A/7 than for students with at least grade C/4. In 2017, over 50 per cent of those with a grade 7 or above in maths progressed to A level, compared to around 45 per cent in 2014.
- For Core Maths, although progression also increased post-reform for all students, the increase was slightly lower among students who achieved at least grade A/7 than among students who achieved at least grade C/4 in their GCSE Maths.
- A statistical model which took account of several variables revealed that the probability of progression post-reform is below the probability of progression pre-reform for the low GCSE grades, but above for the high GCSE grades – so, towards the top of the GCSE distribution, the progression to A level becomes very slightly higher for students who achieved the GCSE in 2017 (post-reform).
- The very top candidates had different probabilities of progression pre- and post-reform: a reference candidate with grade A\* pre-reform (2015, A\*=8.5) had a probability of progression of 0.56, while a reference candidate with grade 9 post-reform had a probability of 0.78.
- The year in which GCSE was taken was also a statistically significant predictor of progression to A level Further Maths and Core Maths, and its effect varied significantly by grade. The probability of progression to A level Further Maths post-reform was lower than the probability of progression pre-reform. For Core Maths progression rates were very low pre- and post-reform, but progression was slightly higher post-reform, independent of the grade achieved in GCSE Maths.

## Key findings - performance

- Compared to the last year pre-reform (2016), students who achieved a GCSE Maths post-reform (2017) were more likely to achieve an A\* grade and at least grade A in their A level (although it was within the range for pre-reform years 2014 to 2016).
- Compared to the pre-reform years, students who achieved GCSE Maths post-reform were less likely to get top grades (A\*, at least grade A, at least grade B) in A level Further Maths. The picture for Core Maths was different: students who achieved a GCSE Maths post-reform performed better than students who achieved the GCSE pre-reform.
- As with progression to A level Maths, the year the GCSE was taken was a statistically significant predictor of performance in A level Maths, and its effect varied significantly by grade.
- Considering the background of the students, including their prior attainment and their grade in GCSE Maths, the probability of achieving at least grade A at A level was lower post-reform (2017) than pre-reform (2014–

16), apart from for the students who achieved the very top GCSE grades. A reference candidate with grade 7 in GCSE Maths had a higher probability of achieving at least a grade A at A level pre-reform than post-reform. The same patterns were found for the achievement of at least grade C.

- Using the same parameters, the probability of achieving at least grade A or at least grade C in A level Further Maths was lower post-reform (2017) than pre-reform (2014–16), apart from for the students who achieved the very top GCSE grades. Performance in Core Maths was, however, generally higher post-reform.

## Conclusions

- Contrary to fears of reduction in the uptake of A level Maths following the reform (e.g., Lee et al., 2018; Redmond et al., 2020) this research showed that progression generally increased post-reform. The increase could, however, be part of an already existing trend.
- When controlling for students' backgrounds (including the grade achieved in GCSE Maths) the probability of progression post-reform was just below the probability of progression pre-reform for students with low GCSE grades. On the contrary, for students who achieved GCSE grades towards the top of grade distribution, the progression to A level was very slightly higher post-reform.
- Performance in A level Maths was generally lower post-reform. In particular, the probability of achieving at least grade A or at least grade C in A level Maths was lower post-reform for students with any GCSE grade, apart from the students at the very top of the GCSE grade distribution.
- This contrasts with the perceptions of A level Maths teachers interviewed in research by Howard and Khan (2019) or Humphries et al. (2017), who commented that the reformed GCSE prepared students for the A level at least as well, if not better, than the legacy GCSE and that students sitting the reformed GCSE would be leaving Key Stage 4 with more mathematical knowledge than previous cohorts.
- However, it should be noted that students taking the reformed GCSE would have also taken the newly reformed A level Maths. It is widely acknowledged that student performance tends to dip slightly in the first years of a new qualification.
- Research showed that the reformed A level specifications were significantly more demanding than legacy specifications (Redmond et al., 2020), and there was concern from some teachers that while more able students may benefit from the more "aspirational" A level, lower performing students may be impacted negatively by the changes.
- Overall, the findings indicate that some aims of the curriculum and assessment reform in upper secondary mathematics (in particular, increasing uptake of post-16 mathematics) may have been fulfilled.

The full document can be downloaded from:

<https://www.cambridgeassessment.org.uk/Images/687723-the-impact-of-gcse-maths-reform-on-progression-to-a-level.-.pdf>