

REVAMP

Research summary 4



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Who wants to study advanced mathematics?

Mathematics for all to 18

In 2011, the then Secretary of State set out his vision that the vast majority of students in England should be studying mathematics to 18 by the end of the decade. Achieving this ambitious goal depends upon the availability of suitable qualification pathways for the whole spectrum of abilities, and sufficient well-qualified staff to teach them. The willingness of 16 - 18 year olds to continue their mathematical studies and availability of funding are also critically important.

New Core Maths qualifications are central to this vision. They are designed for students who currently attain a good GCSE grade and then cease their study of mathematics. The success of Core Maths is contingent upon it being valued by employers and higher education. It also needs to be well resourced. The qualification should increase and widen mathematical engagement rather than divert students from A-level Mathematics.

This ambition for 'maths for all to 18' was reiterated in the Chancellor's March 2016 budget.

The research

In 2015, a national survey of over ten thousand 17-year-old students in England was conducted to explore their views on post-16 mathematics. The final sample of 9255 students who had achieved a GCSE grade C or above (54% female) was clustered in 110 schools and colleges. These were on AS/A level pathways and so could have been, or were, studying mathematics. Around 46% of the sample were studying AS/A level Mathematics with over 10% of these planning to complete AS only. Most (84%) were intending to go to university.

Key findings and conclusions

- ◆ Students are generally opposed to the idea that they should be *compelled* to study 'some maths' post-16 (78%) but are less opposed to being *encouraged* to do so.
- ◆ 80% of the target group for Core Maths, i.e. those not currently studying AS/A-level mathematics, disagree with the idea of making mathematics compulsory post-16.
- ◆ If students have free choice of A levels it is unlikely that there will be a significant rise in post-16 mathematics participation, particularly from those with GCSE grades B and C.
- ◆ Students who have taken A level Mathematics are more likely to report finding their GCSE Mathematics experience to have been interesting, enjoyable and relatively easy.
- ◆ The vast majority (94%) recognise that it is important to do well in mathematics.
- ◆ High proportions of students planning to proceed to STEM degrees are studying A level mathematics (Physics 93%, Engineering 89%, Chemistry 82%, Medicine 77%, Computing 62% and Biology 49%)
- ◆ Undergraduate admissions into some STEM subjects may be reaching a 'tipping point' at which admissions tutors expect A level Mathematics in their course requirements thereby creating a virtuous circle.

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The importance of a good GCSE Mathematics experience

Those studying AS/A-level Mathematics report more positive views of GCSE Mathematics and were happier with their GCSE results than those not studying A-level. With the GCSE Mathematics grade being the strongest predictor of AS/A-level completion, the importance of good experiences in GCSE mathematics and the need for alternative pathways are clear.

The reformed GCSE that will first be examined in 2017 is intended to be more demanding. This might well impact negatively upon attitudes and experiences and thereby post-16 engagement. When students make their post-16 choices the options are not 'maths versus not-maths' but 'maths versus other subjects'. As long as students have a choice of study pathways their experiences of, and grades in, GCSE Mathematics will have a major impact upon post-16 mathematical engagement.

“Government needs to ensure that all young people, regardless of what route they choose, study some form of maths or numeracy education after 16” (CBI, 2009)

Implications for policy

The 'maths for all to 18' goal will not be realised whilst students can choose to *not* study mathematics. Well-designed strategies need to be enacted to effect this change, whether in the form of new curricular structures (e.g. a baccalaureate) or incentives at the individual or institutional level. Investment in staffing and professional development as well as funding for mathematics to be studied as a fourth subject is needed to ensure the success of this step-change in post-16 mathematics education.

A parsimonious range of attractive and engaging mathematics qualifications for all learners needs to have *use value* for learners and *exchange value* for employers and higher education. If university admissions tutors are not persuaded of the usefulness of new Core Maths qualifications they are unlikely to succeed.

There are clear links between students' attitudes towards mathematics, their ongoing engagement with the subject and their educational, career and life trajectories. The quality of GCSE Mathematics is central to the project of increasing mathematical competence. The impact of new GCSE and AS/A-level qualifications need to be monitored in order to mitigate the risks of unintended consequences on uptake.

The full paper can be obtained from the link below or from the authors:

Noyes, A. and Adkins, M. (2016). Studying advanced mathematics in England: findings from a survey of student choices and attitudes. *Research in Mathematics Education*. DOI: 10.1080/14794802.2016.1188139

Rethinking the Value of Advanced Mathematics Participation (REVAMP)

The REVAMP project was funded by the Nuffield Foundation and considers the value of A level Mathematics participation from several viewpoints. Five strands of work address the following:

- ◆ The economic return to A-level Mathematics (*Research summary 1*);
- ◆ The changing nature of A-level Mathematics participation over time (*Summary 2*);
- ◆ The relationship between A-level Mathematics and outcomes in a range of science and social science degree programmes (*Summary 3*);
- ◆ The policy trajectory of 14-19 mathematics education; and,
- ◆ Attitudes to post-16 study of advanced mathematics amongst 17-year-olds in England (*Summary 4*).

For more details visit <http://www.nottingham.ac.uk/research/groups/crme/projects/revamp.aspx>.

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