

## **The challenges facing schools and colleges in engaging with post-16 mathematics support: Findings from a national survey and in-depth case studies**

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Mathematics in Education and Industry's government funded Advanced Mathematics Support Programme (AMSP) has been in place since May 2018. During that period, the National Foundation for Educational Research (NFER) has conducted an independent evaluation of the programme. Key aspects of the evaluation include a national school/college survey into level 3 mathematics, teacher interviews and student focus groups.

Schools/colleges have engaged in various AMSP support activities including teacher professional development and student enrichment and support, but they have faced key barriers such as releasing teachers/students from school/college and the cost or availability of teacher cover. Lack of support from senior leadership was not seen as an issue by many.

This paper draws on analysis from one of the largest responses (717 schools/colleges) to a survey into post-16 mathematics since the GCSE/A level curriculum changes took place in 2015. It also considers feedback from in-depth case studies across two touchpoints.

**Keywords: A levels; post-16 mathematics; policy; mathematics support; professional development**

### **Background to the reform of post-16 mathematics qualifications and the Advanced Mathematics Support Programme**

This paper assumes some familiarity with the English educational system, though insight into recent curriculum developments is provided.

In summer 2017, the first cohort of students took examinations for the new General Certificate of Secondary Education (GCSE) in mathematics (GCSEs are a type of qualification taken in England, usually at aged 15-16 and usually after two years of study. Students in state funded institutions who follow the National Curriculum must study certain GCSEs, like Mathematics, which means there are approximately 550,000 entries each year). The reformed qualification involves more content and the introduction of more difficult topics. It also has a greater emphasis on problem solving and mathematical reasoning than the previous mathematics curriculum.

After GCSEs students have more choice over what qualifications they can study in 16-18 education. The most popular academic route is to study Advanced Levels (A levels), usually taken over two years and Advanced Subsidiary Levels (AS levels), equivalent to one year's worth of study. In September 2017, students embarked on reformed AS and A levels in Mathematics and Further Mathematics, with qualifications becoming linear, meaning that all the exams are completed in the

same series. In addition, as with all other reformed subjects, the new A level Mathematics was decoupled from AS, meaning AS exams no longer counts towards A level grades.

In autumn 2017, just after the new mathematics AS/A levels had been introduced, Lee, Lord, Dudzic, & Stripp (2018) undertook a national survey of teachers. The responses signalled that the introduction of the new mathematics A levels could lead to a decline in student entries. When entry statistics for this first cohort were released in summer 2019 a reduction was seen – A level Mathematics entries in England declined 5.8% (compared to 2018) and A level Further Mathematics declined 10.1% (JCQ, 2019). More drastic drops came due to the changes made to AS levels, with AS Mathematics reducing from 149,805 entries in summer 2017 to 16,731 in summer 2019 (with AS Further Mathematics down from 27,095 to 5,158). This happened across all AS levels when they were reformed. This is a clear indication that a change in policy can result in a fundamental change to uptake of specific qualifications.

Whilst these important curriculum developments were taking place, an external review into post-16 mathematics, commissioned by the Government, was published (Smith, 2017). Recommendations 9 and 10 of this influential report were that there should be a centrally funded mathematics (support) programme. The review suggested that this programme should deliver professional development for teachers of AS/A level Mathematics and Further Mathematics and support the new Core Maths qualifications, to allow them to become embedded.

Subsequently, the Department for Education (DfE) ran an open tender for an Advanced Mathematics Support Programme (AMSP). Educational charity Mathematics in Education and Industry (MEI) won the tender to deliver the programme between 2018-2021. MEI had managed and coordinated its predecessor programme, the Further Mathematics Support Programme (Lord & Lee, 2016), and, as a result, had the capacity to quickly deliver support to schools and colleges, with an enhanced and widened offer.

### **Evaluating schools' and colleges' engagement with post-16 mathematics support**

The support that the AMSP offers is wide reaching. It covers student support and tuition, teacher support and professional development, and dedicated support for schools which are deemed a 'priority', such as schools/colleges located in government defined 'Opportunity Areas'.

A key offer of the AMSP is a flexible and balanced set of professional development options. Opportunities for teachers include sustained (extended) courses, one-day courses, part-day courses, live online courses, on-demand online courses and short sessions (such as teacher network meetings, department meetings and twilight meetings).

Between May 2018 and February 2020, the engagement of schools/colleges and their students with the AMSP included:

- over 7,500 teachers attending professional development,
- over 6,000 students from Years 12-13 attending problem solving and team challenge events and over 30,000 students from Years 7-11 attending enrichment events (to promote mathematics uptake post-16),
- almost 3,000 schools engaging with one or more AMSP 'support activity' and almost 5,000 teachers signing-up to 'stay informed' about AMSP activities.

### ***External evaluation***

The National Foundation for Educational Research (NFER), a charity and a leading provider of independent evidence and assessments in the UK, e.g. NFER (2019), was commissioned to carry out an external evaluation of the AMSP between 2018-20. A high-level summary of the methods used during the evaluation can be seen in Table 1.

Table 1: Evaluation methods, numbers and timescales

Method	When and with whom?
A paper and online survey of schools and colleges	Administered in May/June 2019 to 1566 institutions (717 responses received)
In-depth case studies (part a) Initial telephone interviews with schools and colleges	Conducted between January 2019 and July 2019 with 18 institutions
In-depth case studies (part b) Follow-up visits to the same schools and colleges for interviews and focus groups	Conducted between November 2019 and January 2020 with 15 institutions
Telephone interviews with teachers participating in On Demand Professional Development	Undertaken in June/July 2019 with eight teachers
A small-scale consultation with key stakeholders	Administered in May/June 2019 to 41 stakeholders (13 responses received)
Group discussions with AMSP Programme Leaders	Undertaken in November 2018 and January 2020

This article focuses on the findings of two key evaluation activities: the national survey of schools and colleges and the in-depth, qualitative case studies.

### ***National survey findings***

The survey was a key tool to determine, on a national scale, schools' and colleges' reasons for engaging with AMSP support. It also sought to establish what challenges schools and colleges faced in being able to access and take up the support available, particularly given that, for most activities, there was little or no direct cost. As will be discussed in this section, key challenges were the 'hidden costs', such as the time and costs required to provide cover support whilst teachers were away from the classroom enhancing their skills through professional development.

The survey was sent both electronically and in paper form to 1,566 state-funded institutions in England that offer post-16 mathematics qualifications and was administered between May and June 2019. All of the teachers who received it were registered with the AMSP. A total of 717 replies (46% response rate) were received – one per institution. Most respondents (86%) were from 11-18 schools, while 6% were from sixth form colleges, 5% from general further education (FE) colleges, and 3% from all-through institutions. The achieved sample of schools/colleges included those from different regions, and from different free school meals and attainment quintiles. Quantitative and qualitative analysis of the findings was undertaken. It was established that no systematic difference was seen between those who answered online versus those who answered on paper.

Most respondents indicated that their schools/colleges were offering A level Mathematics (96% of 717 respondents) and Further Mathematics (78%), while less than two-fifths were offering Core Maths (38%). The latter however was still above the national average figure, where around one in three institutions offer Core Maths.

### *Uptake of support and institutional priorities*

Reviewing schools'/colleges' engagement with post-16 mathematics support – firstly, in respect to teacher professional development – revealed that the top three activities they participated in were:

- use of (free) teaching resources for A level Further Mathematics accessed via the Integral online platform (62% of 717 respondents),
- professional development for AS/A level Mathematics and/or Further Mathematics (53%),
- teacher network meetings (41%).

Secondly, in respect to student support and tuition, the top three activities schools and colleges had engaged with were:

- enrichment for students aged 16-19 (54% of 717 respondents),
- year 12/13 problem-solving support and tuition for university entrance exams (30%),
- tuition for A level Further Mathematics (11%).

At this point, it is worth noting that feedback from the case studies showed that schools/colleges engaged with support activities primarily: to help keep their curriculum and subject knowledge up-to-date, to access advice from external mathematics experts, to inspire and stretch students, and for reassurance that they were 'doing things right'. These qualitative findings mirror the institutional priorities that schools and colleges reported in the survey, with the top three being to:

- improve the quality of A level Mathematics/Further Mathematics teaching (46%),
- maintain student participation rates in A level Mathematics (44%),
- increase student participation in A level Mathematics (37%).

Conversely, schools/colleges indicated the following activities were 'not a current issue or priority for action':

- maintaining student participation rates in Core Maths (74%),
- improving the quality of Core Maths teaching (70%),
- increasing the range of level 3 mathematics courses on offer (67%),
- increasing capacity to teach level 3 Core Maths (65%),
- increasing student participation rates in Core Maths (59%).

From the two bulleted lists above, and the percentage responses for each, it is clear that, in general, teachers responding to the survey felt more strongly about what was not a priority than what was. In particular, offering Core Maths was not a priority for most schools and colleges.

### *Challenges to engaging in support*

Survey respondents were asked to what extent their institutions had faced a range of challenges in engaging with AMSP support activities. They were asked to rate a list of eight options on a five point scale from 'to a very large extent' to 'not at all'. The main challenges reported related to releasing staff from school and the single greatest challenge, with 39% responding 'to a large' or 'to a very large extent', was the 'cost or availability of teacher cover'. Two further challenges, to which 33% responded 'to a large' or 'to a very large extent', were 'releasing teachers to take students to enrichment events' and 'releasing teachers to participate in professional development'.

Conversely, the least common areas of challenge, indicated by the proportion of respondents reporting 'not at all', were 'lack of support from senior leadership'

(63%) and the ‘costs of activities’ (41%); the latter is perhaps not surprising as the support activities from the AMSP are often offered for free or at low cost.

### *Case studies*

Telephone interviews were conducted with senior mathematics staff in 18 case-study schools/colleges between January 2019 and July 2019. The sample included teachers from 12 institutions offering provision for students aged 11-18, three sixth form colleges, one all-through institution, one 11-16 school, and one general FE college. The interviews explored schools’ and colleges’ priorities for level 3 mathematics, participation in the AMSP and its predecessor programmes, views on what was working well and challenges, and perceptions of early outcomes for teachers and students.

These initial interviews were followed-up with visits to 15 of the same schools/colleges. The visits involved interviews with a Mathematics Lead or senior staff member responsible for the delivery of level 3 mathematics qualifications (most of whom had been interviewed in the initial phase), together with focus groups with students and teachers who had taken part in AMSP provision, where relevant. In total, during the follow-up visits, interviews were undertaken with 19 Mathematics Leads/senior leaders, 30 mathematics teachers and 63 students across Years 10-13.

Of the many areas covered within the case-study visits, key insights were gathered relating to the challenges schools/colleges faced and the outcomes they achieved, for example:

“Getting quality cover for teachers attending courses creates a problem. So staff tend to attend activities where the impact of missing lessons is less significant” (FE College)

“Releasing staff and the cost of cover is the hardest. Getting cover is so difficult as the school policy is to not put Year 12 and 13 on cover” (16-18 institution)

“[A key challenge is] getting agreement for teachers to attend the longer-term courses and having days out of school” (11-18 institution)

Mathematics Leads and teachers reported a range of outcomes arising from teacher professional development. These included: increased subject knowledge and confidence in teaching; ideas for new and effective approaches to teaching, which were feeding into schemes of work; and increased knowledge of the level 3 mathematics curriculum specifications and assessment regimes, including the style of exam questions and ideas for problem-solving activities. These were all perceived to be leading to improved quality of teaching and learning at an individual and departmental level, and increased expertise of both new and experienced staff.

A range of student-focused outcomes were also reported by Mathematics Leads, teachers and students arising from student enrichment and tuition activities. These outcomes included students’: increased engagement, enjoyment and enthusiasm in lessons; increased knowledge and understanding of mathematics topics (for example mechanics) and of mathematics within a broader context; improved study skills, independent learning and exam technique; development of transferable skills, such as problem solving, reasoning and teamwork; and increased confidence in their abilities, which was both improving attainment and confirming or raising aspirations for mathematics-related careers and study within higher education, including at the more prestigious universities.

Direct quotes from schools/colleges that reflect on the outcomes of engaging with support activities include:

“[Outcomes include] increased staff confidence to teach the new courses, introducing problem solving into the scheme of work, understanding the types of questions students will be asked and how to prepare them to achieve the best grades” (Sixth Form College)

“It has given us a more secure subject knowledge and confidence in our teaching. Some of this has been about enhancing knowledge and being aware of syllabus changes. These things have all been very valuable. Experienced teachers have benefitted just as much as less experienced staff” (11-18 institution)

“Without the support of the AMSP, we wouldn’t have been able to stretch our students as successfully as we have done. And we wouldn’t be able to provide them with the exam support required to access Further Mathematics. The AMSP addresses a gap in our provision” (11-18 institution)

Specifically, in terms of introducing and delivering Core Maths, which is still a relatively new qualification, case-study interviewees reported key challenges related to: staffing, timetabling, financing the course, and uncertainty about whether it was sufficiently recognised by universities. This is concerning and emphasises that much work needs to be done to enable these qualifications to reach and benefit the large target audience they are suitable for.

### Concluding remarks

The data for 2019 shows that the numbers of students studying A level Mathematics/Further Mathematics has fallen for the first time in 15 years. Within this context, the high-quality post-16 mathematics support that the AMSP provides is invaluable in supporting schools to maintain, and improve, their teaching of these important subjects, which evidence has shown can lead to wage returns in the longer-term (Noyes & Adkins, 2017). However, the findings from this large-scale national survey and in-depth case studies reveal the challenges and barriers schools/colleges face in engaging with this, and potentially other forms of post-16 mathematics support. These challenges require careful monitoring and review, including at government level. Appropriate mathematics support for schools/colleges post 2021 should be offered, alongside support to overcome these challenges.

### References

- JCQ. (2019). A level and AS Results Summer 2019. Retrieved from <https://www.jcq.org.uk/examination-results/a-levels/2019/main-results-tables>
- Lee, S., Lord, K., Dudzic, S. & Stripp, C. (2018). *Investigating the impact of curriculum and funding changes on level 3 mathematics uptake: Comparison of A level Mathematics/ Further Mathematics and Core Maths uptake in 2016-17 and 2017/18*. Trowbridge: MEI.
- Lord, K. & Lee, S. (2016). MEI Insights VI: The Further Mathematics Support Programme. *Mathematics in School*, 45(3), 9-11.
- Noyes, A. & Adkins, M. (2017). *Rethinking the value of Advanced Mathematics Participation: Final Report*, Nottingham: The University of Nottingham.
- Smith, A. (2017). *Report of Professor Sir Adrian Smith’s review of post-16 mathematics*. London: Department for Education