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Report

Evaluation of the Advanced Mathematics Support Programme

Research report

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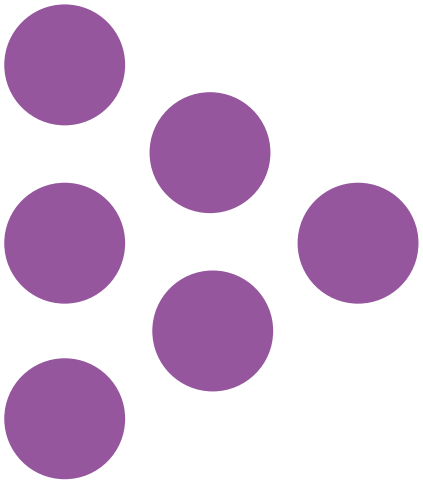

Evaluation of the Advanced Mathematics Support Programme (AMSP): Research report

Matt Walker, Suzanne Straw, Eleanor Bradley, Lorna Jones and Jennie Harland

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By the National Foundation for Educational Research,

The Mere, Upton Park, Slough, Berkshire SL1 2DQ

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Executive Summary

In November 2018, the National Foundation for Educational Research (NFER) was commissioned to undertake a mixed-methods external evaluation of the Advanced Mathematics Support Programme (AMSP). The summary below focuses on the main findings from three key elements of the evaluation.

About the AMSP

The AMSP is a government-funded initiative managed by Mathematics in Education and Industry (MEI). It aims to increase participation in Core Maths, AS/A level Mathematics and AS/A level Further Mathematics, and improve the teaching of these Level 3 mathematics qualifications.

The AMSP started on 1 May 2018 and provides national support targeted at teachers and students in all state-funded schools and colleges in England. Additional support is given to those in priority areas to boost social mobility, so that, whatever their gender, background or location, students can choose their best mathematics pathway post-16, and have access to high-quality mathematics teaching.

About the evaluation

The aims of the evaluation were to explore schools'/colleges' and teachers':

- reasons for engagement in the AMSP
- participation in the AMSP
- views on what is working well, challenges and areas for development
- perceptions of shorter-term outcomes and longer-term impacts.

The evaluation included:

- a large-scale survey of 717 teachers of Level 3 mathematics qualifications, each from a different school or college
- initial telephone interviews with Mathematics Leads and teachers from 18 schools and colleges from across England[1]
- follow-up case-study visits to 15 schools and colleges, which included consultations with Mathematics Leads, mathematics teachers and students.

[1] While the AMSP does offer enrichment activities for students aged 11-16 (to encourage students to continue to study mathematics beyond GCSE), the programme's focus is on supporting the teaching and delivery of post-16 mathematics. As a result, only teachers from institutions that offered post-16 mathematics qualifications were invited to participate in the survey. By contrast, one 11-16 institution was included in the case-study sample.

Key findings from the evaluation

Most survey respondents reported that their schools and colleges were offering AS/A level Mathematics and Further Mathematics, while only a minority were offering Core Maths.

Survey respondents reported that the Level 3 mathematics qualification being most widely offered to students in the academic year 2018/19 was A level Mathematics, which 96 per cent of respondents said they were offering. This was followed by A level Further Mathematics (78 per cent), AS level Mathematics (62 per cent), and AS level Further Mathematics (56 per cent). Level 3 Core Maths was less widely offered, with about four out of ten respondents (38 per cent) reporting that their institutions were currently offering this.

Given the importance of A level Mathematics and Further Mathematics to respondents' host institutions, it is perhaps not surprising that both student- and teacher-focused institutional priorities were reported to be focused on these two subjects.

Survey respondents indicated that their top three **student-focused priorities** were to:

- maintain student participation rates in A level Mathematics (44 per cent)
- increase student participation rates in A level Mathematics (37 per cent)
- increase student participation rates in A level Further Mathematics (36 per cent).

Survey respondents indicated that their top two **teacher-focused priorities** were to:

- improve the quality of A level Mathematics/Further Mathematics teaching (46 per cent)
- increase their capacity to teach A level Mathematics/Further Mathematics (35 per cent).

By contrast, Core Maths did not appear to be a priority for most survey respondents. For example, the majority reported that neither increasing student participation in the subject nor increasing the capacity to teach it was a current priority (59 and 65 per cent respectively).

Most survey respondents (74 per cent) reported that their schools and colleges had found out about the AMSP activities through registering with the programme.

In addition, about two-thirds of respondents (65 per cent) found out through previous involvement with the Further Mathematics Support Programme (FMSP), while about four out of ten respondents also reported finding out about the programme's activities though Area Coordinators (40 per cent), emails from the AMSP (39 per cent) and by signing up to the 'Stay-informed list' (37 per cent) on the programme website.

Survey respondents had engaged in a range of AMSP activities, with the most frequently accessed including enrichment for students aged 16-19, the use of teaching resources for AS/A level Further Mathematics and professional development for AS/A level Mathematics and Further Mathematics.

In terms of student support, just over half of responding teachers (54 per cent) reported accessing 'enrichment for students aged 16-19 (including Senior Team Mathematics Challenge)', while a

slightly smaller proportion (47 per cent) reported accessing 'enrichment for students aged 11-16 years (including Maths Feast competition)'.

In terms of teacher professional development, most survey respondents reported that they had made 'use of teaching resources for AS/A level Further Mathematics accessed via the Integral online platform' (62 per cent). Just over half (53 per cent) also reported accessing 'professional development for AS/A level Mathematics and/or Further Mathematics'.

Regarding dedicated support for schools, about three out of ten respondents (28 per cent) reported accessing 'information, guidance and/or advice from the AMSP Area Coordinator, central team or website', while only four per cent reported having a 'tailored Participation Plan for Level 3 Mathematics'.

Survey and case-study respondents rated the quality of AMSP provision very highly.

For example, for all four forms of '**student support and tuition'** that survey respondents were asked about, 95 per cent of respondents or more rated the quality as 'very good' or 'good'. A similar picture emerged for support received as part of **'teacher professional development'**, with the proportion of respondents reporting this was 'very good' or 'good' averaging around 90 per cent or better for most of the forms of support listed.

The only instances where less than 90 per cent of respondents rated the training as 'very good' or 'good' were 'professional development for Core Maths' (87 per cent), 'teacher network meetings' (84 per cent), and the 'use of teaching resource for Core Maths' (77 per cent). However, these are still high ratings.

Most case-study respondents were similarly enthused about the support they had accessed. Typical comments included: 'It's a godsend' and 'It's an essential place to go for maths teachers'.

While most survey and case-study respondents were positive about the AMSP support they had accessed, some challenges were reported in relation to schools and colleges engaging with AMSP provision.

The main challenges related to schools and colleges releasing staff and students from school. For example, the single greatest challenge, with 39 per cent of survey respondents responding 'to a large' or 'very large extent', was the **'cost or availability of teacher cover'**. This was followed by 'releasing teachers to participate in professional development' and 'releasing teachers to take students to enrichment events', both reported 'to a large' or 'very large extent' by one-third (33 per cent) of respondents. Similarly, case-study interviewees reported experiencing very few challenges in engaging with AMSP provision, which were in the AMSP's control, with most being internal challenges within schools/colleges, such as issues in releasing staff and teacher time to explore what AMSP had to offer and organise student enrichment activities.

A range of suggestions were made for how the AMSP could be made even better.

In terms of **teacher professional development**, some survey respondents suggested they would have liked a greater focus on pedagogy within the training they had received, whether that was online or face-to-face. Another suggestion was that teachers who were planning to deliver AS/A level Mathematics for the first time should be allowed to attend the Teaching A level Mathematics (TAM) course in the previous academic year. This, it was argued, would help them better prepare,

but the view of some respondents was that this course was only available to teachers who were already teaching AS/A level Mathematics.

Suggestions were also made for improvements to the AMSP's **student support** offer, including a request for more tutorials and resources to support the core content for AS/A level Mathematics. Some teachers also wanted to see greater differentiation within these materials, so they could better cater for different student groups. In addition, teachers suggested that enrichment activities could be advertised earlier, perhaps within a yearly events calendar, to allow more time for planning student attendance.

Case-study interviewees reported experiencing a range of outcomes resulting from participation in AMSP activities.

Mathematics Leads and teachers reported a range of outcomes 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
- 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 outcomes 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. In turn, these outcomes were seen to be leading to increases in students' engagement, enjoyment and understanding of mathematics and were expected ultimately to impact on levels of attainment.

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
- 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.

Given most survey respondents' very positive experiences of the programme, it is perhaps not surprising that the vast majority (95 per cent) reported that they would recommend the AMSP to other schools and colleges.

Similarly, the vast majority of survey respondents (83 per cent) reported they planned to continue their involvement with professional development and support for staff over the next 12 months, with about one in seven (14 per cent) reporting they did not know. However, survey respondents appeared to be less certain regarding student support and tuition. Just over half (55 per cent) reported that they would continue to be involved, while almost a third (31 per cent, 221 respondents) reported they did not know if they would continue with these activities or not). However, it is worth noting that of the 221 respondents who indicated that

they did not know if they would continue with student support, almost four out of ten (38 per cent) had not actually engaged with any form of AMSP student support, meaning there was no activity for them to continue with.

Conclusions

The findings presented in this report demonstrate the high regard that teachers who are accessing AMSP provision have for the programme, as well as the range of outcomes being experienced by both teachers and students. Indeed, survey and case-study respondents rated the quality of the AMSP provision they had accessed very highly. However, despite these positive outcomes, the programme also faces some challenges. In terms of engaging schools and colleges, the single greatest challenge appears to be related to the release of teachers and students to undertake activities, and the costs associated with this. These internal challenges within schools and colleges faced by a provider of external support are not unique to the AMSP, but reflect the budgetary, time and workload constraints that many schools/colleges and teachers feel they are under (Walker *et al.,* 2019). In addition, findings from the survey suggest that offering Core Maths does not appear to be a priority for many schools/colleges, which, at the programme level, makes achieving the AMSP's goal of increasing student participation rates in the subject challenging.

Recommendations

The evaluation's findings give rise to a number of recommendations for the AMSP.

Core Maths

1. Given the ongoing challenge of increasing the number of schools/colleges offering Core Maths, the AMSP should continue to make the case to senior leaders within schools/colleges for the benefits of offering Core Maths, including how they might draw on the advanced maths premium to support its introduction. This could include drawing together some best practice examples of schools and colleges which have effectively introduced Core Maths, including how they have tackled staffing, timetabling and financial challenges and the benefits and outcomes for students.
2. The AMSP should also seek to further increase and promote universities' recognition of Core Maths to both stimulate supply from schools/colleges as well as demand from students. In addition, the programme team should draw together data on those universities that recognise it, which will help persuade schools/colleges to offer it and students to take it.
3. DfE should consider ways to secure long term and more stable funding for schools to support the delivery of Core Maths.

Teacher professional development

4. Releasing teachers to participate in professional development was revealed as one of the main challenges facing schools/colleges. To help address this, the AMSP should look for opportunities to expand its on-demand professional development (ODPD) offer. This is the most flexible way of teachers accessing professional development and was rated highly in the teacher interviews.

5. The AMSP could develop further professional development and resources to support teaching of AS/A level Mathematics and Further Mathematics, including on effective pedagogies and schemes of work. Further tailoring of content to the specifications of different awarding bodies would also be beneficial.
6. To help better prepare would-be AS/A level Mathematics teachers, the AMSP should consider opening up the Teaching AS/A level Mathematics course (the TAM course) to teachers who are not yet teaching it, but are planning to, and/or explore whether offering a separate course for this group would be appropriate.
7. To help build networks between teachers in different schools/colleges, the AMSP could also consider setting up an online forum to enable teachers to voice questions to professional development leads, access support from other institutions and share learning and effective practice.

Student support

8. The AMSP could consider offering more enrichment activities targeted at 'middle ability' students, as well as more targeting of pre-16 enrichment activities at potential Core Maths students. This could include tasters of Core Maths content and examples of how students will benefit from taking it.
9. There seems to be a demand for more whole year group enrichment activities delivered within schools. Whilst this would be resource intensive, it is worth considering whether this demand could be accommodated, particularly within priority schools.
10. The AMSP could provide schools and colleges with greater notice of enrichment activities, perhaps within a yearly events calendar, to allow more time for planning student attendance.

Future evaluation activities

11. This report has explored the perceptions of the programme's key stakeholders, and the findings demonstrate the high regard that teachers who are accessing AMSP provision have for the programme. However, in order to undertake a more comprehensive assessment of the impact of the AMSP, an impact evaluation should also be undertaken to drill down into the effect of the programme over and above what might have happened anyway and to determine the extent to which any changes can be directly attributed to the AMSP. Approaches such as quasi-experimental and pre- and post-intervention designs could be considered.
12. As mentioned above, more research could be undertaken on exploring the benefits of Core Maths and how challenges to its introduction are being effectively tackled.

1 Introduction

1.1 Aims of the evaluation

In November 2018, the National Foundation for Educational Research (NFER) was commissioned to undertake a mixed-methods external evaluation of the Advanced Mathematics Support Programme (AMSP). This report presents the findings from the evaluation.

The aims of the evaluation were to explore schools'/colleges' and teachers':

- reasons for engagement in the AMSP
- participation in the AMSP
- views on what is working well, challenges and areas for development
- perceptions of shorter-term outcomes and longer-term impacts.

1.2 Advanced Mathematics Support Programme (AMSP)

The AMSP is a government-funded initiative managed by Mathematics in Education and Industry (MEI). It aims to increase participation in Core Maths, AS/A level Mathematics and AS/A level Further Mathematics, and improve the teaching of these Level 3 mathematics qualifications.

The AMSP started on 1 May 2018 and provides national support targeted at teachers and students in all state-funded schools and colleges in England. Additional support is given to those in priority areas to boost social mobility, so that, whatever their gender, background or location, students can choose their best mathematics pathway post-16, and have access to high-quality mathematics teaching.

The AMSP is staffed by a national team, a team of Regional Leads across nine English regions (East of England, London and the South East, North East, North West, East Midlands, West Midlands, South, South West, Yorkshire and the Humber), and more than 40 Area Coordinators (ACs). The Regional Leads manage the Area Coordinators in their area and liaise with Maths Hubs, Regional Schools Commissioners and Opportunity Areas.

The Area Coordinators are employed by partner organisations (mainly universities, but some are based in schools) on behalf of MEI and are responsible for coordinating support for Level 3 mathematics provision in their local area. This includes organising local meetings and networks for Level 3 mathematics teachers, arranging enrichment and professional development events and drafting and agreeing Participation Plans for priority schools and colleges. There are three types of priority school/college: a) Priority list schools/colleges, which are institutions that had entries for A level Mathematics in 2016/17, had no entries for A level Further Mathematics in 2016/17, but had entries for A level Further Mathematics in any of the three previous years; b) schools/colleges in the 12 Opportunity Areas; and c) Low Participation Area Schools/Colleges – these are schools/colleges within 20 local authorities designated as low participation areas in terms of advanced mathematics. Participation Plans

identify institutions' mathematics needs and priorities and the AMSP activities that will support them.

The AMSP provides a wide range of support including:

- **student support and tuition:** enrichment activities for students aged 11-16 (to encourage students to continue to study mathematics beyond GCSE) and 16-19 (to encourage students to progress to degree programmes and careers in mathematics and other STEM disciplines); tuition for AS/A level Further Mathematics; year 12/13 problem-solving support and tuition for university entrance exams
- **teacher professional development and support:** both short and sustained professional development programmes for GCSE Mathematics Higher Tier, AS/A level Mathematics and Further Mathematics and Core Maths; access to teaching resources e.g. Integral online resources and resources for Core Maths; live online professional development (LOPD) and on-demand professional development (ODPD); teacher network meetings; and professional development for supporting students with university entrance test preparation and higher level problem-solving
- **dedicated support for schools:** tailored Participation Plans for Level 3 mathematics (as described above); information, guidance and/or advice from AMSP Area Coordinators, Central Team or website.

The AMSP aims to increase participation in the advanced mathematics qualifications - Core Maths, AS/A level Mathematics and AS/A level Further Mathematics - and support improvement in the teaching of these qualifications. The mechanisms by which the programme is designed to bring about its intended impacts are outlined in the Theory of Change (see Appendix 2).

1.3 Recent reforms to mathematics education in England

The rollout of the AMSP follows significant recent changes to both the GCSE and A level curricula and assessment regimes in England. In July 2017, the first cohort of students sat the new GCSE mathematics curriculum, which involves more content and the introduction of more difficult topics, a greater emphasis on problem-solving and mathematical reasoning, with all exams now taken at the end of the course. In September 2017, students embarked on reformed AS and A level Mathematics, with qualifications becoming linear, meaning that all the exams are completed in the same series at the end of the course of study. In addition, as with all other reformed subjects, the new A level Mathematics was decoupled from AS, meaning AS units no longer count towards A level grades. These important developments have a bearing on teachers' engagement with the AMSP, as discussed throughout the report.

1.4 Previous Level 3 mathematics support programmes and funding

Preceding the AMSP were the Further Mathematics Support Programme (FMSP), the Core Maths Support Programme (CMSP) and funding for Early Adopters of Core Maths.

The FMSP was also delivered by MEI. It was established in 2009 and provided mathematics support for teachers and students in schools and colleges. It provided a wide range of

professional development for AS/A level Further Mathematics, AS/A level Mathematics, GCSE Mathematics and university entrance examinations via extended courses, single day events and an extensive programme of live, online interactive courses. Previous research has highlighted the quality and value of the activities that were delivered to schools and the positive regard with which stakeholders held the FMSP (Boylan *et al.,* 2016).

The Core Maths Support Programme (CMSP) was delivered by the Centre for British Teachers (CfBT), now the Education Development Trust (EDT). Introduced in September 2014, Core Maths is intended for students who have passed GCSE Mathematics at grade 4 or better, but who have not chosen to study AS or A level Mathematics. It can be studied in a single year or over a two-year period and can be taken alongside A levels or other qualifications, including vocational courses. The qualification is designed to prepare students for the mathematical demands of work, study and life. The first examinations took place in the summer of 2016. The CMSP provided support to teachers to promote and teach Core Maths. This included professional development and support groups provided within a range of Maths Hub areas[2].

The Early Adopters of Core Maths were around 150 schools and colleges, each of which received funding to offer Core Maths qualifications to their students and lead the development of teaching and learning for Core Maths. Teaching started in autumn 2014. The level of funding differed by institution, depending on their activities, to a maximum of £30,000 for an individual institution over two and a half financial years[3].

2 Methodology

This section provides details on the evaluation methodology and the report structure.

2.1 Overview of methodology

The evaluation data that has been collected and analysed for this report includes:

- a paper and online survey of schools and colleges that was administered in May/June 2019
- initial telephone interviews with schools and colleges which were undertaken between January 2019 and July 2019
- follow-up visits to the same schools and colleges between November 2019 and January 2020
- telephone interviews with teachers participating in ODPD which were undertaken in June/July 2019

[2] Analysis reveals that 88 per cent of survey respondents reported that their school or college had previously been involved with the FMSP, while 20 per cent reported they had been involved with the CMSP.

[3] Analysis reveals that nine per cent of survey respondents reported that their school or college had received funding as an Early Adopter of Core Maths.

- a small-scale consultation of key stakeholders that was administered in May/June 2019.

In addition, at both the beginning and end of the evaluation, interviews were undertaken with the AMSP strand leads responsible for teacher support, raising participation (student support), Core Maths resources and priority schools. One of the main talking points to emerge from these discussions was the delivery of Core Maths. A summary of the main points is provided in Section 3.1.3.

2.2 About the survey

The main survey of schools and colleges was distributed online and on paper and was sent to 1566 teachers of Level 3 mathematics qualifications across England[4]. The survey was administered between May and June 2019. All of the teachers were registered with the AMSP and were from different state-funded schools and colleges that offered post-16 mathematics qualifications. From this initial sample, 717 completed responses were received. This equates to a 46 per cent response rate, exceeding the target response rate of 33 per cent. Analysis of selected school- and college-level characteristics of both the dispatch and the achieved samples shows a close match, suggesting those teachers that responded to the survey are representative of those in the larger sample (see Appendix 2). However, while the AMSP focuses primarily on improving the teaching of Level 3 mathematics qualifications, some 11-16 schools also access AMSP support, and as these schools were not included in the survey sample, some caution should be taken when generalising the findings to all AMSP users.

Additional analysis revealed that about a fifth of respondents (21 per cent) were working in AMSP designated 'priority' schools/colleges[5].

In terms of survey respondents' roles: 51 per cent were Heads of Mathematics; 21 per cent were Key Stage 4/Key Stage 5 Coordinators; 14 per cent were mathematics teachers; 12 per cent were Assistant Heads of Mathematics; and two per cent held other roles such as Advanced Skills Teacher and Gifted and Talented Coordinator. We identified their roles using their name and school URN and matched to MEI administrative information. It is worth noting that this information was not available for 152 respondents.

The survey explored a range of questions including on: schools'/colleges' priorities for Level 3 mathematics, involvement with AMSP provision, perceptions of the quality of AMSP provision, challenges in engaging with the AMSP, the extent to which the AMSP will help

[4] Analysis of selected cross-tabulations revealed that in the majority of cases, teachers answering the paper questionnaire did not respond differently to those answering online. There is no evidence of systematic differences between those who answered online versus those who answered on paper. See Tables 13, 14 and 15 in the companion document.

[5] There are three types of priority school/college: a) Priority list schools, which are schools that had entries for A level Mathematics in 2016/17, had no entries for A level Further Mathematics in 2016/17, but had entries for Further Mathematics in any of the three previous years; b) schools in Opportunity Areas; c) Low Participation Area Schools – these are schools within 20 local authorities designated as low participation areas in terms of advanced mathematics.

schools/colleges achieve their priorities, their plans for continued involvement in the AMSP, and prior involvement in predecessor initiatives.

2.3 About the interviews with case-study schools and colleges

Telephone interviews were conducted with senior mathematics staff in 18 case-study schools and 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 further education (FE) college. All but one of these institutions offered post-16 mathematics provision. The case studies were selected using data provided by MEI. This allowed the research team to include institutions that had accessed teacher professional development, student enrichment, or both, and to ensure that we had representation from institutions in different parts of the country, as well as priority schools. The sample included: an Assistant Headteacher with responsibility for the curriculum; eight Heads of Mathematics/Mathematics Curriculum Leaders; two Deputy Heads of Mathematics; three Key Stage 5 Coordinators/Leads; one Coordinator of Mathematics and Further Mathematics; and three mathematics teachers, one of whom was an early career teacher. Throughout the remainder of this report, we refer to this group as 'Mathematics Leads'.

The interviews explored schools' and colleges' priorities for Level 3 mathematics, participation in the AMSP and predecessor programmes, views on what is 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 and colleges between November 2019 and January 2020. The intention was to visit all 18, but unfortunately, this could not be arranged. The visits involved interviews with a Mathematics Lead or senior staff member responsible for the delivery of Level 3 mathematics qualifications (most of whom we had interviewed previously), 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. The additional interviews allowed us to explore any subsequent engagement case-study schools and colleges had had with the AMSP and the views of students and teachers on the outcomes and impacts resulting from their involvement.

Details on the characteristics of the case-study schools and colleges involved in the initial interviews and follow-up visits can be found in Appendix 4.

2.4 About the ODPD interviews

In July 2019, eight telephone interviews were conducted with teachers who were currently accessing, or had previously accessed, the on-demand professional development (ODPD) provided by the AMSP. This is a relatively new offer and that is why it is being evaluated.

Of the eight interviewees, two were currently teaching A level Mathematics, two were teaching A level Further Mathematics, and four were teaching both A level Mathematics and

Further Mathematics. Interviewees taught across a variety of specialisms, for example, pure mathematics, applied mathematics and statistics. None of the participants reported that they taught Core Maths. The majority of participants (six out of eight) had no additional responsibilities in relation to Level 3 mathematics, one was a lead teacher in Further Mathematics, and one was a second in department who was also Key Stage 5 coordinator.

The interviews explored: which ODPD course teachers had undertaken or were undertaking and why; why they had chosen to undertake this type of professional development; how participants found out about the courses; the time spent on the courses; and whether the courses and course materials were useful. Other questions were used to ascertain: how the participants collaborated with others on the courses; the general experience of using the ODPD courses; suggestions for how the courses could be improved; the benefits of undertaking the courses; and whether participants' learning had yet been embedded into their professional practice. Finally, participants were asked for any advice they might offer to others who might be considering undertaking the AMSP ODPD and for any other comments and observations they had.

2.5 About the stakeholder consultation

During May/June 2019, 41 MEI key stakeholders were invited to complete a short online consultation comprising six questions. The questions explored stakeholders' awareness of the AMSP and views on: the extent to which the AMSP is meeting the needs of teachers of advanced mathematics qualifications and their students; their perceptions of the impact of the AMSP; what more the AMSP could be doing to support teaching and learning and increase participation in post-16 mathematics qualifications; and to what extent the AMSP complements other Level 3 mathematics support for schools and colleges.

The stakeholder list was supplied by MEI and included representatives from business, learned societies, AMSP partner organisations, Maths Hubs, awarding bodies, universities and other STEM organisations. Thirteen responses were received representing a response rate of 32 per cent. Of the responses received, one respondent was from a STEM organisation, two were from Maths Hubs, four were from universities, three were from partner institutions and three were from professional bodies.

2.6 Report structure

Chapter 3 intersperses the findings from the main teacher survey with the findings from the initial telephone interviews and follow-up visits with schools and colleges. As such, this chapter provides a broad overview of respondents' experiences of accessing AMSP support, together with more detailed insights into selected respondents' experiences. Selected cross-tabulations from the survey, which variously explore differences between priority and non-priority schools, region, and schools'/colleges' levels of engagement with the AMSP, were also undertaken, and the findings are summarised in this report. The data tables behind this analysis have been published in a separate companion document. Chapter 4 explores the experiences of eight teachers who have participated in on-demand professional development (ODPD), and Chapter 5 explores the findings from a small-scale consultation of key stakeholders. The report concludes with Chapter 6, which presents conclusions and recommendations. Further information is available in the appendices,

which include three standalone case-study write-ups that provide examples of the impact of AMSP support in different settings (see Appendix 1).

3 Findings from the main survey and case-study interviews

This section details the findings from the survey of 717 teachers. It also draws on case-study data involving an initial telephone interview with a Mathematics Lead in 18 different schools/colleges. Fifteen of these institutions were subsequently followed-up with a visit in which interviews were conducted with the Mathematics Lead and/or a senior leader or senior mathematics teacher and two group interviews were undertaken, one with teachers and one with students (where relevant) who had taken part in AMSP activities.

3.1 Current mathematics provision and priorities

3.1.1 Provision

Survey respondents were asked to provide details of the range of Level 3 mathematics qualifications their schools and colleges were offering in the academic year 2018/2019. The findings are presented in Table 1 below.

From the list of qualifications presented, the most common was A level Mathematics, which 96 per cent of respondents said they were offering. This was followed by A level Further Mathematics (78 per cent), AS level Mathematics (62 per cent), and AS level Further Mathematics (56 per cent). Level 3 Core Maths was the least common, with about four out of ten respondents (38 per cent) reporting that their institutions were currently offering this. See Table 1 below.

Table 1. Level 3 mathematics qualifications being offered to students in the academic year 2018/19

	Yes		No		Don't know	
	N	%	N	%	N	%
A level Mathematics	686	96	31	4	0	0
A level Further Mathematics	549	78	153	22	1	0
AS level Mathematics	428	62	264	38	1	0
AS level Further Mathematics	385	56	301	44	4	1
Level 3 Core Maths	255	38	410	61	6	1

Percentages may not sum to 100 due to rounding
Missing responses are excluded
Source: NFER survey of teachers that have received support from the AMSP, 2019

The findings from the case-study interviews largely mirrored those from the survey. Of the 18 case-study schools where initial interviews were conducted, 17 reported offering A level Mathematics, 15 also offered A level Further Mathematics, and just four also offered Core Maths (for one of these schools, Core Maths was newly offered for the 2019-20 academic year). In a few cases where courses had been offered, they had not always run in recent years due to low or no take up from students.

Across the case-study schools and colleges, student attainment in Level 3 mathematics ranged from below national average attainment through to above national average attainment. Interviewees tended to identify a male-bias in the take up of mathematics post-16, with underrepresentation of females, however this trend was countered by two schools that reported a more balanced gender profile.

Interviewees alluded to some of the challenges to student participation in post-16 mathematics, including: the move away from AS level Mathematics which may be more accessible for some students; higher expectations for GCSE Mathematics which discourage students from further study; and students being attracted to alternative A level Mathematics provision in neighbouring schools (particularly prestigious grammar schools).

3.1.2 Priorities

Survey respondents were also asked to comment on their institution's current mathematics priorities for students and teachers. In general, responding teachers felt more strongly about what was not a priority than what was, as can be seen from the distribution of responses in Table 2 below.

Respondents indicated that the three most frequently cited student-focused priorities were to:

- maintain student participation rates in A level Mathematics (44 per cent)
- increase student participation rates in A level Mathematics (37 per cent); and
- increase student participation rates in A level Further Mathematics (36 per cent).

However, it should be noted that similar proportions of teachers (about four out of ten) reported that these same areas were not currently a priority for action, indicating that there was no strong consensus amongst responding teachers regarding the main student priorities in their settings.

There were two areas in which there was stronger agreement. The first was Core Maths, where the majority of teachers agreed that neither maintaining nor increasing student participation in the subject was a current priority (74 and 59 per cent respectively). The second area was increasing the participation of girls in Level 3 mathematics courses, which just over half of respondents (53 per cent) reported was also not a current priority.

Survey respondents indicated that their two most frequently cited teacher-focused priorities were to:

- improve the quality of A level Mathematics/Further Mathematics teaching (46 per cent); and
- increase their capacity to teach A level Mathematics/Further Mathematics (35 per cent).

However, as with the student priorities, notable proportions of teachers reported that these same areas were not currently a priority for action (32 and 44 per cent respectively), indicating that there was no strong consensus amongst responding teachers regarding the main teacher priorities in their settings.

As with the student priorities, there were two areas in which there was stronger agreement. The first was, again, Core Maths, where the majority of teachers agreed that neither improving the quality of Core Maths teaching nor increasing the capacity to teach Core Maths was a current priority (70 and 65 per cent respectively). The second area was increasing the range of Level 3 mathematics courses/qualifications on offer, which about two thirds of teachers (67 per cent) reported was also not a current priority. See Table 2 below.

Table 2. Current priorities for action in survey respondents' schools and colleges

Current Priorities	Of concern, priority for action		Of concern but not currently priority for action		Not a current issue/ priority for action	
	N	%	N	%	N	%
	Student priorities					
Maintaining student participation in A level Mathematics	313	44	143	20	253	36
Increasing student participation in A level Mathematics	265	37	132	19	317	44
Increasing student participation in A level Further Mathematics	255	36	181	26	274	39
Providing mathematics-related enrichment activities for students	245	34	260	36	210	29
Maintaining student participation in A level Further Mathematics	234	33	179	26	290	41
Supporting students with university entrance exams in mathematics	209	29	247	35	259	36
Increasing student participation in Core Maths	177	25	114	16	410	59
Increasing participation of girls in Level 3 mathematics courses	170	24	163	23	377	53
Maintaining student participation in Core Maths	94	14	86	12	514	74
	Teaching priorities					
Improving the quality of A level Mathematics/Further Mathematics Teaching	329	46	158	22	228	32
Increasing capacity to teach A level Mathematics/Further Mathematics	246	35	155	22	312	44
Increasing capacity to teach Level 3 Core Maths	117	17	127	18	461	65
Improving the quality of Core Maths teaching	121	17	90	13	495	70
Increasing the range of Level 3 mathematics courses/qualifications on offer	95	13	137	19	478	67

Percentages may not sum to 100 due to rounding
Missing responses are excluded
Source: NFER survey of teachers that have received support from the AMSP, 2019

In the initial interviews and case-study visits, Mathematics Leads were asked what their current priorities were for post-16 mathematics. Priorities tended to be similar at both time-points.

Interestingly, and in contrast to survey respondents, more than half of the case-study schools and colleges researchers visited were prioritising Core Maths. Four schools were already offering it, and wanted to build on their existing offer, and four were in early discussions with senior leaders about introducing it, including thinking about how to accommodate staffing and budgetary requirements. Where Core Maths was already being offered, there appeared to be a high level of senior leadership commitment to sustaining the delivery of this subject. In descending order of frequency, Mathematics Leads reported that their current priorities were:

- **introducing or increasing the numbers studying Core Maths**, including increasing the capability of staff to teach it and convincing school leaders that offering Core Maths would be financially viable (eight respondents)

  We know that this year we have got to carry on growing that [Core Maths] *and we would like to have more groups going through to next year … there are lots of students taking vocational courses who would also really benefit from Core Maths and so moving forward this is an area we are going to try to market. Certain vocational subjects like Applied Science would work well with Core Maths…* (Sixth form college)

  Promoting and encouraging more students to take Core Maths has been a focus again this year…our open evening is in a couple of weeks so we'll have a big push on it [Core Maths] *there. We'll get some of the students currently doing it there, because they started it and are really enjoying it…my vision at the moment is that we can provide maths education that caters for everyone regardless of their starting point…Core Maths has been a natural filler.* (11-18 institution)

  Moving forwards a lot of students will find they have got to do some maths as part of a degree or an apprenticeship or something and it [Core Maths] *enables them to still move forwards with their maths. And I think the critical analysis aspect of it is really useful in real world context…* (FE College)

- **ensuring staff have the confidence and expertise to teach the relatively new A level Mathematics** syllabus (including the new requirement to become familiar with a large dataset during the course of study), which includes both upskilling existing staff and new recruits to ensure secure subject knowledge (six respondents)

  Ensuring we have staff that are fully qualified to teach every aspect of the new A level, particularly with the changes with mechanics, so that's our main one [priority], *but also I suppose improvements with results but that's going to come with improvements to teaching and learning* (11-18 institution)

- **starting, sustaining and/or improving the delivery of A level Further Mathematics**, which includes maintaining or augmenting the expertise of current and new teachers through professional development. This includes ensuring all staff have the required expertise to teach mechanics and/or statistics (six respondents).

Our priorities are to sustain the delivery in the longer-term – ensuring that staff are able and capable, from a skills and experience point of view, to be able to deliver it [Further Maths]. (11-18 institution)

- **increasing the numbers of girls taking A level Mathematics and, in a smaller number of cases, Further Mathematics** (five respondents)

  I would like to see more girls [in Further Mathematics]. *If we go into a Further Maths class typically we will have one girl, maybe two, and we might have a class of 7 to 12* [students]. (11-18 institution)

- **increasing the numbers of students taking A level Mathematics and Further Mathematics** (five respondents)

  What we do is we go out and we do go to secondary schools to try and push the maths and in there we do talk to them about the fact that Further Maths can be a fourth option. (Sixth form college)

  We are trying to get students more engaged with maths and these feasts and the different things [that AMSP provide] *have really helped us, especially for the uptake of Further Maths* (11-16 institution)

- **improving A level Mathematics results** (five respondents)

  They've not been as good as we'd hope so we are really looking to power on and get better results at A level [Maths] (All through institution)

  GCSE grade 7s were underachieving. There was a lot of support in place for those with grade 6, those with grade 8/9 were fine but there was a gap so this year we focused on extending the support and the challenge to those with grade 7 (Sixth form college)

Individual respondents reported a range of other priorities:

- offering A level Further Mathematics (with the support of a tutor sourced through AMSP)
- increasing the department's ALPS (A level Performance System) score
- reviewing what and why they are doing things
- improving GCSE Mathematics grades
- getting more time on the timetable to teach A level Mathematics to account for the problem solving element and the difficulty of the exams
- improving A level Further Mathematics grades
- preparing for the linear mathematics exam, working with other institutions
- making better use of technology
- focusing on mastery lower down the school to improve post-16 take-up and attainment.

3.1.3 Core Maths: a brief discussion

The fact that the survey data suggests that offering Core Maths does not appear to be a priority for many schools/colleges is a challenge for the AMSP, as increasing participation in Core Maths is one of its goals. However, the interviews with teachers and the AMSP strand

leads, together with the findings from other research, suggest that the picture is more complex than schools/colleges simply not wanting to offer it. AMSP strand leads spoke of encountering a number of challenges including:

- lack of awareness, particularly amongst senior school leaders, about what the qualification entailed
- concerns from schools regarding how it would be funded, timetabled and staffed
- concerns from schools about whether there would be sufficient demand from students to make it viable
- difficulty in persuading universities to recognise it, and further education providers to offer it
- the perception that some schools/colleges have that Core Maths is less important/relevant than other subjects, such as the Extended Professional Qualification (EPQ), which is worth more UCAS points and requires fewer guided learning hours[6].

The case-study interviews revealed that while many school/college Mathematics Departments were keen to offer Core Maths, senior school and college leaders were often less convinced, for the reasons outlined above. In addition, there was little evidence to suggest that the introduction of the advanced maths premium (AMP), which is designed to support the education sector to grow the number of students studying mathematics qualifications to level 3 (Education and Skills Funding Agency, 2019), was encouraging schools/colleges to increase numbers by offering Core Maths. For example, of the 12 case-study senior staff members for mathematics that spoke about the premium, none said they were motivated to increase student numbers in order to receive the premium, with two saying this was not a 'driving factor', and another saying: 'I don't think we look at it from that point of view; I think we try to increase the numbers because we see the value in doing that'. This was despite all but one reporting that they wanted to further increase the number of students undertaking Level 3 mathematics qualifications. One interviewee also expressed concern about putting staffing in place based solely on funding from the premium, as the funding could fluctuate from one year to the next and therefore was potentially unreliable. This finding was supported by evidence from the survey. This found that of those teachers who reported they had heard of the AMP, over half (53 per cent) were planning to increase student numbers anyway, while only about one in ten (11 per cent) reported they (or their institution) had been trying to increase the number of students studying mathematics at Level 3 in order to receive the AMP funding (see Table 3 below).

[6] The EPQ requires 120 guided learning hours, while Core Maths qualifications require 180 hours.

Table 3. Proportion of schools/colleges who have been trying to increase the number of students studying mathematics at Level 3 in order to receive the advanced maths premium

	n	%
We were planning on increasing numbers anyway	289	53
Yes to receive the funding	60	11
No	175	32
Don't know	21	4
		N = 545

Only survey respondents who reported having heard of the AMP were asked this question
Percentages may not sum to 100 due to rounding
Missing responses are excluded
Source: NFER survey of teachers that have received support from the AMSP, 2019

Despite this, there is evidence to suggest that Core Maths is valued by those that study and teach it. Initial findings from the Nuffield-funded project, 'The early take-up of Core Mathematics: successes and challenges', suggest that staff who have been teaching Core Maths are enthusiastic about both the course content and the pedagogical approach used for its delivery, while students coming to the end of their Core Maths course are almost universally pleased they signed up to it (Mathieson and Homer, 2018). Clearly, more needs to be done to promote the take-up of Core Maths, and these efforts need to extend beyond the support offered by the AMSP.

3.2 How schools and colleges found out about the AMSP activities

Most survey respondents (74 per cent) reported that their schools and colleges had found out about the AMSP activities through registering with the programme, which they could do through the programme's website[7].

Previous involvement with the Further Mathematics Support Programme (FMSP) was also a key method of finding out about the AMSP, with this being reported by about two-thirds of respondents (65 per cent). About four out of ten respondents also reported finding out about the programme's activities though Area Coordinators (40 per cent), emails from the AMSP (39 per cent) and by signing up to the 'Stay-informed list' (37 per cent), which is also on the website. See Table 4 below.

[7] https://amsp.org.uk/register

Table 4. How schools and colleges found out about the AMSP activities

	N	%
Registered with the AMSP	533	74
Through previous involvement with the Further Mathematics Support Programme (FMSP)	468	65
AMSP Area Coordinator	289	40
Via an email from the AMSP	282	39
Signed up to AMSP 'Stay informed list'	263	37
AMSP website	201	28
Other websites	15	2

Percentages will not sum to 100 as this is a multiple response question
Missing responses are excluded
Source: NFER survey of teachers that have received support from the AMSP, 2019

Similarly, all but one of the case-study schools and colleges involved in the initial interviews had found out about the AMSP activities through previous involvement in the FMSP and had developed a strong relationship with their Area Coordinator(s) over many years. Many also mentioned receiving regular emails and newsletters alerting them to activities and events. A small number had Participation Plans and some mentioned undertaking their own research via the AMSP website.

3.3 Prior involvement with the FMSP and CMSP

Additional analysis revealed that 88 per cent of survey respondents reported that their school or college had previously been involved with the FMSP[8], while, as mentioned above, all bar one of the case-study schools and colleges had previously been involved in the predecessor programme to the AMSP.

As part of the FMSP, case-study schools and colleges involved in the initial interviews had accessed a range of support, including online lectures, tuition and revision materials, student enrichment, staff professional development, and support to prepare students for university entrance examinations. In many cases, interviewees regarded their involvement with the AMSP as a continuation from their involvement with FMSP, although several noted a broader and more customised support offer as part of AMSP. All interviewees who had received support from the FMSP regarded it as being very effective and commended aspects such as the content, structure, responsiveness and quality of support. Case-study interviewees

[8] In response to a question asking whether survey respondents' schools or colleges had previously been involved with the Further Mathematics Support Programme (Question 14), 88 per cent reported they had, seven per cent reported they had not, and five per cent reported they did not know.

reported that involvement with the FMSP had led to a range of positive impacts on both students' and teachers' mathematics knowledge, confidence, enthusiasm and skills. In this regard, the impacts of the FMSP were reported to be similar to those starting to emerge from the AMSP.

Survey and case-study respondents involved in the initial interviews reported being less familiar with the Core Maths Support Programme (CMSP). For example, only 20 per cent of survey respondents reported that their school or college had previously been involved with the CMSP[9], while just four of the 18 Mathematics Leads taking part in the interviews had engaged with the programme. These interviewees reported that their institutions had accessed teacher professional development, materials and webinars about delivering Core Maths, and had attended networking meetings. This support was regarded as being effective in preparing teachers for delivering Core Maths. Two other schools that were delivering Core Maths but had not received support through the CMSP had accessed alternative support from Maths Hubs. Two other schools recalled receiving some initial information about Core Maths but had not yet proceeded to offer the course.

3.4 AMSP activities in which schools and colleges have been involved

Survey respondents were asked what involvement they had had to date with the AMSP (i.e. between May 2018 and May/June 2019). Respondents' involvement in the different strands of AMSP support are shown in Table 5 below. Given the early stage of the AMSP's development, engagement in the range of activities was high.

[9] In response to a question asking whether survey respondents' schools or colleges had previously been involved with the Core Maths Support Programme (Question 14), 20 per cent reported they had, 68 per cent reported they had not, and 12 per cent reported they did not know.

Table 5. Types of AMSP involvement survey schools and colleges have had

	N	%
Student Support and Tuition		
Enrichment for students aged 16-19 (including Senior Team Mathematics Challenge)	387	54
Enrichment for students aged 11-16 years (including Maths Feast competition)	338	47
Year 12/13 problem-solving support and tuition for university entrance exams	212	30
Tuition for A level Further Mathematics	77	11
Teacher Professional Development and Support		
Use of teaching resources for A level Further Mathematics (via the Integral online resources)	447	62
Professional development for AS/A level Mathematics and/or Further Mathematics	382	53
Teacher Network meetings	294	41
Sustained professional development for AS/A level Mathematics and/or Further Mathematics	178	25
Professional development for Core Maths	159	22
Professional development for GCSE Mathematics Higher Tier	135	19
Live Online (LOPD) on-demand professional development (ODPD)	134	19
Professional development for supporting students with university entrance test preparation and higher level problem solving	107	15
Use of teaching resources for Core Maths (via the AMSP online platform – in development for 2019)	88[10]	12
Dedicated Support for Schools		
Information, guidance and/or/advice from AMSP Area Coordinator, central team or website	199	28
Tailored Participation Plan for Level 3 Mathematics	30	4
		N = 717

Missing responses are excluded
Source: NFER survey of teachers that have received support from the AMSP, 2019

[10] At the time of the survey, just 30 trial schools actually had access to the developing Core Maths platform, suggesting some survey respondents were mistaken in reporting they had access to this resource.

Teacher professional development

Most survey respondents reported that they had made 'use of teaching resources for A level Further Mathematics accessed via the Integral online platform' (62 per cent). Just over half (53 per cent) also reported accessing 'professional development for AS/A level Mathematics and/or Further Mathematics'.

Smaller proportions reported attending 'teacher network meetings' (41 per cent), 'sustained professional development for AS/A level Mathematics and/or Further Mathematics' (25 per cent) and 'professional development for Core Maths' (22 per cent).

Less than two out of ten respondents reported using professional development for 'GCSE Mathematics Higher Tier' (19 per cent), 'live online professional development' (LOPD) or 'on-demand professional development' (ODPD) (19 per cent) or 'professional development for supporting students with university entrance test preparation and higher level problem solving' (15 per cent), or 'teaching resources for Core Maths' (12 per cent).

In initial interviews and during case-study visits, Mathematics Leads were asked about the AMSP professional development teachers had been involved with. The professional development they reported that they or staff members had attended had been accessed in school/college, out of school/college (e.g. courses, workshops and conferences) and online. Many mentioned future professional development that they or their staff were intending to take up.

Teachers had attended a range of sustained courses, one-day courses, ODPD and made use of the resources available to support their teaching from Integral. The most commonly mentioned teacher professional development activities were Teaching Mechanics, accessing Integral resources, TAM and TFM (1 and/or 2). Further details of the AMSP professional development that case-study institutions had accessed over the last year are shown in Table 6 below.

Table 6: Professional development accessed by case-study institutions

Professional development	Number of respondents
Teaching Mechanics	9
Integral resources	8
Teaching A level Mathematics (TAM)	8
Teaching A level Further Mathematics (TFM) (1 and/or 2)	7
Problem solving courses (including problem solving and resilience, raising confidence and attainment, problem solving conference)	5
Core Maths (including days, courses, conference)	5
Teaching Statistics	4
GCSE Maths Higher Tier	3
Network meetings through AMSP	3
ODPD (not specified)	3
ODPD – Supporting students with entrance exams	3
Further Mathematics Conference	2

Professional development	Number of respondents
Technology for A level	2
University preparation	1
Teaching Discrete Mathematics 1 and 2	1
Subject knowledge days (e.g. quadratics and trigonometry)	1
Mechanics (online course)	1
GCSE and A level support group	1
Modelling course	1

A number of interviewees also mentioned attending teacher network meetings, Key Stage 5 monthly meetings with Maths Hubs, GCSE and A level Support Groups and accessing Integral Mathematics.

Student support

Just over half of responding teachers (54 per cent) reported accessing 'enrichment for students aged 16-19 (including Senior Team Mathematics Challenge)', while a slightly smaller proportion (47 per cent) reported accessing 'enrichment for students aged 11-16 years (including Maths Feast competition)'.

Smaller proportions reported accessing 'Year 12/13 problem-solving support and tuition for university entrance exams' (30 per cent) and 'tuition for A level Further Mathematics' (11 per cent).

During case-study visits, Mathematics Leads were asked about the AMSP student activities that they had been involved with. Students had attended activities both outside school/college and delivered by their Area Coordinator in school/college. The most commonly mentioned student activities were Senior Team Maths Challenge, Maths Feast, Problem Solving and STEP. Further details of the AMSP activities that the 15 case-study institutions which were visited had accessed over the last year are shown in Table 7 below.

Table 7: AMSP student activities accessed by case-study institutions

Activity	Number of respondents
Years 12-13	
Senior Team Maths Challenge	9
Problem Solving (sustained) Year 12/13	7
Year 12 STEP (Sixth Term Examination Paper)	6
Problem Solving (day)	3
MAT (Maths Admission Test)	2
Mechanics introduction/booster for year 12/13	2
Statistics year 12/13	2
Further Mathematics tutoring	2
Free online courses/tuition	2
TMUA (Test of Mathematics for University Admission)	1
Access to Integral	1
Year 12/13 Girls Florence Nightingale Day	1
Years 9-11	
Year 10 Maths Feast	8
Year 10/11 girls' enrichment (bespoke problem solving/girls into mathematics/girls' enrichment)	4
Year 9/10/11 enrichment	2
Year 11 Girls Florence Nightingale Day	1
Teaching mathematics to GCSE students in feeder schools	1
Year 11 tasters in Mathematics and Further Mathematics	1
Year 10/11 problem solving	1
Year 10/11 Core Maths taster/presentation	1

Teachers also mentioned that they directed their students to online courses and videos.

Dedicated support for schools

About three out of ten respondents (28 per cent) reported accessing 'information, guidance and/or advice from AMSP Area Coordinator, central team or website', while only four per cent reported having a 'tailored Participation Plan for Level 3 Mathematics'.

Across the 15 case-study schools where follow-up interviews were conducted, Mathematics Leads in four schools reported receiving AMSP dedicated support to develop Participation Plans (these are designed to identify institutions' mathematics needs and priorities and the AMSP activities that will support them). They explained that this support had included face-to-face meetings in school, plus follow-up remote discussions, with an AMSP Area Coordinator to explore the schools' needs in relation to advanced mathematics provision, and identify and agree a package of tailored support to address these needs through the programme (e.g. the need to increase girls' participation). The Participation Plans were also reviewed and refreshed annually in discussion with the AMSP Area Coordinator. Mathematics Leads in three other schools mentioned that their schools were based in priority areas (e.g. Opportunity Areas[11]) but that they had not developed

[11] Opportunity Areas are part of the government's national plan for dealing with social mobility through education. The programme operates across 12 local authority district areas identified because of the social, economic and cultural challenges they face in improving people's life chances.

Participation Plans. In this regard, several participants implied some lack of clarity in terms of the support available for schools in priority areas.

Differences in schools' and colleges' involvement with the AMSP by selected characteristics

Further analysis was undertaken to explore differences in survey responses by selected teacher and school/college characteristics. The data tables behind this analysis have been published in a separate companion document. A summary of the findings is presented below.

Differences between priority schools and non-priority schools

The findings suggest that teachers in priority schools were generally engaging in fewer AMSP activities than their colleagues in non-priority schools. The exception was the dedicated support options, such as the development of Participation Plans, which were designed specifically for priority schools, and so unsurprisingly were accessed most frequently by them. In addition, a higher proportion of priority schools accessed 'Information, guidance and/or advice from AMSP Area Coordinator, central team or website'. This was perhaps related to them receiving more bespoke or personalised support from their Area Coordinator. See Table 1 in the companion document.

Differences by region[12]

These findings suggest that, for some topics, responding teachers in the South and South West were most likely to report that they had engaged in teacher professional development and support than those in other regions. In addition, a higher proportion of teachers in London and the South East reported involvement in professional development for AS/A level Mathematics and Further Mathematics, whilst lower proportions reported involvement in professional development for Core Maths and professional development for supporting students with university entrance test preparation and higher level problem solving. However, these differences are small, and it is not known whether the achieved sample is representative of all AMSP users, and therefore generalisations should not be drawn from the findings. See Table 4 in the companion document.

3.5 Reasons for engagement

While not explored in the survey, during the initial case-study interviews and follow-up visits, Mathematics Leads were asked why their institutions had engaged with AMSP activities. The most commonly reported reasons for engaging with the AMSP mentioned during the 15 case-study visits, in descending order of frequency, were to:

- **make mathematics a more enjoyable/fun subject, to motivate students, and/or to develop a love of mathematics** (six respondents)

[12] The AMSP operates across nine regions, but due to the small number of responses from some regions, these have been collapsed into four: the North; the Midlands and East; London and the South East; and the South and South West.

We can see the benefit to the kids [of AMSP activities]. *We can see that they come away motivated and they enjoy it. It helps them to have a sense that they can actually 'do things'* (11-18 institution)

We want to develop a love of maths, we don't just want them to come here to pass an exam…So more and more it is becoming compulsory that they get involved in these sorts of things [enrichment] (11-18 institution)

- **enable students to see mathematics in different/wider contexts outside of the classroom** (six respondents)

  It gives them a good experience. It makes them think about maths outside of just their lessons and gets them thinking about doing maths in a different way (11-18 institution)

- **bring in an element of competition, teamwork and stretch and challenge which has a positive impact on students** (four respondents)

  It gives them something to aspire towards. There are some students that like the competitive side of it (11-18 institution).

  …sometimes there's not much competition amongst the pupils…so it's quite nice for them to have experience of that (All through institution).

  To stretch the more able students which the school struggles to do on its own (11-18 institution)

- **access help with areas in which there is lack of internal expertise** including mechanics, statistics and preparing students for university entrance exams (four respondents)

  It is just getting them in to some maths that we may not be able to do as much of in class time (All through institution).

  Developing students' skills where we aren't [able to] *and getting them interested and engaged and showing different ways of working with problems.* (11-18 institution)

- **grow and increase interest in mathematics post-16, raise aspirations and broaden horizons** (three respondents)

  Also because a lot of them have been lecturers, that come in [to school] *when the students talk to them, they are talking to them about taking maths beyond their A level. We can talk to them about it but we are just their teachers but actually talking to somebody who is a lecturer or was a lecturer is better for them* (Sixth form college)

  Our area is bad for numeracy and we want to grow the A level provision. (Sixth form college)

  To broaden their horizons and get them exposed to as much interesting maths as possible really (All through institution)

- **develop skills such as problem solving and reasoning skills** (three respondents)
- **enable students to work alongside students from different schools** (three respondents)
- **expose students to more practical applications of mathematics** (two respondents)

  When you are doing the statistics here, in lessons, you have got these time constraints and so you are just trying to get through the syllabus … whereas, those days, it is practical uses

of it. It is introducing it in a very practical and fun way and we want the students to get involved in that more (Sixth form college).

Other reasons for engagement mentioned by individual respondents included:

- place an additional focus on areas in which students are weaker, for example mechanics and statistics
- encourage more independent learning: 'What we are trying to do between GCSE and university is get students to learn more independently because ultimately they have got to be learning how to learn independently…' (FE College)
- access useful materials
- introduce students to female role models
- encourage students to talk about their experiences with others which leads to wider benefits.

In the initial telephone interviews, Mathematics Leads also focused on the advisory and support role of the AMSP and gaining reassurance that they were 'doing things right':

> *I've always been involved with the FMSP…Why wouldn't you? It's great to have someone to go to for advice and support. It's great to feel you can talk to like-minded people who can give you suggestions.* (All-through institution)
>
> *It's absolutely brilliant and it can be lonely being a Head of Mathematics. It's a pressured subject. There is so much information you have to take in very quickly…There has been very little support materials from the exam boards so it's great to be able to pick up the phone to someone who has the time and recent experience.* (11-18 institution)
>
> [Our reason for engaging is] *to stay up-to-date with curriculum developments, problem solving, modelling etc. The quality of provision* [mathematics-specific professional development] *is very good.* (11-18 institution)
>
> *We are a small school…It provides the support to ensure they* [teachers] *are doing everything they can and what they are doing is right.* (11-18 institution)

Most of the students spoken to reported that they had volunteered to participate in AMSP activities and events. This was either through teachers making them aware of the events, which they could then sign up for, or through teachers selecting specific students to participate. Students from two of the 15 schools visited at follow-up reported that involvement in AMSP activities had been compulsory, with all A level Mathematics students taking part in a range of activities.

3.6 Ratings of the quality of provision

Survey respondents were asked to rate the quality of the AMSP provision they had been involved with.

The findings show that, in general, survey respondents rated the support they had received very highly. For example, for all four forms of '**student support and tuition'** that respondents were asked about, 95 per cent of respondents or more rated the quality as 'very

good' or 'good'. A similar picture emerged for support received as part of **'teacher professional development'**, with the proportion of respondents reporting this was 'very good' or 'good' around 90 per cent or better for most of the forms of support listed.

The only instances where less than 90 per cent of respondents rated the training as 'very good' or 'good' were 'professional development for Core Maths' (87 per cent), 'teacher network meetings' (84 per cent), and the 'use of teaching resource for Core Maths' (77 per cent). However, these are still high ratings.

Finally, of the relatively small number of survey respondents who reported accessing **'dedicated support for schools'**, the overwhelming majority (91 per cent or more) reported that the quality of the provision had been 'very good' or 'good'.

The survey findings are presented in Table 8 below.

Table 8. How survey respondents rated the quality of the AMSP provision

	Very good		Good		Average		Poor		Very poor		My school/ college has not been involved	
	n	%	n	%	n	%	n	%	n	%	n	%
Student Support and Tuition												
Enrichment for students aged 16-19 (including Senior Team Maths Challenge)	240	62	133	34	11	3	0	0	0	0	3	1
Enrichment for students aged 11-16 years (including Math Feast competition)	205	61	122	36	9	3	0	0	0	0	2	1
Year 12/13 problem-solving support and tuition for university entrance exams	119	56	83	39	5	2	0	0	0	0	4	2
Tuition for A level Further Maths	36	47	37	49	3	4	0	0	0	0	0	0
Teacher Professional Development and Support												
Sustained professional development for AS/A level Further Maths	115	65	52	30	3	2	0	0	1	1	5	3
Professional development for AS/A level Maths and/or Further Maths	227	60	134	35	12	3	2	1	0	0	5	1
Use of teaching resources for A level Further Maths (via the Integral online resources)	251	56	175	39	16	4	3	1	1	0	1	0
Professional development for GCSE Maths Higher Tier	70	52	56	42	4	3	0	0	0	0	5	4

	Very good		Good		Average		Poor		Very poor		My school/ college has not been involved	
	n	%	n	%	n	%	n	%	n	%	n	%
Professional development for supporting students with university entrance test preparation and higher level problem solving	54	51	42	39	7	7	1	1	1	1	2	2
Online (LOPD) or on-demand professional development (ODPD)	64	48	60	45	7	5	0	0	0	0	3	2
Teacher Network Meetings	133	45	114	39	40	14	1	0	0	0	6	2
Professional development for Core Maths	63	40	74	47	13	8	4	3	1	1	2	1
Use of teaching resources for Core Maths (via the AMSP online platform – in development for 2019)	23	27	43	50	12	14	1	1	1	1	6	7
Dedicated Support for Schools												
Tailored Participation Plan for Level 3 Maths	16	55	12	41	0	0	0	0	0	0	1	3
Information, guidance and/or advice from AMSP Area Coordinator, Central Team or website	109	56	69	35	8	4	3	2	0	0	7	4

Percentages may not sum to 100 due to rounding
Missing responses are excluded
Source: NFER survey of teachers that have received support from the AMSP, 2019

Mathematics Leads in two case-study schools that reported receiving dedicated support to develop Participation Plans were similarly positive about the effectiveness of the support they had received. The support was valued for helping to focus on action to address identified needs and providing a structure and impetus to review progress against needs. The Plans had also led to targeted

provision, for instance, lectures to encourage girls to participate in advanced mathematics, and individualised support for advanced mathematics students. One Mathematics Lead added that Participation Plans could be particularly beneficial for schools at an earlier stage in their development of advanced mathematics provision, but implied that some schools may not be aware of the availability of such support. The other Mathematics Lead reported that, at the time of interviewing, they were awaiting follow-up contact to review the Participation Plan.

Mathematics Leads were asked during follow-up case-study interviews whether they had received any subsidies towards travel costs, course fees and cover costs to support participation in AMSP activities. Seven of the interviewed Mathematics Leads reported receiving subsidies and suggested this was invaluable in enabling them to access the AMSP support, as this Mathematics Lead explained:

> *That* [the subsidy] *has been a very useful thing for persuading senior staff to release people to go on these courses. I think that has been really, really helpful*. (11–18 institution)

Differences in schools' and colleges' rating of the quality of AMSP provision by region

Further analysis was undertaken to explore differences in responses by region. The data tables behind this analysis have been published in a separate companion document. In summary, these findings suggest that across all four regions, the vast majority of teachers rated both '*student support and tuition' and 'teacher professional development and support'* as either 'very good' or 'good'. In addition, there were negligible differences between regions. See Tables 5 and 6 in the companion document.

3.7 What is working well?

Survey respondents were given the opportunity to detail what they felt was working well with the programme. Given the very positive ratings for the quality of the support received, it is not surprising that many respondents reported that the activities they had participated in had gone well, describing them as enjoyable and engaging for both students and staff. In particular, resources for students were commended for being of high quality, useful and challenging. The resources to support staff with planning, delivery and assessment were also commended, as was staff professional development and enrichment for being flexible, free and informing and enhancing their teaching practice. A small proportion of survey respondents also acknowledged their gratitude for support with introducing Core Maths into their institutions.

Similarly, case-study Mathematics Leads and teachers spoke very positively of the 'high quality' and 'easy to access' AMSP provision they had engaged with and the 'positive partnership' they had developed with trainers/Area Coordinators who were 'passionate about mathematics'. They spoke of the high reputation AMSP has in schools and colleges and the reliable, accurate and wide-ranging provision that it offers which can be adapted to need. Typical comments were: 'It's a godsend', 'It's an essential place to go for maths teachers' and 'It's an overarching body providing reliable and accurate information on the Level 3 programmes on offer. It is a good source of resources and provides a good level of support'.

All case-study interviewees were complimentary about their Area Coordinator who they were in regular contact with. They reported the excellent relationships that they had built and praised the responsiveness, communication and organisational skills of Area Coordinators and their willingness to come into school/college, as the comments below confirm.

> *Our relationship with* [name of Area Coordinator] *is important. You build up a relationship with an individual…If it was pulled you would feel you had been abandoned.* (11-18 institution)
>
> *He's persistent. He regularly reminds me about events and deadlines for applications and that's actually really helpful.* (11-18 institution)
>
> *Our Area Coordinator visited before Christmas and gave me a plan and some advice on Core Maths. I feel we are well supported. (*11-18 institution)
>
> *They are very responsive and willing to come in.* (16-18 institution)

Regarding teacher professional development more specifically, case-study interviewees reported this to be: well run, high quality and delivered by experts; tailored to schools'/colleges' needs and regularly updated; and flexible to access (including face-to-face sessions run during and after the school/college day, online professional development and resources). Some selected comments include:

> *There is such a range of opportunities you can draw on, both online and in person. AMSP really understands this, and allow us to tailor to school priorities. Compared to expensive commercial courses which are often a whole day in London, the AMSP offer is more*

tailored to local need. Often twilight or half-day courses, often on more than once, so you can juggle accordingly. (11-18 institution)

They are more tailored so worth making the sacrifice for. They are made by people who understand what we need from the syllabus at that moment in time. (11-18 institution)

They listen to teachers and provide courses that are relevant…The courses to help improve teachers' subject knowledge and confidence have generally been of a high quality... They are very good at tailoring the courses to what teachers are doing in the classroom… (11-18 institution)

Teachers praised the enthusiasm of professional development presenters and their passion for mathematics and the quality of the AMSP online teacher resources:

*One of the things I've really enjoyed is that they are all very enthusiastic. This is sometimes in short supply. They are passionate about mathematics as a subject. You are talking about people who care about their actual role. They get back to me very quickly. (*11-18 institution)

All of the resources online are fantastic. (11-18 institution)

They also reported the importance of the low cost of activities, which made them accessible and enabled them to involve more staff in professional development. Typical comments included:

The low cost of them [professional development courses] *has made them accessible as we don't have a huge CPD budget.* (11-18 institution)

They don't charge very much or are free which is good as there is very little money in school. (11-18 institution)

In addition, case-study Mathematics Leads and teachers commented on the inspiring and engaging nature of activities targeted at students and the useful resources. They reported that the resources were useful for students to access at home when time to deliver the curriculum in lessons was tight. They reported a range of positives to their engagement in AMSP student activities. These included:

- **activities going beyond the curriculum and taking students out of their comfort zone**:

The problem solving ten-week course has been very effective and has got them out of their comfort zone and as a result they are more confident mathematicians and it may have impacted on their plans for maths study and careers (FE College)

…they get trapped into just seeing everything in a narrow way and I think the challenges and the Senior Team Maths Challenge help them to be a little more outward looking and to see things more 'in the round' and it encourages them to engage with their friends on something that isn't in the textbook, isn't part of their work…It encourages that enquiry (11-18 institution)

- **accessing very effective enrichment activities which could be customised to need and fill gaps in staff expertise**:
  We are very happy with what we are getting…we know we can ask and we know they will deliver the best they can (11-18 institution)

  The way that [name of Area Coordinator] *comes in and just helps out with absolutely everything has been so valuable…he really enriches the maths – he's really phenomenal* (11-18 institution)
- **excellent resources which can be used with all students**, not just those taking part in enrichment activities
- **no cost and subsidies for travel** (depending on the course/activity undertaken).

Students were similarly positive about the AMSP enrichment activities they had participated in, typically describing them as 'fun' and 'interesting' opportunities for them to gain extra support with their mathematical knowledge, outside of the classroom. Those who had attended the Senior Team Maths Challenge and Maths Feast commented on liking the competitive nature of these events, which gave them an opportunity to test their mathematical skills against students from other schools. Students were also keen to gain insights into how they might use their mathematics skills in their future studies and careers.

3.8 Understanding the role the AMSP plays alongside other forms of mathematics support

Survey respondents were asked to what extent they agreed or disagreed with a series of statements which described the AMSP's support and its relationship to other similar forms of mathematics-specific support. The results are presented in Table 9 below.

Table 9. Extent to which survey respondents agreed with a list of statements about the AMSP

	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		Don't know		N/A	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
The AMSP offers unique support that is not available elsewhere	231	32	325	45	78	11	14	2	3	0	39	5	26	4
The AMSP has helped/is helping us to introduce or maintain A level Further Mathematics	124	17	216	30	150	21	34	5	30	4	7	1	156	22
The AMSP complements the support that is available from other mathematics-related initiatives, such as the Maths Hubs	116	16	359	50	99	14	10	1	5	1	50	7	78	11
The AMSP has helped/is helping us to introduce or maintain A level Mathematics	85	12	219	31	215	30	36	5	29	4	11	2	122	17
The AMSP has helped/is helping us to introduce/establish Core Maths	35	5	142	20	132	19	28	4	23	3	13	2	341	48

Percentages may not sum to 100 due to rounding
Missing responses are excluded
Source: NFER survey of teachers that have received support from the AMSP, 2019

More than three quarters of survey respondents (77 per cent) 'strongly agreed' or 'agreed' that the AMSP 'offers unique support that is not available elsewhere', while two-thirds (66 per cent) 'strongly agreed' or 'agreed' that the AMSP 'complements the support that is available from other mathematics-related initiatives, such as the Maths Hubs'.

Just under half of the responding teachers 'strongly agreed' or 'agreed' that the AMSP 'has helped or is helping to introduce or maintain A level Further Mathematics' (47 per cent) and to 'introduce or maintain A level Mathematics' (43 per cent). Finally, a quarter of all survey respondents (25 per cent) 'strongly agreed' or 'agreed' that the AMSP 'has helped or is helping to introduce/establish Core Maths'.

Differences in teachers' perceptions of the AMSP by selected characteristics

Further analysis was undertaken on the survey data to explore differences in responses by selected teacher and school characteristics. In most cases, there was little variation in the responses given. The data tables behind this analysis have been published in a separate companion document. A summary of the findings is presented below.

Differences between priority schools and non-priority schools

Teachers in priority schools were less likely to agree that AMSP support was unique, although this may be explained by the greater proportion that reported they did not know whether it was unique or not. Similarly, teachers in priority schools were less likely to agree that the AMSP was helping them to introduce or maintain A level Further Mathematics, compared to their colleagues in non-priority schools. However, this finding could reflect the fact that a smaller proportion of priority schools were delivering A level Further Mathematics (compared to non-priority schools), as indicated by the higher proportion of teachers in priority schools that reported this statement was not applicable. For the other questions, differences between these different types of school were small. See Table 2 in the companion document.

Differences by region

For some questions, there was variation by region regarding respondents' views on the AMSP. For example, responding teachers in London and the South East were more likely to strongly agree that the AMSP programme had helped them to introduce or maintain A level Mathematics than those in other regions. However, the differences across questions were generally minor suggesting that AMSP support is consistent across the country. It is also worth noting it is not known whether the achieved sample was representative of all AMSP users, and therefore generalisations by region should not be drawn from the findings. See Table 7 in the companion document.

Differences by level of engagement[13]

Teachers in schools where engagement with student and/or teacher support was higher were more likely to agree with the statements presented. Specifically, where engagement was higher, teachers were more likely to agree that the AMSP offers unique support, that is has helped them to introduce A level Mathematics and Further Mathematics, and that it complements support that is available from other mathematics-related initiatives. However, it should be noted that schools that reported lower levels of engagement were also more likely to report that they neither agreed nor disagreed with the statements, or that they were not applicable. As expected, this indicates that they had less experience of the support offered, and that therefore they were not in as strong a position to comment on the extent to which they agreed with the statements. See Tables 9 and 10 in the companion document.

3.8.1 Comparisons with other providers: insights from the case studies

Mathematics Leads and teachers in case-study institutions were asked how support for teachers from the AMSP compared with that from other providers of teacher CPD. Having had a good experience, and because most CPD was free or very low cost, most interviewees reported that they now sourced their training and support almost exclusively from the AMSP.

Two schools/colleges that had more recent experiences of accessing CPD from other providers, and were therefore better placed to draw comparisons between AMSP and mathematics CPD offered by other providers. Interviewees from both settings described some of these other courses as being 'a waste of time' due to the lack of ideas they were able to take away and put into practice. One Mathematics Lead reported that AMSP CPD had typically been more effective in developing teachers' confidence with mathematics teaching, as illustrated below:

> *You never feel like you are intimidated by it… sometimes you can go on a course and feel like 'I'm not good enough I can't teach this anymore, I have done it for years'… but to come back* [from AMSP training] *and feel confident, it's really important.* (11 – 18 institution)

A further important element in interviewees' comparison of AMSP with other CPD, related to the delivery approaches and quality of trainers. Interviewees described AMSP CPD facilitators as typically being more experienced and knowledgeable of the mathematics curriculum and of the expectations placed on teachers and students. This was reported to have led to the delivery of content that better supported teachers with their planning and teaching. Teachers also welcomed the fact that many of those staff involved in delivering AMSP CPD had previous or current teaching experience, which they felt meant they better understood the challenges they were facing.

[13] For this cross tabulation, four engagement measures were created. For 'student support', a 'low or zero' engagement measure was created based on respondents who selected 0-1 response options from question four of the survey, and a 'high' engagement measure for respondents who selected 2-4 options. For 'teacher support', a 'lower or zero' engagement measure was created based on respondents who selected 0-2 response options from the relevant part of question four of the survey, and a 'higher' engagement measure for respondents who selected 3-9 options.

Teachers were grateful for the support received both during and after courses, as those delivering were approachable and responsive to their needs.

> *Somehow, they just make it more relevant* [compared to what I have received elsewhere]. *They've got a clearer grasp on what it's actually like to be working in education right now.* (11 – 18 institution)

Interviewees also suggested that AMSP CPD was more cost-effective than some other providers' offerings in terms of the investment of budget and staff time given the perceived benefits for mathematics teaching and provision.

During the case-study visits, Mathematics Leads were also asked how the AMSP student-focused activities they had accessed compared to provision offered by other providers. Interviewees reported that they accessed mathematics enrichment from AMSP alongside other organisations such as the United Kingdom Mathematics Trust (UKMT) (particularly their Mathematics Challenges), London Mathematical Society, Maths Inspiration, Institute of Maths and Applications, Puzzle Box Company, Midas Construction and a range of universities (for example lectures and master classes). The UKMT, universities and Maths Inspiration were most commonly mentioned, with the UKMT Maths Challenges and Maths Inspiration lectures often perceived to be equally well run and valuable activities.

However, most Mathematics Leads reported that the AMSP student activities compared very favourably with other providers' student-focused provision as:

- they were applied, practical and hands-on
- the workshop format was engaging and more informal than lectures
- they appealed to a range of year groups
- they brought in external people who had made a career in mathematics which was not always done so effectively elsewhere
- they were of a high and consistent quality and effectively targeted at students' needs:

> *I think the AMSP, when they do a session, they have got people who are experienced people who have been teaching at that ability level so they generally do a good job…In all the years that we have sent people to anything we have never had a bad experience …and we have been sending students for over 10 years…They tend to try and deliver within the team…they are a very good team. They have got a lot of experience* (11-18 institution)

- most activities were free: 'Our students wouldn't get these opportunities if they weren't free. We couldn't afford to do what we do if it wasn't for the AMSP' (11-18 institution)
- activities were easy to arrange.

3.9 Challenges and barriers in engaging with AMSP provision

Survey respondents were asked to what extent their institutions had faced a range of challenges in engaging with AMSP provision. 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 findings suggest that the main challenges related to releasing staff from school. For example, the single greatest challenge, with 39 per cent responding 'to a large' or 'very large extent', was the **'cost or availability of teacher cover'**. This was followed by 'releasing teachers to participate in professional development' and 'releasing teachers to take students to enrichment events', both reported 'to a large' or 'very large extent' by one-third (33 per cent) of respondents.

By contrast, the least challenging elements, indicated by the proportion of respondents reporting 'not at all', were 'lack of support from senior leadership' (63 per cent) and the 'costs of activities'[14] (41 per cent).

Table 10 below presents the results.

[14] Through government funding, the AMSP is able to offer many events for free or at low cost.

Table 10. Extent to which survey respondents reported that their school/college had faced challenges in engaging with AMSP provision

	To a very large extent		To a large extent		To a moderate extent		To a small extent		Not at all	
	N	%	N	%	N	%	N	%	N	%
Cost or availability of teacher cover	119	17	154	22	149	21	130	18	157	22
Releasing teachers to take students to enrichment events	100	14	136	19	162	23	118	17	193	27
Releasing teachers to participate in professional development	95	13	139	20	185	26	118	17	174	25
Cost of activities	54	8	93	13	125	18	147	21	291	41
Cost of travel	58	8	87	12	138	19	164	23	263	37
Location of events/activities	51	7	100	14	177	25	168	24	214	30
Timing/ scheduling of events/activities	36	5	79	11	165	23	195	28	234	33
Lack of support from senior leadership	16	2	36	5	90	13	121	17	445	63

Percentages may not sum to 100 due to rounding
Missing responses are excluded
Source: NFER survey of teachers that have received support from the AMSP, 2019

Survey respondents were also invited to provide further details about these or any other challenges they might have experienced in engaging with the AMSP. Of those who replied, most reiterated the challenges associated with releasing teachers to take students to enrichment activities, including arranging and resourcing teaching cover. For example, a number of survey respondents reported issues with finding good-quality teacher cover which was needed in order to release staff from school.

A small number of survey respondents reported the location of some AMSP events to have hindered participation. This was specifically mentioned by respondents in the South, South West, East of England and Midlands, where it was suggested that the offer of more local enrichment activities outside of the larger cities would have been welcomed. Some respondents also raised concerns about some of the resources for students, citing gaps in the new specifications and content not always being tailored to schools' chosen examination boards. Some respondents also called for more resources for particular Level 3

qualifications, including Pure Mathematics and Further Mathematics. Some respondents also indicated that that there was 'room for improvement' with the teacher network meetings, where respondents voiced concerns around their frequency and flexibility in terms of location and duration.

Case-study interviewees were also asked whether they had experienced any challenges in engaging with AMSP professional development and student enrichment activities. Very few challenges were reported which are in the AMSP's control, with most being internal issues faced by schools and colleges.

Regarding AMSP teacher professional development, a small number of teachers reported that the timing of some activities (e.g. network events) did not always suit them. One teacher noted difficulties for staff attending events after the school/college day when they had childcare commitments. However, another commented that there was so much on offer that teachers could usually find professional development with timings that suited them:

> *Sometimes the timings don't work for us but there is plenty going on so we will always find something to engage with.* (All through institution).

Distance to professional development activities was also mentioned as a barrier to access, with one interviewee remarking that: 'Sometimes it is a reasonable trek'.

As was the case with survey respondents, most case-study interviewees did not see the cost of attending AMSP activities to be a barrier. However, one commented that, if the cost of attending professional development increased it would become a barrier, as professional development budgets were 'tiny'.

A key internal issue that teachers reported was gaining permission for teachers to attend external courses. This was due to senior leaders and staff themselves being reluctant to cover exam teaching, it being difficult to arrange quality cover and the cost of cover. And, this was particularly problematic for longer courses. The comments below illustrate these points.

> *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)

One interviewee suggested that the AMSP could overcome this barrier by providing more online courses or twilight sessions:

> *We're aware that we don't use the staff development side of things as it's very difficult to get staff out of school. If the AMSP was able to offer more online modules, or twilight training, it might make these training opportunities more accessible.*
>
> (11-18 institution)

In terms of challenges in accessing AMSP student enrichment activities, all of these related to issues internal to the school/college. The next most commonly mentioned barrier, raised by five out of the 15 Mathematics Leads taking part in case-study visits, was teacher time to organise activities and explore what AMSP offered. Other barriers mentioned by one or two Mathematics Leads included: arranging staff cover; budget for travel; and gaining agreement to taking students out of school/college when they were undertaking GCSE and A level courses, with teachers of other subjects being reluctant to let them go. A number of interviewees did not mention any challenges.

Some case-study interviewees reported the specific challenges of offering Core Maths related to difficulties in staffing, timetabling and financing the course, as well as uncertainty about whether it was sufficiently recognised by universities (see Section 3.1.3).

Only one case study interviewee mentioned barriers in terms of students accessing activities. This interviewee mentioned some of their students not being able to attend STEP courses as many had weekend jobs.

3.10 Suggested improvements to the AMSP

Survey respondents were given the opportunity to briefly describe any improvements they believed would be useful for the AMSP. A total of 326 teachers gave a response. Of these, about a quarter of respondents actually reported that there was nothing for the AMSP to improve upon, and reiterated that their institutions had been very pleased with the support they had received.

Of those who suggested improvements, these could be broadly split into those to do with 'teacher professional development and support', and 'student support and tuition'. In terms of **teacher professional development**, some respondents suggested they would have liked a greater focus on pedagogy within the training they had received, whether that was online or face-to-face. Another suggestion was that teachers who were planning to deliver AS/A level Mathematics for the first time should be allowed to attend the TAM course in the previous academic year. This, it was argued, would help them better prepare, but the view of some respondents was that this course was only available to teachers who were already teaching AS/A level Mathematics. Finally, some teachers also said they wanted more activities and resources that related to the new teaching specifications, schemes of work that related to the parallel teaching of A level Mathematics and Further Mathematics, and an online forum to allow teachers to voice questions and access support from other colleagues.

Suggestions were also made for improvements to **student support**, including a request for tutorials and resources to support the core pure content for A level Mathematics. It is worth noting that these types of resources are available on Integral for a fee. In addition, some teachers also wanted to see greater differentiation within these materials, so they could better cater for different student abilities.

Finally, some suggestions were made for improvements to the running of enrichment activities. Specifically, it was suggested these could be advertised earlier to allow schools

more time to plan their attendance, and that the publication of a yearly events calendar would be helpful.

Mathematics Leads in the 15 case-study schools/colleges which were visited were asked about how AMSP student enrichment activities could be improved. Four did not report any improvements, as they felt that activities were effectively managed and run. As one reported: 'It is all run very skilfully. I have got no criticism and I think it is about right. It is about what they need to be doing' (11-18 institution)

Where offered, the main suggestions for improvement, in descending order of frequency, included:

- **allow schools to send larger numbers of students** to activities, or offer whole year group team challenges (five respondents)

  If we run that it is for four students and it means that all the other students miss their lesson … So it benefits those few students and what we would rather do, I think, is run some sort of 'in house' team challenge which benefits everybody because otherwise I think it is not fair on all the other students (FE College)

- **place more emphasis on the middle ability students** (not just the high achievers) (four respondents)
- **offer more activities for 11-16 year olds**, particularly Years 8 and 9 (three respondents)
- **timing** – provide more advance notice and consider the timing of activities to suit year groups (three respondents)
  'Our trips must be booked a half term in advance, I would really love some advanced notice' (11-18 institution)
- **ensure activities and resources encompass the requirements of all exam boards** so that they are fully relevant and students get the support they need (two respondents)
- **enable students to access resources themselves**, not just through their teacher (one respondent).

Interviewees were also conscious of the large geographical areas that Area Coordinators cover and the resulting demands on their time, as this comment indicates:

> *There is more we would like to do in terms of getting AMSP staff into school. They have limited time and a large area to cover* (11-18 institution).

3.11 Extent to which survey respondents think the AMSP will help their institution to achieve its priorities

Survey respondents were asked to comment on the extent to which they felt their involvement with the AMSP would help achieve their institutions' Level 3 mathematics priorities (see Table 8 below).

About four out of ten survey respondents (42 per cent) agreed that the AMSP would help them to achieve their **student priorities** 'to a very large extent' or 'to a large extent'. A similar proportion (41 per cent) reported the programme would support them with these priorities 'to a moderate extent'.

Similar results were found in terms of **teaching priorities**, with over half (52 per cent) believing that the AMSP would help 'to a very large extent' or 'to a large extent'. A further 34 per cent reported the programme would support them with these priorities 'to a moderate extent'. Table 11 presents the results.

Table 11. The extent to which survey respondents thought the AMSP would help their institution to achieve its priorities

	To a very large extent		To a large extent		To a moderate extent		To a small extent		Not at all		N/A	
	N	%	N	%	N	%	N	%	N	%	N	%
To what extent will the AMSP help you to achieve your **student priorities**?	58	8	240	34	289	41	88	12	16	2	23	3
To what extent will the AMSP help you to achieve your **teaching priorities**?	84	12	284	40	244	34	76	11	7	1	20	3

Percentages may not sum to 100 due to rounding
Missing responses are excluded
Source: NFER survey of teachers that have received support from the AMSP, 2019

Differences in teachers' perceptions of the impact of the AMSP by selected characteristics

Further analysis was undertaken to explore differences in survey responses by selected teacher and school characteristics. The data tables behind this analysis have been published in a separate companion document. A summary of the findings is presented below.

Differences between priority schools and non-priority schools[15]

Exploring responses from priority and non-priority schools regarding to what extent the AMSP would help their institutions to achieve their priorities revealed no meaningful differences between the two groups. See Table 3 in the companion document.

[15] There are three types of priority school: a) Priority list schools, which are schools that had entries for A level Mathematics in 2016/17, had no entries for A level Further Mathematics in 2016/17, but had entries for Further Mathematics in any of the three previous years; b) schools in the 12 Opportunity Areas; and c) Low

Differences by region

The findings suggest that responding teachers in London and the South East were most likely to report that the programme will help them to achieve their student and teaching priorities compared to those in other regions. However, the differences are small, and it is not known whether the achieved sample is representative of all AMSP users, and therefore generalisations should not be drawn from the findings. See Table 8 in the companion document.

Differences by level of engagement

As might be expected, the findings suggest that teachers in schools where engagement with student and/or teacher support was higher were more likely to agree that the programme will help them to achieve their respective priorities. This could be a reflection of differences in the breadth or depth of the support being received, or possibly of the pre-conceived perceptions of the AMSP by different teachers, with those who felt it was more likely to make a difference, choosing to engage in wider range of activities. See Tables 11 and 12 in the companion document.

3.12 Early outcomes resulting from participation in AMSP activities

This section presents case-study interviewees' perceptions of the early outcomes being realised for teachers and students resulting from their engagement with the AMSP.

Outcomes for teachers

3.12.1 Findings from the initial telephone interviews with Mathematics Leads

Telephone interviewees' reported a range of early outcomes that they were realising as a result of teachers' engagement with the AMSP.

Interviewees' reported that one of the most immediate outcomes of teacher professional development was increased knowledge of the Level 3 mathematics curriculum specifications and assessment regimes, including the style of exam questions and ideas for problem solving activities. This was perceived to be reflected in improved quality of teaching at an individual and departmental level and in the increased expertise of both new and experienced staff. The box below illustrates these points.

> *The A level course is new so this* [professional development] *has offered valuable information for example on assessment, variety of questions, problem solving activities...It* [professional development attended] *has given a framework for delivery of the A level Mathematics and Further Mathematics curriculum...*
>
> (FE College)

Participation Area Schools – these are schools within 20 local authorities designated as low participation areas in terms of advanced mathematics.

[Outcomes include] *staying informed about the new specification, seeing how to build modelling and problem solving into the curriculum.*

(11-18 institution)

The AMSP is a source of developing knowledge and expertise which is reflected in the teaching at individual level and in departmental development.

(11-18 institution)

[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)

Another key outcome that the majority of interviewees mentioned was increased teacher subject knowledge and confidence, which was starting to improve the quality of teaching and learning. A number of interviewees reported that the AMSP was helping to build the capacity of their department and one hoped that there would be a knock-on effect on student attainment, as illustrated by the quotations below.

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)

Improved staff confidence in delivering A level through improved subject knowledge. Improved lessons which are more engaging and interesting.

(11-18 institution)

...we have a limited number of teachers who feel confident with A level teaching so we are building capacity. We have four teachers who started teaching in the last couple of years who have engaged with the AMSP professional development and resources, which are supporting and building the capacity of the team...

(11-18 institution)

Several interviewees reported that they had been able to spread the positive benefits associated with undertaking professional development by cascading their learning to other teachers in their school/college.

3.12.2 Findings from the follow-up visits to schools/colleges

These findings were reiterated during the case-study follow-up visits when speaking with Mathematics Leads about the outcomes and impacts that had been realised from teachers' involvement in AMSP CPD. Mathematics Leads also identified the impact of exposure to new teaching strategies and inspiring resources through the AMSP which, once implemented in

teaching practice, had subsequently supported students' understanding of content and enjoyment of mathematics lessons.

Mathematics Leads also discussed an additional key outcome for teachers in terms of lesson and curriculum planning – teachers had been able to adapt their schemes of work to incorporate new activities and delivery methods, thus enhancing the quality of their lessons. One school evidenced this improvement in the quality of mathematics lessons from their results in the new A levels; they had seen outstanding results despite the changes to the specifications, in comparison to other schools and subject areas which had experienced slight declines. They attributed this success to their careful and effortful preparation, supported by the AMSP.

The collection of comments below made by Mathematics Leads during follow-up interviews exemplify the impacts of the AMSP on mathematics teaching.

Sometimes it is just that nice idea, a resource that you might not have thought of to invent ourselves but you suddenly use it and you can just see kids going 'actually that is really clever and really good (All through institution).

It is doing a better job isn't it? Self-confidence, knowing what we are doing with the kids, knowing the material, knowing how to pitch the material … it is anticipating problems. It has allowed us to reflect on what we have got to do before we have done it in terms of the planning side (11 – 18 institution).

I think it is just the planning, what we have brought in for our students [as a result of the AMSP CPD], *what we have been able to incorporate and change because maybe an activity we thought was going to work well they have done something slightly different and we think that will be far better* (Sixth form college).

The focus groups with teachers echoed a similar range of impacts to those described above. Teachers reported positive impacts on their practice; having gained understanding of new and effective approaches to delivering topics in the specifications, which had strong application to classroom practice.

These new techniques, combined with increased subject and specification knowledge had led to increased confidence in teaching, for both developing teachers and experienced teachers who had attended the course as a refresher. Teachers also recognised the impact that had filtered through to students; the new techniques, resources and their own deeper understanding had enabled them to deliver more engaging lessons, with strategies to clearly convey concepts and procedures, which they explained elicited greater pupil engagement, understanding, and confidence. The box below presents a collection of teachers' comments about these impacts.

Everything I have done is useful in terms of when it gets to the point of which I am teaching that material I am infinitely better prepared and familiar with the ins and outs of the data set and I can just go in as an experienced teacher basically (11 – 18 institution).

The teaching mechanics one, it allowed me firstly, not to be scared of it, because I was a bit scared of the subject. But also to see, rather than disconnected topics, I have been able to see the bigger picture which is what you really want as a teacher, you want to have the full understanding (FE College).

It was teaching ideas to make it [the lesson] *interesting and engaging which is then good when you go in to a lesson and the students are all keen and eager and want to try the activities* (Sixth form college).

You are speaking to other people and asking why, why…you have those debates with other teachers on a teacher-level so that strengthens your understanding on a teacher-level and you feel more confident then when you've got students asking you questions (FE College).

Mathematics Leads were also asked in follow-up interviews if the outcomes and impacts that had been exhibited from teacher involvement would have occurred without the AMSP support. There was a strong consensus that these impacts either would not have occurred, or would have occurred later.

One interviewee said that without the AMSP support, staff would not have been made aware of new teaching techniques and how to incorporate these into schemes of work. The access that AMSP provides to training and resources was also raised as an important aspect of the additionality of the AMSP, with two interviewees admitting they were unaware of courses and resources they could source from other providers that were of the same high quality and affordability. Two interviewees also recognised that without the AMSP support, they would not have been able to offer Further Mathematics at their institution, and since they have been able to do this, have placed great reliance on the AMSP to provide resources for the subject.

The quotes below illustrate how Mathematics Leads view the AMSP as being vital in supporting the delivery and quality of their advanced mathematics provision.

[Without the AMSP] *we wouldn't have been aware of a lot of the new techniques. We wouldn't have had those discussions with other people and so we wouldn't have been able to start looking at incorporating it in to our scheme of work at all because we just wouldn't have known about it* (Sixth form college).

I would say that if we did not access AMSP support, with the transition to linear A levels we would have struggled because before people had their area of strength, so one teacher may have just taught statistics and that would have been fine… but now everyone has to be up to speed [with all content] *and that's why we have engaged in so many courses over the recent years* (11-18 institution).

[Without the AMSP] *it would have taken us a lot longer to do. We would have been inventing the wheel basically* (11-18 institution).

We would have been floundering more on our own... I think the prices of stuff that is offered by independent companies would mean we wouldn't have been on half as much (All through institution).

Outcomes for students

3.12.3 Findings from the initial telephone interviews with Mathematics Leads

Case-study interviewees also reported a number of early positive outcomes for students. These were resulting from students' participation in AMSP activities and their use of resources in their own time, as well as from students benefitting from the increased quality of mathematics teaching in school/college.

Teachers most commonly reported outcomes in terms of students' increased engagement in lessons, understanding of mathematics topics (such as mechanics) and attainment in exams. They also reported students' having improved independent study skills, a better understanding of how they would be assessed in exams and being 'more able mathematicians' as the following comments reveal:

I think our teaching has been enriched by the courses we've been on. We have picked up more fun ideas about how to do something. This in turn has helped students to become more engaged and help deepen their understanding of mathematics concepts (All through institution).

[The AMSP] *enables passing on the expectations of assessment, more motivation and engagement in lessons, the development of independent study skills (through video clips)* (FE College).

They benefit from what staff have been doing with them. We feel that we have prepared our students well for their courses as a result (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).

We are hoping for a big impact on results (Sixth Form College).

Several interviewees also reported the benefits from students attending in-school activities being delivered by AMSP Area Coordinators. Students were perceived to more confident with mathematics and more knowledgeable about the broader context, which enabled them to answer exam questions more effectively, as this interviewee's remark confirms:

> *For the student when* [name of Area Coordinator] *comes in it is more exciting than normal lessons. Teachers are very exam-focused whereas* [name of Area Coordinator] *is more relaxed and sees the bigger picture and makes mathematics exciting. It gives students confidence and context so that when they answer exam-style questions they can see where this fits within the bigger picture, for example with problem solving they understand this better* (11-18 institution).

Mathematics Leads also reported students' involvement in the AMSP as encouraging them to consider studying mathematics at A level:

> *Year 10s who go on enrichment events always love it and it helps encourage them to choose A level* (All through institution).
>
> *Open students' eyes to A level mathematics, increases enthusiasm and uptake at Level 3* (11-18 institution).

In addition, interviewees reported the AMSP problem solving courses were helping students to consider applying to, and getting into, more prestigious universities such as Russell Group universities and Oxbridge. Some interviewees reported that, without the AMSP, students would not receive the same level of support in applying to university due to teachers' lack of time. The comments in the box below illustrate these points.

The problem solving classes help them to think about what they are going to do at university and prepare them for the entrance exams. I don't have time to do this... (11-18 institution).

We are hoping for our current Year 12 that we have more students accessing Russell Group universities, either for mathematics or mathematics-related courses (16-18 institution).

The group that went on the problem solving were the first cohort to get to Oxbridge. Abstract mathematics has widened their ability. We have two out of five from A level Further Mathematics applying this year and I think they have a good chance (16-18 institution).

Some teachers reported positive discrimination in taking girls to events which was impacting on girls' uptake of mathematics courses at A level.

3.12.4 Findings from the follow-up visits to schools/colleges

The focus groups with students revealed a number of general positive outcomes associated with AMSP enrichment support and activities, as well as some that were associated with particular activities. In terms of **general skills**, students talked about improvements in their mathematical knowledge and understanding, as well as in their confidence, enjoyment and interest in mathematics. Some reported that these improvements had in turn led to improvements in their mathematics attainment, as illustrated by this quotation: 'The more confident you are the less likely you are to give up on those hard questions and the better you will do'.

Students who had participated in the **Senior Team Maths Challenge** and/or **Maths Feast** reported they had developed their team working and problem-solving skills, practised questions under pressure, and gained insights about how other schools/students approached mathematical challenges. In addition, students who had participated in the Senior Team Maths Challenge often also reported they had developed their mathematical reasoning and fluency in using mathematical techniques to solve complex problems.

In addition, a number of students had taken part in activities designed to improve their **problem-solving skills, including those required for university admissions tests**. Several students reported these activities had helped to deepen their mathematical problem-solving skills, equipping them with a range of new approaches to help them tackle mathematic problems: 'One of the things I recently did was an exam for University, some of the questions were similar style questions so definitely helped with preparation for that'. Students also reported the benefits of working with students from other schools/college, which had 'encouraged more mathematical discussions'.

Attending these **enrichment events** had also given students an understanding of what was covered in A level mathematics (for KS4 students) and at university (for KS5 students), while also helping them make decisions about further study. The majority of the A level students spoken to as part of the focus groups planned to or had already applied to study mathematics or mathematics-related courses at university. While this was not a decision made exclusively from attending AMSP enrichment, students did comment that attending the events had reinforced and confirmed for them that this was the study route they wanted to pursue, while the experience gained from these events helped to enhance their university applications and prepare for university admissions tests. There was evidence that for some of the students in KS3 and 4, attending these events had influenced their decision to study A level Mathematics and Further Mathematics.

> *I don't think I would have studied anything other than Maths but it* [Senior Team Maths Challenge] *did make me a lot more passionate about studying it. It made me strive to apply for the best courses*

It's made me reconsider doing maths A level, because I think it will help with every aspect of what I do

I think this has helped because it's about problem solving so because I enjoy that stuff I thought I'd do accounting, so it has helped me in making that decision

I'd like to do Astrophysics… I was actually scared about the amount of maths in it but after the activity [Florence Nightingale Day] *I realised actually this is going to be fun maths*

Several students also reported seeing the **real world applications** of mathematics skills and reported developing a greater understanding of related careers, as the following comments reveal.

It definitely made me interested in doing Maths and Further Maths A levels

It's given me an insight into what to expect if I want to go onto a certain kind of career

I thought it was good because we got to go round the actual Uni. So that was quite good to see what it was like. It also opened my eyes to see what Maths can actually be used for in the real world, because you don't usually see that.

Mathematics Leads were also asked at the follow-up interviews what outcomes and impacts they had identified from students' involvement in AMSP activities. Their comments largely echoed those previously identified, and were similar to the points made by the students themselves.

Increased engagement with mathematics was a recurring theme, with Mathematics Leads noting that students had developed a broader perspective of the subject, with them showing increased interest and actively exploring mathematics outside of the classroom, which in turn had raised their awareness of the practical application of mathematics. There was increased confidence, enthusiasm and enjoyment of mathematics, with one interviewee reporting this had also been seen amongst students who traditionally found mathematics challenging and had shown lower engagement.

> *We've taken students who struggle with maths to those events as well and it has helped encourage them to try to succeed a bit more, so we haven't only taken the top kids or the Further Maths kids… it has helped their engagement in lessons to an extent as well* (11-18 institution).

Mathematics Leads recognised the impact enrichment had upon raising aspirations and shaping students' future decisions. For Year 10 students, the Maths Feast appeared to be key in encouraging them to study mathematics and further mathematics at A level. For Year 12 and Year 13 students, it provided them with insight into the mathematics related degrees they may study at university and subsequent careers they could apply their skills to.

Mathematics Leads again highlighted their involvement in enrichment activities designed specifically to support the participation of girls, with one interviewee noting the importance of

showing their female students there were other women who share their enthusiasm for mathematics. This, they argued, acted as encouragement for them to pursue further study.

A number of Mathematics Leads reported that they had used some of the activities presented to students who attended enrichment days with the rest of their class. This was sometimes done as part of warm up activities, and meant that the learning from these events could be shared with a wider group of students. The indirect impact upon students of staff attending CPD was also raised, as from these sessions, staff brought back materials and ideas which could inspire students in the classroom.

Mathematics Leads were asked to what extent involvement with the AMSP had influenced students' decisions to take mathematics-related degrees. Most could not say that the AMSP had entirely influenced students' decisions but they did report that the AMSP had contributed in some way, alongside other factors. A small number felt that the AMSP support had increased enthusiasm and consolidated decisions that would have been made anyway. Where AMSP support had influenced decision-making, it had done this by:

- **helping students to understand the power of mathematics:** 'It wouldn't necessarily force them down the maths-specific route but I think it helps them to realise the power of maths in the area that they want to go into' (11-18 institution).
- **raising awareness of mathematics-related career options and providing access to successful role models (including females)**
  A couple of the year 12s were talking about careers in maths following last week's Florence Nightingale Day, because they actually saw successful female mathematicians doing different things, so it wasn't just maths it was also using maths in a different context…So I would say it has had quite a significant impact on shaping their direction (11-18 institution).

  It opens their eyes to the maths-related things they can do (11-18 institution).
- **showcasing what mathematics looks like at university which could increase confidence**

  …going to these workshops that AMSP offer allows them to get an experience of what more challenging maths might look like at university...they might think of being more ambitious in their application and when they go to interview to feel a bit more confident and to be able to show that they can actually do more… (11-18 institution).
- **providing support with MAT and STEP, which was particularly beneficial where school sixth forms and colleges did not have this expertise**

  I think they perform an invaluable role…In some school sixth forms and some college sixth forms, there isn't the expertise maybe to encourage and guide and support them with things like these MAT exams for instance, or STEP, or to support them with what they are going to do when they go to interview (11-18 institution).
- **providing support to more disadvantaged students to access the more elite universities**

I think that it is good at levelling up…they help to even out the playing field a bit…recruiting people who have got experience of getting kids through those sort of exams [university entrance] *is very difficult in the state sector. And what you have got, it is the AMSP which is offering something for these kids…these are all things that are very valuable at levelling up…they give opportunities* (11-18 institution).

- **raising the standard of teaching which in turn benefitted students**

  They help to raise the standard I think of the teaching that the students get in colleges and schools…they provide high-quality courses which are subject-specific but also advice on strategies, how to organise and run and move forward in the maths curriculum. And this is sorely lacking and if it wasn't for what the AMSP have been doing with sixth forms for instance I think we would be in a right mess as a nation really… (11-18 institution).

- **increasing students' enthusiasm for and confidence in mathematics** which, in turn, impacted their interest in mathematics-related courses
- **increasing staff knowledge of mathematics courses in higher education which make them better able to promote these courses to students**
- **bringing students from different schools together and, in doing that, dispelling myths that mathematics is 'geeky'**
- **encouraging students to choose Mathematics A level following enrichment in year 10/11**

Mathematics Leads were also asked in follow-up interviews if these outcomes and impacts they had seen for students would have occurred had it not been for the AMSP. Some found it difficult to isolate the positive effects to AMSP involvement. One reason given for this was that most schools/colleges involved their highest achieving students in the enrichment and support, meaning that even without the additional input, they would continue to be amongst the best mathematicians in the cohort. Others explained that as they were involved in a number of mathematics initiatives throughout the school, which had a positive impact upon students of all years, it was difficult to separate the effects and measure the impacts of AMSP alone. Mathematics Leads did, however, all agree that their involvement in the AMSP had been beneficial for students.

On the other hand, several interviewees were confident that without the AMSP support, they would not have experienced these impacts for their students. The quotes below illustrate how important access to AMSP has been:

I think that the main activity that we have seen the impact is the STEP and I am not sure if they [the students] *would have been able to access those exams without that support. I would have tried my best but I don't know how much I would have done* (Sixth form college).

I would say they wouldn't have been realised later, I would say they wouldn't have come to fruition, because it is quite a competitive market when students go to universities and I do think we need to be a forefront of advertising our subjects and AMSP do a really good job and that's why our students are aiming for those career (11-18 institution).

Being involved in AMSP has made it much easier to access [activities / enrichment opportunities]… I think the fact that we get such healthy numbers going through at A-Level is because they do get these things, they do see that maths can be quite fun (All through institution).

If we didn't do it I think we'd be disserving a number of our higher ability students…I think they benefit more than they realise (11-18 institution).

3.13 Continued involvement with the AMSP

Survey respondents were asked if they planned to continue their involvement with the AMSP over the next 12 months.

The vast majority (83 per cent) reported they would continue to be involved with *professional development and support for staff*, with about one in six (14 per cent) reporting they did not know. Respondents appeared to be less certain regarding *student support and tuition*, with just over half (55 per cent) reporting that they would continue to be involved, while almost a third (31 per cent) reporting they did not know (see table below). However, it is worth noting that of the 221 respondents who indicated that they did not know if they would continue with student support, almost four out of ten (38 per cent) had not actually engaged with any form of AMSP student support, meaning there was no activity for them to continue with.

Table 12. Proportion of survey respondents who planned to continue their involvement with the AMSP over the next 12 months

	Yes		No		Don't know		Not applicable	
	N	%	N	%	N	%	N	%
Professional development and support for staff	593	83	9	7	99	14	14	2
Student support and tuition	390	55	43	6	221	31	59	8

Percentages may not sum to 100 due to rounding
Missing responses are excluded
Source: NFER survey of teachers that have received support from the AMSP, 2019

All of the case-study interviewees planned to continue their involvement with the AMSP.

3.14 Schools'/colleges' recommendation of AMSP

Finally, the vast majority of survey respondents (95 per cent) reported that they would recommend the AMSP to other schools and colleges, with just one per cent reporting they would not, and four percent reporting they did not know.

The case-study data echoed the survey data in that all interviewees were highly complementary about the AMSP provision.

All of the students we spoke to said they would recommend the AMSP to other students. Asked why, students emphasised the benefits of developing their mathematical thinking and problem solving skills, the insight they gained into the types of careers that were open to students who had taken advanced mathematics qualifications, and the opportunities to have fun and learn something new.

4 Findings from interviews with teachers participating in On-demand Professional Development (ODPD)

This section presents the findings from the interviews undertaken with the small sample of teachers who were currently undertaking, or who had completed, On-demand Professional Development (ODPD).

4.1 How participants found out about the ODPD courses

Half of the participants (four out of eight) found the course on the AMSP website; three participants saw their course on Twitter; and one heard about their course via an email as their college is on the AMSP mailing list.

4.2 ODPD training completed or being undertaken

Participants were asked which courses they had completed or were currently undertaking. The table below shows the number of participants who had started or signed up for the different courses.

Course	Number
Spreadsheets and the large data set	5
Preparing your students for STEP	4
GeoGebra in the Mathematics classroom	3
Numerical Methods for A level Mathematics	0
Preparing your students for the MAT and the TMUA	3

Only two participants were signed up for or undertaking only one course, the majority of participants (six out of eight) were signed up for, or undertaking, two or more courses.

4.3 Reasons for undertaking ODPD

Participants were asked why they had chosen to undertake a specific on-demand course and why they chose this form of professional development.

Why teachers chose to undertake this form of professional development

> *It's more flexible – it allows me to finish in my own pace.*
>
> *…it's at my own pace and I don't have to go and travel far.*

The majority of participants undertook this form of professional development because of the flexibility it offered. Five respondents liked being able to fit the course around their other commitments; two commented that it was convenient not having to travel to do the course; one participant noted that the courses are free and there is a lot of online support available.

Why teachers chose to undertake specific ODPD courses

Half of the participants wanted ideas that could be used in the classroom; other participants felt that they lacked expertise, confidence or experience in the subject(s) chosen.

> *I wanted to develop more use of technology in the classroom.*
>
> *I wanted experience of those types of questions before starting to teach them.*

Spreadsheets and the large data set

This was the most popular course with the sample of teachers interviewed. Two of the five participants who took the course wanted to improve the teaching of this topic in their school, for example to get teaching ideas and activities for the classroom; two respondents wanted to find out about how to use the new technology; one respondent chose the course because they wanted to do something they hadn't done before and felt that the course would help them to achieve their next career goal.

Preparing your students for the MAT and the TMUA and Preparing your students for STEP

The majority (three out of four) who are undertaking, or have signed up for, the STEP course have also signed up for the MAT/TMUA course, and their reasons for undertaking these two courses were similar.

One wanted to gain experience of these questions before starting a new job in September; two felt that the course(s) would prepare them for supporting students doing university entrance exams; one chose the courses to help tailor teaching towards entrance exams and to recognise student who would benefit. One of the participants had worked specifically through Proof (a unit of the STEP and MAT/TMUA courses) because they felt that proof tends to be taught separately, whereas they wanted to integrate it across their teaching.

GeoGebra

The three participants who had chosen to undertake this course reported that they wanted to update and improve their skills in using this software.

4.4 How long the course(s) are taking to complete

Participants were asked approximately how long it had taken or was taking took to complete their course(s).

The amount of time spent varied enormously depending on the course undertaken and the individual doing the course. Some participants went through the courses thoroughly, while others selected only the parts that they identified as being most relevant to them. It seemed that participants found it hard to quantify the time they had spent on the courses so far which may be because they were fitting them in around their other commitments and, generally, in their own time.

Nearly all of the participants reported that the time spent had been or would fall out of school hours, specifying school holidays, evenings and weekends, or simply "in their own time". Two

participants indicated that they felt they would have more time to do the course(s) now that exams were over. Participants were attracted to the flexibility of the courses and the fact that they could be completed in their own time. They were less concerned with how long they would take to complete.

4.5 Usefulness of course content

All participants commented positively about the course content and/or the resources.

Videos

The majority of participants (seven out of 8) commented on the videos. Four of these reported that the videos were helpful or useful. Of the other three participants, one said that they were 'really happy with the videos', another felt that they gave ideas about how to get into a question and the other felt that they were fine and worked very well.

One of the participants who had completed the Spreadsheets and Large Data Sets course felt that users who lacked IT skills might find that the explanations of the different functions of Excel went '*over their head'*.

Practice materials

Three out of eight participants commented on the practice materials. Two of the participants commented that the practice questions were pitched at the right level(s) of difficulty. The participant who had undertaken the Spreadsheets and the Large Data Set course found it useful to be able to download the materials. However, they reported that it would have been useful to have more resources to use with students as they found it difficult to find resources elsewhere for this new area.

'Triggers for reflection'

One-quarter of the participants (two out of eight) commented positively about the triggers, with one saying that they are a very helpful starting point. One participant reported that they found the reflections and giving feedback after every session 'tricky'.

Suggestions for further study

Three out of eight participants commented: one thought they were useful; one liked the links to resources; one intends to do more.

4.6 Use of the online forums

The majority of participants in this sample were not using the forum to collaborate with others doing the same course(s); more participants read comments on the forum than posted their own.

Three out of eight participants have interacted with others via the forum(s). One commented that they participated when it seemed necessary, but had not consciously looked to collaborate – they did not feel the need to discuss a section with which they were happy, the other said that they had collaborated only via the forum, although they thought they might be interacting with some of the same people on Twitter. One had interacted generally, having

introduced themselves, discussed problem solving in general and discussed the framework at the start of the STEP ODPD, but had not yet interacted on question-specific things

Five out of eight participants did not collaborate with others via the forums. Of these, one commented that they posted on the forum when prompted at the end of the course and had read the comments others had posted, finding it interesting to see others' perspectives, but they haven't interacted with others on the course; another commented that the forum was not really useful -because of how they were using the course, they hadn't used the forum and added that the forum was impersonal so they were not using it; a further interviewee reported that they had received a lot of emails recently from other teachers who had completed the course, but when they completed the course, there were not many other comments and no-one was available to respond to their queries. One participant did not see others using the forum or commenting on the things they needed and one interviewee responded that they hadn't yet used the forum - they interact with other teachers on Twitter.

4.7 Experiences of accessing AMSP professional development in this way

What works well?

Five out of eight participants reported that they liked being able to undertake the course in their own time. Of these, three participants commented that they liked the fact that they could repeat sections and two liked being able to choose how long they spent on different aspects of the course, which is not possible with traditional professional development. Although one of these participants felt that face-to-face courses can get you more engaged, they liked being able to undertake online professional development whenever they wanted to without having to travel anywhere.

> *Being able to do* [it] *when you want is perfect.*

One participant commented that this form of professional development was beneficial because there was no negative impact on classes.

Another teacher commented that ODPD was '…really flexible, nicely structured, great content, really to the point – I'm really happy with it'.

Two participants found it straightforward and easy to complete the course and one of these commented that the quality of the information was the same as other forms of professional development: '… Staff are available to talk with so this is as good as attending conferences.'

One participant mentioned the fact that the course was free, another said that they were really enjoying the course they hope that there will be others available and they plan to sign up for more once they have completed the two currently being undertaken. A further interviewee commented that it was a fantastic opportunity, as without paying a lot of money for the course, cover and overnight costs, it is difficult to find courses which cover these topics with such a high level of support.

Challenges, barriers and support requirements

Half of the participants (four out of eight) reported that they did not experience any challenges in undertaking online professional development. However, four participants pointed out challenges or issues in undertaking this form of professional development.

Two participants commented that online professional development lacks personal interaction with one of these commenting further that they found it hard to see their progress because, despite watching the videos, their progress was not being registered. One participant commented that this kind of PD is disjointed compared to professional development that takes place in one day.

One teacher raised an internal challenge in teachers accessing this form of professional development. They reported that their college did not recognise this form of professional development and that external courses held more prestige within the college. They added that they would like their college to give the time dedicated to completing the course more recognition.

None of the participants said that they had any further support requirements.

4.8 What improvements are needed?

This question prompted a variety of responses which were different for each interviewee. The suggestions for improvement were:

- increase variety of activities available:
  - one participant (referring to GeoGebra and Spreadsheets and the Large Data Set) reported that they would like more practical activities after a presentation or video that could be used with the students. They would also find it useful to have more worksheets to use in the classroom.
  - one participant (referring to preparation for MAT, preparation for STEP and Spreadsheets and the Large Data Set) suggested that more quizzes could be added to increase interaction, although this participant added that it was working effectively in its current format.
- improvements to the website:
  - one participant suggested that the website would benefit from ‘an overhaul’ and another commented that some things were difficult to find on the website.
- better matching of ODPD questions and exam questions:
  - one participant felt that exam questions for Spreadsheets and the Large Data Set do not match what is in the ODPD course as well as those for GeoGebra.
- remove requirement to give feedback at the end of every stage:
  - one participant felt it should not be necessary to give specific feedback at the end of every stage, although she was overall very pleased with the course and found it a very positive experience.
- improve promotion of courses:

  - one participant felt that the courses could be better promoted in schools and colleges rather than relying on teachers to find them themselves.
- extending the provision to include A level statistics
  - one participant reported that there is only one exam board doing A level statistics, so it would be really useful if the AMSP could produce some more materials around the higher statistics content.

4.9 Benefits of undertaking the course

Participants were asked about the benefits that they had experienced or were currently experiencing through undertaking ODPD. Five out of eight reported that they had benefited from an improvement in their subject knowledge or understanding: *'It improved my knowledge of the datasets'.* In addition, three of the participants commented that their problem-solving skills or their approaches to problem solving had improved:

> *My problem-solving toolkit is already enhanced.*
>
> *I'm a better thinker and a better teacher for it already.*

Two teachers reported that they had benefited from the opportunity to work through questions and topics.

In addition, individual teachers reported: that they felt better prepared for teaching for the [university] entrance exams; and that the courses had helped to identify areas they need to improve.

One participant reported that, in the future, they would share their learning with the members of the department who did not have time to do the course themselves which would provide wider benefit within their school.

4.10 Has learning been embedded into practice?

Three out of eight participants have already embedded their learning into their practice. Of these, two have been using questions from the materials and one participant (who has done the GeoGebra course) has demonstrated the intersections of planes to her students and has found this useful as it helps them to gain a better understanding of the vectors.

Three-quarters of the participants (six out of eight) intend to embed what they have learnt into their practice in the future. Two of these want some preparation time for themselves before using what they have learnt and one is building problem solving and questions into next year's scheme of work. Another teacher is planning to design an activity to help students become familiar with large data sets: '*It has convinced me that I really should be doing loads more of that kind of visualisation'.*

For one participant, the opportunity to embed their learning had not yet presented itself, but they will be able to draw on learning in the new school term.

4.11 Advice to other teachers who might be considering AMSP ODPD

Five out of eight participants directly encouraged other teachers to do some AMSP ODPD. Their comments are presented in the box below.

> *Invaluable…I think it is some of the best mathematics CPD that is on offer at the moment and so I would urge any teacher to do* [the preparing for STEP course] *whether or not they are teaching Oxbridge candidates.*
>
> *Definitely do it!*
>
> *I would encourage anybody to have a go.*
>
> *Make the most of it.*
>
> *…absolutely take advantage of this ODPD – I can't recommend it highly enough!*

The other three participants all commented positively about undertaking ODPD: one pointed out that it was free so there is nothing to lose by having a go; another observed [the GeoGebra course] was really useful and that teachers could do the course with any level of GeoGebra experience; the other advised ensuring that your school is aware that you are doing the extra PD so it is not overlooked.

Other advice and comments to other teachers participating in ODPD courses included:

- Go through at least one cycle of teaching the A level content before the course so the content is fresh.
- Consider the start timing – June better [because timetable lighter].
- The forum is really useful when there is a specific part of the course you don't understand - this teacher says they often receive responses from 15 other teachers offering support and guidance.
- If you want to get the most out of it, you're going to have to put in a bit of time.

5 Findings from the stakeholder consultation

This section presents the findings from the consultation with 12 key stakeholders.

5.1 Awareness of the AMSP

Awareness of the programme was generally good amongst the 13 stakeholders who responded to the consultation, with the majority reporting that they were aware of the AMSP 'to a great extent' (10), with two responding 'to some extent' and another 'not at all'. The one responding 'not at all' from a university mathematics department did not then go on to answer any further questions so the responses noted below are out of 12.

5.2 Perceptions of the extent to which the AMSP meets teachers' and students' needs

Ten out of the twelve stakeholders felt that the AMSP met teachers' and students' needs and further details are provided below. Most rated the AMSP highly and commended staff for their hard work and commitment to increasing participation in Level 3 mathematics.

Teacher professional development and support

Stakeholders commented that the AMSP was 'very well connected to the teaching community' which enabled its staff to focus on the 'right areas' and their provision was built on a 'strong understanding of the needs of teachers of advanced mathematics' and was 'vital to meeting current and future educational needs'. In addition, their programme was perceived to offer 'wide-ranging professional development' for Level 3 mathematics which was effectively delivered and of high quality. Quotations from stakeholders on this theme include:

Teacher feedback on AMSP support has been phenomenal.

The courses and activities run through the AMSP are of high quality and are valued by those who access them.

Good subject knowledge and pedagogical support.

I believe the AMSP is an invaluable resource for supporting both teachers and students and their work deserves commendation.

The AMSP is the main source of expertise and support for Level 3 mathematics…The main gaps the new programme is addressing lie in support for Core Maths and in the very clear messages about Level 3 mathematics participation.

One consultee focused on the importance of flexibility in engaging teachers with professional development and felt that the AMSP was leading the way in this respect:

> *Given the increasing demands on teachers' time, flexible professional development is the future and the AMSP is championing this approach.*

Other consultees praised the AMSP's increased focus on schools that require more support, with one suggesting that the AMSP could be even more selective in the schools and teachers it targeted – 'a focus on quality of impact not quantity of reach would be healthier'.

Stakeholders also noted a range of challenges regarding schools' and teachers' access to the AMSP. One noted the challenge in engaging some schools who would only engage when there was a 'problem'. Another reported teachers being released to attend external courses during the school day as a challenge, due to the impact this has on their classes as well as the cost implications, particularly in terms of providing quality cover. Stakeholders also recognised that persuading school leaders to offer a greater variety of Level 3 mathematics provision, particularly Core Maths, would be a challenge.

Student support

Consultees focused less on student support in their responses, but were still largely positive of the provision available. One university admissions tutor commented that the AMSP effectively prepares students to progress onto mathematics-based degree courses, and gave university departments confidence that they can fill their mathematics degree places despite having Further Mathematics A level on their entry criteria. This was due to the AMSP supporting schools to effectively deliver Further Mathematics A level and increase student participation in this subject.

The student enrichment offer was also praised, with one consultee based in a university mathematics department commenting that as a result of AMSP activities focused on encouraging students to take up post-16 mathematics, there had been a subsequent increase in the number of students, particularly girls, following a STEM-related discipline.

The AMSP's focus on a range of examination preparation activities such as supporting students' mathematical thinking was also praised.

5.3 Perceptions of the impacts of the AMSP

Most consultees were positive about the actual, or potential, longer-term impacts of the AMSP. A small number felt that, at this early stage of delivery, it was too soon to confidently say whether the AMSP is having an impact, particularly as developing schools' capacity is a long-term strategy. However, since they perceived the FMSP to have achieved a significant impact, they expected the AMSP to do the same. More details are provided below.

Several consultees saw the work of the AMSP as vital for making A level Further Mathematics available across the UK. One university representative went as far as to say: 'To be frank, I think Further Mathematics A level would not exist in the UK (outside the independent sector) without the AMSP…As it stands the AMSP is pretty much all we have in terms of getting the higher-level mathematics education the UK needs'.

Several stakeholders also recognised the AMSP's more recent focus on raising the profile of Core Maths, with one describing this as 'developing, effective and well targeted'. Another commented:

> *The AMSP is really beginning to have an impact on raising the profile of Core Maths in the same way that its predecessor programme did for Further Mathematics…The programme provides high-quality events which support teachers well in developing their practice…Girls' participation is a key area being tackled by the programme.*

However, to increase their impact, two stakeholders suggested that the AMSP should place even more focus more on providing sustained professional development and support over a period of time and supporting teachers to embed learning in their practice.

Some stakeholders praised the AMSP's focus on priority schools and engaging girls and their drawing on research evidence in this respect. They acknowledged the challenges in engaging some schools. However, one stakeholder felt that priority areas were too broad and this meant that some schools in need slipped under the radar: 'pockets of challenge in areas that don't attract funding go unattended whilst strong schools which are doing well in priority areas access funding that should go to more needy schools'. They suggested that the AMSP could work more closely with the Regional Schools Commissioners to 'get into the right specific schools' Linked to this, one stakeholder felt that, to gain maximum impact, the AMSP should target provision more at an individual school's needs and objectives, rather than offering a broader less targeted programme aimed at accessing large number of teachers.

One consultee commented that the AMSP was a 'good sticking plaster' but was not sufficient to tackle the deep rooted issues in mathematics teaching and they called on the DfE to do more:

> *The DfE should be thinking long and hard about how, and why, the UK is in such a state regarding the education of mathematics. They are ultimately responsible for this - we are eternally short of five thousand mathematics teachers and there is no coherent long-term plan to address this over the next 20 years. The AMSP is a good sticking plaster but it is not the cure…*

5.4 What more could the AMSP be doing?

Stakeholders were asked what more, if anything, the AMSP could be doing to help improve teaching and learning and increase participation in post-16 mathematics qualifications. Some stakeholders felt that it was too early to suggest what else the AMSP could be doing. Other stakeholders suggested a range of actions, stressing that action needs to be taken earlier in both teachers' and students' education. Not all of the actions suggested fall within the AMSP's remit.

Improving teaching and learning

One stakeholder suggested that, to enhance the quality of teachers entering the profession, there should be more focused work with undergraduate students prior to their teacher training. Through setting targets on this, it was thought that a positive impact would not only be seen in teaching quality, but also in the teacher shortage and retention crisis. They felt that this would be a more effective strategy than 'improving weak teachers who aren't subject specialists'. However, others acknowledged the shortage of mathematics teachers coming into the profession and the value in upskilling existing teachers. One suggested that the AMSP should place more focus on supporting less experienced teachers rather than those who are already competent A level teachers. Another

consultee suggested that developing the expertise of teachers from similar subjects, like science, to deliver Core Maths might be an option.

In relation to Core Maths, a small number of stakeholders voiced an opinion on the AMSP's work. One felt that it was an oversight to 'start afresh' and not to build on the previous work of the CMSP. Another felt that it had been a 'big mistake' to take down the Core Maths website as it was 'gaining traction' and that it has lost its identity now that it was part of the AMSP which was negatively affecting the qualification's uptake.

Increasing student participation

Several consultees commented on the curriculum and engagement of students pre-16 (which forms a component of AMSP's provision, but is not its main focus), as well as on widening the subjects available to students post-16.

One stakeholder commented on what they perceived as the current negative attitude of students towards mathematics which they attributed to their negative experiences of mathematics gained from lower down in school. They felt that more focus was needed on improving the engagement in mathematics of students in primary schools, ensuring that these students had a positive and inspiring experience of the mathematics curriculum. This would mean that, when they chose their post-16 options, they would 'see the value in the subject' rather than feeling that they had to study something that they had 'grown up disliking':

> *I think the greatest challenge in participation post-16 is not in 11-16 mathematics but before that. Students' mathematics journey starts before that and the mathematics curriculum is, in my opinion, as a professional mathematician, not inspiring or future proof…it is vital the developmental support is provided to ensure both the mathematics curriculum and experiences of all children are positive…*

Another commented that, for England to compete with other countries, 'we need post-16 mathematics for every child', offering a wide range of advanced mathematics options as well as alternatives to re-taking GCSE mathematics to those who did not achieve a grade four or above at GCSE. It was reported that some students who had not succeeded in GCSE mathematics at the first attempt were discouraged to re-take it and needed a wider range of options.

Another consultee suggested that engaging teachers and students in 11-16 schools in 'Core Maths and A level style' teaching would lead to a greater understanding of what the post-16 courses entail, thus encouraging students to enrol on the courses.

5.5 Does the AMSP complement other similar Level 3 mathematics provision?

Most consultees felt that the AMSP complemented other Level 3 mathematics support. However, a small number felt that there was duplication in the offers of different organisations, with particular mention of the local Maths Hubs. More details are provided below.

Some consultees viewed the AMSP as the only initiative freely providing expertise, high-quality subject-specific professional development and enrichment activities for teachers and students of

Level 3 mathematics qualifications. One consultee gave the example of the now compulsory mechanics element of A level Mathematics, on which AMSP provides specialist, in-depth knowledge which is not provided by other support programmes. Others praised the support for students through STEP in preparing for university admissions tests.

Most stakeholders viewed the AMSP as complementing rather than duplicated other similar provision. One consultee commented that, in their area, the Maths Hub and AMSP ensure that their offers are different, therefore avoiding any duplication or confusion for teachers. Others noted that the cooperation between the two organisations brought coherence rather than duplication and noted the benefits of the AMSP's local focus:

> *The programme is working closely with the Maths Hubs Network which enables a greater coherence of offer to all teachers and schools, rather than duplication, as well as a more consistent message about participation.*
>
> *Maths Hubs seem to do a good job of avoiding Key Stage 5 and cooperating with the AMSP…AMSP is good at working locally with schools and HEIs.*

Although recognising the close working of the two organisations and the willingness to collaborate, one consultee noted 'tensions which need to be ironed out'. However, they felt 'greater direction from national leadership in both organisations' to form a well-established strategy would help to resolve these issues.

Two consultees commented on the overlap of provision between the AMSP and the Maths Hubs, although one felt that the AMSP had more reach:

> *It* [the AMSP] *does not* [complement other provision]*, it overlaps and causes confusion. Too many areas see both Hubs and AMSP offering similar events. What a waste. AMSP should focus solely on A level and Further Mathematics, otherwise rename it.*
>
> *The Maths Hubs appear to have overlap with this provision, but I am not convinced they have the same reach, engagement and penetration.*

To eliminate potential confusion, it was suggested that teachers could be given a clear guide of what is available to them, thus allowing them to access support most suited to their needs:

> *I believe teachers need a clear guide as to what support is available from a number of organisations and help to plan the most appropriate support for themselves.*

Regarding where Core Maths provision should sit, one stakeholder believed that it should fall under the remit of the Maths Hubs, as they did not view it as an advanced qualification. This would leave the AMSP focusing solely on A level and Further Mathematics. This consultee went on to add that 'too much money is being spent by DfE supported groups on overlapping projects'.

One consultee also commented that there was some duplication with the awarding organisations' support for qualifications and another that there were too many providers focused on London.

6 Conclusions and recommendations

6.1 Overview

The findings presented in this report demonstrate the high regard that teachers who are accessing AMSP provision have for the programme. Indeed, survey and case-study respondents rated the quality of the AMSP provision they had accessed very highly. For example, for all four forms of 'student support and tuition' that survey respondents were asked about, 95 per cent of respondents or more rated the quality as 'very good' or 'good'. A similar picture emerged for support received as part of 'teacher professional development', with the proportion of respondents reporting this was 'very good' or 'good' averaging around 90 per cent or better for most of the forms of support listed. Most case-study respondents were similarly enthused about the support they had accessed. Typical comments included: 'It's a godsend' and 'It's an essential place to go for maths teachers'.

Mathematics Leads and teachers reported a range of outcomes 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. In turn, these outcomes were seen to be leading to increases in students' engagement, enjoyment and understanding of mathematics and were expected to ultimately impact on levels of attainment.

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; 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.

However, despite these positive outcomes, the programme also faces some challenges. In terms of engaging schools and colleges, the single greatest challenge appears to be related to the release of teachers and students to undertake activities, and the costs associated with this. These internal challenges within schools and colleges faced by a provider of external support are not unique to the AMSP, but reflect the budgetary, time and workload constraints that many schools/colleges and teachers feel they are under (Walker *et al.,* 2019). In addition, findings from the survey suggest that offering Core Maths does not appear to be a priority for many schools/colleges, which, at the programme level, makes achieving the AMSP's goal of increasing student participation rates in the subject challenging. The case-study interviews revealed that, while many school/college mathematics departments were keen to offer Core Maths, senior school and college leaders were often less convinced. This is due to a range of reasons, including a lack

of awareness about what the qualification entails and concerns from schools regarding how it would be funded, timetabled and staffed. In addition, there was little evidence to suggest that the introduction of the advanced maths premium, which was designed to support the education sector to grow the number of students studying mathematics qualifications to Level 3, was doing much to encourage schools/colleges to increase student numbers by offering Core Maths. Clearly, more needs to be done to promote the take-up of Core Maths, and these efforts need to extend beyond the support offered by the AMSP.

6.2 Wider context

As summarised in the introduction to this report, the roll-out of the AMSP follows significant recent changes to both the GCSE and A level curricula and assessment regimes. These developments present both opportunities and challenges for the programme. The changes in subject content have created opportunities for staff professional development, as teachers have needed to develop their familiarity with the new compulsory content, such as statistics and mechanics at A level. The survey and case-study findings suggest that most teachers have found the new training and development opportunities, provided to address these needs, to be both useful and of high-quality, as they have with AMSP provision in general. However, these reforms have also created challenges. While, in recent years, mathematics has been the largest entry A level in England, the number of entries in 2019 decreased by approximately 5.9 per cent compared to 2018. This is against a background of an overall reduction in the number of A level entries in England by 1.2 per cent, and a fall in the size of the 18-year-old population of around three per cent compared to 2018 (Nye and Thomson, 2019). Several commentators have suggested that students have become more reluctant to apply to study mathematics at A level, having been put off by the more difficult GCSE Mathematics, while the move to decoupling AS from A level may have also contributed to the decline in numbers at A level (see for example Ward, 2017 and Noyes and Adkins, 2017). It is not yet clear whether this decline represents a 'blip' or part of a downward trend but, arguably, the decline in A level Mathematics entries may have been more acute were it not for the student enrichment and teacher professional development support being offered through the AMSP.

6.3 Recommendations

The evaluation's findings give rise to a number of recommendations for the AMSP.

Core Maths

1. Given the ongoing challenge of increasing the number of schools/colleges offering Core Maths, the AMSP should continue to make the case to senior leaders within schools/colleges for the benefits of offering Core Maths, including how they might draw on the advanced maths premium to support its introduction. This could include drawing together some best practice examples of schools and colleges which have effectively introduced Core Maths, including how they have tackled staffing, timetabling and financial challenges and the benefits and outcomes for students.
2. The AMSP should also seek to further increase and promote universities' recognition of Core Maths to both stimulate supply from schools/colleges as well as demand from students. In

addition, the programme team should draw together data on those universities that recognise it, which will help persuade schools/colleges to offer it and students to take it.

3. DfE should consider ways to secure long term and more stable funding for schools to support the delivery of Core Maths.

Teacher professional development

4. Releasing teachers to participate in professional development was revealed as one of the main challenges facing schools/colleges. To help address this, the AMSP should look for opportunities to expand its on-demand professional development (ODPD) offer. This is the most flexible way of teachers accessing professional development and was rated highly in the teacher interviews.
5. The AMSP could develop further professional development and resources to support teaching of AS/A level Mathematics and Further Mathematics, including on effective pedagogies and schemes of work. Further tailoring of content to the specifications of different awarding bodies would also be beneficial.
6. To help better prepare would-be AS/A level Mathematics teachers, the AMSP should consider opening up the Teaching AS/A level Mathematics course (the TAM course) to teachers who are not yet teaching it, but are planning to, and/or explore whether offering a separate course for this group would be appropriate.
7. To help build networks between teachers in different schools/colleges, the AMSP could also consider setting up an online forum to enable teachers to voice questions to the professional development leads, access support from other institutions and share learning and effective practice.

Student support

8. The AMSP could consider offering more enrichment activities targeted at 'middle ability' students, as well as more targeting of pre-16 enrichment activities at potential Core Maths students. This could include tasters of Core Maths content and examples of how students will benefit from taking it.
9. There seems to be a demand for more whole year group enrichment activities delivered within schools. Whilst this would be resource intensive, it is worth considering whether this demand could be accommodated, particularly within priority schools.
10. The AMSP could provide schools and colleges with greater notice of enrichment activities, perhaps within a yearly events calendar, to allow more time for planning student attendance.

Future evaluation activities

11. This report has explored the perceptions of the programme's key stakeholders, and the findings demonstrate the high regard that teachers who are accessing AMSP provision have for the programme. However, in order to undertake a more comprehensive assessment of the impact of the AMSP, an impact evaluation should also be undertaken to drill down into the effect of the programme over and above what might have happened anyway and to determine

the extent to which any changes can be directly attributed to the AMSP. Approaches such as quasi-experimental and pre- and post-intervention designs could be considered.

12. As mentioned above, more research could be undertaken on exploring the benefits of Core Maths and how challenges to its introduction are being effectively tackled.

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Appendix 1: Standalone case-study write-ups

Case study 1: Example of the impact of teacher professional development

College context

This is a large general further education college based in the Midlands. It provides education and training to almost 5,000 young people, 6,000 adults and 2,000 apprentices. The college provides courses and apprenticeships across the whole range of subject areas, from entry level through to higher education. The college currently offers mathematics courses in GCSE Mathematics, A level Mathematics and Core Maths. The college is rated as Good by Ofsted.

Aims and priorities

The college's main priorities are to increase both the levels of participation in Level 3 mathematics qualifications and also the progress that students make. This has been made more challenging by the fact that teaching time for A level Mathematics has recently been reduced from five hours to four and half hours per week. A level Further Mathematics was offered until recently, but student numbers have dwindled to the point where it is no longer viable to offer it.

To help address these priorities and improve the quality of teaching, the Mathematics Lead, together with their colleagues, has attended a number of AMSP professional development courses and events, as detailed below.

Activities undertaken

The Mathematics Lead and a colleague have undertaken sustained and on-demand professional development (ODPD) on mechanics and A level Further Mathematics, and have attended one-day conferences on Further Mathematics and Core Maths. They have also accessed various resources on the Integral online platform, including resources that relate to the GCSE Higher Tier, and problem-solving resources for GCSE students. One teacher has also embarked on the Teaching A level Mathematics (TAM) course, but at the time of the visit, this had not yet been completed.

Impacts

The mechanics course was a sustained course that involved ten online sessions (fortnightly) and three of four face-to-face sessions. These were whole day workshops in London. There was an assessment at the end of the course. The teacher that attended described it as 'extremely beneficial', and said it helped her to overcome her reservations about the subject:

> *It allowed me firstly, not to be scared of it, because I was a bit scared of the subject. But also to see, rather than disconnected topics, I have been able to see the bigger picture which is what you really want* [in your teaching], *you want to have the full understanding.*

The Core Maths conference was used as a refresher for one teacher, while the Mathematics Lead attended in preparation for future teaching duties: 'I could see that at some point I will teach Core Maths in the future and I wanted to know a bit more about it. It was really useful'.

It also helped widen their pool of teaching resources and approaches for Core Maths, such as introducing them to 'QUIBANS': QUestions Inspired By A News Story, which can be used to provoke mathematical questions in the classroom. One teacher commented: *'We've had great feedback from the students, they loved it!'*

While it is not currently being offered, the Mathematics Lead and their colleagues had found the AMSP resources for A level Further Mathematics to be very helpful, particularly given what was perceived to be a dearth of resources from their exam Board.

> *Any teacher would agree that students get a lot of confidence doing past paper questions and because it was the first year through, the exam board had produced barely any… AMSP resources, through Integral, were invaluable actually because with the lack of other* [resources] *from the exam board itself, they really helped planning … sometimes that was all we had.*

Similarly, the Further Mathematics conference was reported to be very useful, as it helped the College get up to speed with the new specification. The fact that the conference was organised as a series of workshops meant that the Mathematics Lead could tailor the sessions to meet their needs.

One teacher had started the TAM course, as she wanted to develop her experience of teaching A level Mathematics. As a specialist in statistics, this course enabled the teacher to develop a better understanding of the other components of the course, such as mechanics: 'It is taking a lot of my time but I am quite happy because it is something that will help me become a much better teacher I think. It really has with mechanics'.

As the teacher explained, some of the resources from the course had already been used with students:

> *I have already tried some of the resources from that course and the feedback I have got from the students has been really positive. In fact, I have got some of them who, at the end of the lesson, said to me 'I really enjoyed this lesson, can we do it more often?'*

The course has also provided an opportunity to network with teachers from other settings, as the Mathematics Lead explained:

> *It gives her the opportunity to network with other staff in other schools, beyond just the obvious things about the learning and development and the sharing of resources*.

Resources from the course have also been shared with the other teachers in the department, widening its impact.

Reflections

While the College staff had very positive experiences of attending AMSP teacher professional development, as detailed above, the Mathematics Lead explained that staff always had to weigh up the impacts of mathematics teachers being out of the classroom. A particular concern was that while 'money is usually available for transport and paying for cover', it was 'very difficult to get maths cover teachers'. The general feeling was that it was easier to attend courses towards the end of the academic year:

> *Any of the courses that are in July, yes, I will be there, or in June because I might have lost my A2 classes and so my timetable is lighter so if I have a day on a course it doesn't have as much of an impact.*

In addition, finding time to reflect on and cascade training could also be a challenge:

> *It is like a lot of things where you go and you feel very enthused and everything but it is having the time afterwards to then develop everything and I think that is one of the main challenges.*

Despite this, the Mathematics Lead could see a lot value in the AMSP resources and training they and their staff had accessed, and would look for similar opportunities in the future:

> *Anything that is going to engage and enthuse staff and students is always good value. We would always look very carefully at what is available and look at when it is and who it would be of value to.*

Case study 2: Example of the impact of student support

School context

This is a smaller than average mixed 11-18 academy based in the North West of England. The large majority of students are White British. There is a much smaller than average proportion of students supported through the pupil premium. At post-16, the school offers AS Mathematics, as well as A level Mathematics and Further Mathematics. The attainment of different groups of students across different subjects is very high, including in mathematics. The school is rated as Outstanding by Ofsted.

Aims and priorities

The school has two main priorities for mathematics. They are to: i) increase the numbers of students studying Further Mathematics at A level; and ii) increase the number of girls studying mathematics at level 3, and particularly in Further Mathematics. The decoupling of AS from A level was said to have made it harder to encourage students to study both Mathematics and Further Mathematics at A level, as the Head of Mathematics explained:

> *In the past, you could turn to a student and say, choose that AS level and we will see how you get on, give it a term. And then at the end of it, even if it all gets too much, you finish at the end of Year 12 and that has got some currency.* [This is no longer the case].

In addition, the school is considering offering Core Maths, and at the time of the visit, in January 2020, discussions were taking place between the mathematics department and the school's senior leadership team:

> *With our budget being absolutely clobbered, persuading the school that we could take on somebody to run this course is a bit of risk if we don't get the uptake. So we have not offered Core Maths this year…but the senior management recognise that Core Maths is valuable and that at some point we need to do it.*

Activities undertaken

The school regularly takes part in both Maths Feast and the Senior Team Maths Challenge.

Maths Feasts take place in the spring. It is a challenge for Year 10 students which tests problem-solving and teamwork skills. Teams of four students compete over several rounds requiring different skills and strategies for success. The school sends a couple of teams every year. As the Head of Mathematics explained, the main goal was for students to 'have fun' and 'learn something new':

> *We do that every year* [Maths Feast], *the kids get a lot out of it. We are not in to win because they don't really have an overall winner. They have rounds and you can win separate rounds. It is about really having fun and learning something new.*

The Senior Team Maths Challenge takes place in the autumn. It is a competition which gives students in years 11-13 the opportunity to tackle a variety of mathematical activities while developing teamwork and communication skills. Teams of four students from schools and colleges across the UK take part in dozens of Regional Finals and high-scoring teams are invited to compete in the National Final.

> *The senior team challenge is great. We have been doing that since it started. Our students like it and it is very enjoyable.*

The school also accessed support for university entrance examinations, as one class teacher explained:

> *Our A level results are pretty good and so most of our students aspire to go to university, which sometimes require STEP and MAT and so on and so it seemed logical* [for us to access appropriate AMSP support] *to get to grips with those things.*

Impacts

Students found both Math Feast and the Senior Team Maths Challenge motivating and enjoyable, and, as the Head of Mathematics explained, it was useful for the students to 'think about maths outside of just their lessons and to get them thinking about doing maths in a different way'.

The Head of Mathematics liked the fact that Maths Feast linked to topics they were studying in class, while also preparing students for topics they would study later on.

> *The activities lend themselves well to them* [the students] *exploring the ideas in school as well so you can use them with the whole class and we can use some of the activities that are on their website from past years. We can use that as well so they are actually pretty good for use and they often touch on things that they might need to use a bit later on as well so there are some nice tasks for them to work on.*

A group of six Year 12 and 13 students, who had previously participated in Maths Feasts, spoke of the benefits of attending, which included developing their confidence in mathematics, new skills, and an increased enthusiasm for the subject.

I think I kind of took away experience because not only did I use my own skills but I saw other ways that people did things

It was also just fun. It definitely made me more interested in maths following the day

Working in a team you get a grasp of how other people would go about questions and it gives you a wider view of how to do them

Thinking more broadly because the way we divided it [the activity] *up … it allowed us to think more broadly so we were just focusing on one question, one person and I think that was very useful*

Because we won it [the challenge] *in our Year and so definitely it gave us more confidence in our Maths*

There were different types of questions as well, not just the ones you get in a textbook but a range of questions so that was quite nice

The Head of Mathematics thought the Senior Team Maths Challenge was particularly helpful for sixth formers as it helped them to be outward looking, and to support the development of enquiry skills.

> *It is very easy for sixth formers to fall into the trap of thinking 'well, this is my homework, this is my class, I come in to college, I do my lectures, I go home' and they get trapped in to just seeing everything in quite a narrow way. I think the…Senior Team Challenge helps them to be a little bit more outward looking and see things more 'in the round'…It encourages them to actually look up something and ask questions about it; It encourages that enquiry.*

The Year 12 and 13 students we spoke to were similarly enthusiastic about the Senior Team Maths Challenge, emphasising the benefits meeting students from different schools, exploring new mathematical concepts/approaches, and their general enjoyment of the day.

It was an opportunity to explore different areas of maths at a higher level than we do in A level Maths

Again, enjoyment, it was a great day

Last year we got to the National Finals and so that was also an enjoyable day and an opportunity to meet a lot of people that also were really, really good at Maths. And have a chance to be in a National competition at such a young age was quite enjoyable

I think just the competing part is really fun because you don't get to compete with others as much

I think that [the Senior Team Maths Challenge] *is what kick started me in getting a lot more interested in maths and I bought the book by UKMT with loads of questions and that really kick started my interest in maths a lot more so that is something I got out of it personally*

Asked whether either programme had influenced students' desires to study mathematics at a further or higher level, the Head of Mathematics explained that Maths Feast was particularly effective in encouraging students to think about studying mathematics post-16:

> *Often when they are doing the team challenge there is relatively small numbers of students and they have already made their minds up that they like maths. But the Year 10* [Maths Feast students]*, I think is really worthwhile because they come back and think 'I can do Maths, I enjoyed this, this is actually good' and it just lights that idea that it is something that they might want to do later on. It is very, very valuable.*

The students we spoke to were also positive about the fact that the Senior Team Maths Challenge had reinforced the fact that they liked mathematics, although, as the Head of Mathematics had suggested, its impact of their choice of degree subjects was mixed.

I always wanted to study Computer Science but it [the Senior Team Maths Challenge] *just reinforced the fact that I like maths, I like that logical thinking, I like problem solving*

I don't think I would have studied anything other than maths but it [the Senior Team Maths Challenge] *did make me a lot more passionate about studying it. A lot more wanting to strive for the best courses maybe*

The Head of Mathematics was also very positive about the impact of AMSP support for university admissions tests, such as STEP, MAT and TMUA. He described this support as 'helping to level the playing field' when compared with schools that were able to dedicate resources to supporting students to enter elite universities.

> *You have got somewhere like* [name of local selective grammar school], *where they have somebody who is in charge of promoting Oxbridge entrance and they will have extra sessions put on for them* [the students]. *Whereas there are a lot of children who don't have that opportunity and I feel quite passionately about that because recruiting people who have got experience of getting kids through those sort of exams* [University entrance exams] *is very difficult in the state sector…The AMSP is saying 'look, you have got a group of kids who would benefit from this, look, we are running these sessions …'. But these are all things that are very valuable at levelling up.*

Reflections

The school has accessed similar student enrichment activities from other providers, including those hosted by nearby schools and universities, as well as those organised by national mathematical organisations. However, while the quality of AMSP events had consistently been high, this had not always been the case with the provision provided elsewhere, as the Head of Mathematics explained:

> *I think you can have a varying quality of presenter when you have got certain things* [non AMSP] *on. Some of these* [non-AMSP] events, I would not go to again…*I think the AMSP, when they do a session, they have got people who are experienced people who have been teaching at that ability level…In all the years that we have sent people to anything* [on AMSP] *we have never had a bad experience.*

Case study 3: Example of a school that has received 'priority support'

School context

The school is a larger-than-average mixed 11–18 sponsored academy based in the North East of England. The proportion of students eligible for free school meals is above the national average. Advanced level mathematics provision includes A level Mathematics and Further Mathematics. Student attainment across subjects in Key Stage 4, as captured by the Progress 8 measure, indicates that progress is slightly below the national average. The school is rated as Good by Ofsted.

Aims and priorities

In the mathematics department, priorities were identified around the need to improve GCSE mathematics attainment (this was a priority across the school resulting from a slight dip in GCSE grades which had been seen since the new qualifications), as well as A level Mathematics uptake. The need to increase the participation of girls in advanced level mathematics was also identified. The Key Stage 5 (KS5) Mathematics Coordinator commented: 'We are conscious that we need to improve things and we are getting there'.

AMSP activities undertaken: priority support

As a Priority School, the Mathematics Lead and KS5 Mathematics Coordinator had met with their AMSP Area Coordinator to discuss their needs and to develop a Participation Plan. The process had involved diagnosing their needs, identifying AMSP activities that would help address these needs, and agreeing a timetable of activities for the year ahead.

One of the needs identified through this process was to improve the participation of girls in Level 3 mathematics study. Encouraging girls to access a range of mathematics enrichment activities has been a priority and some activities have been delivered specifically for girls to encourage them to pursue mathematics both at Level 3 and beyond post-18 education. These events aimed to raise girls' awareness of female role models who are studying or working in mathematics or mathematics-related fields, thereby showcasing the variety of careers in which mathematical skills can be applied.

Another need was identified around supporting particularly high attaining students with extension activities. The KS5 Mathematics Lead noted that there were a small number of students in KS4 who had completed the curriculum early, so extra support was needed to challenge these students further. The Mathematics Lead had worked with their AMSP Area Coordinator to design bespoke additional study programmes, with advanced level mathematics questions as part of classwork and homework, and enrolling students on a problem-solving course.

The Mathematics Lead planned to meet with the AMSP Area Coordinator annually, to review and refresh the Participation Plan as necessary.

Activities undertaken

As a result of identifying these needs in the Participation Plan, the school had accessed AMSP sessions and lectures, where they particularly encouraged girls to attend, and the AMSP had also delivered a bespoke session for girls in the school. In addition, the school had also accessed AMSP support for several students who were particularly advanced to extend and develop their skills. This included a problem solving course and an annual mathematics competition. The school were also involved in numerous other mathematics enrichment and teacher CPD activities, signposted by the AMSP Area Coordinator. These included the Mathematics Challenges, Maths Feast, and the Teaching A level Mathematics (TAM) course.

The school had also benefited from access to subsidies towards travel fees, course fees and cover costs, for instance to enable staff to attend networking sessions.

Impacts

The senior mathematics teachers in the department commended the expertise and effectiveness of the AMSP Area Coordinator in supporting the provision of the Participation Plan and subsequent activities. They said the coordinator was very well informed about the activities available and was able to work in a very collaborative way to recognise the needs of the school and work with them to accommodate and be flexible to those needs. The Mathematics Lead explained:

> *We know we can ask… if we need anything… and we know they will deliver the best they can. We are very happy with what we are getting. We have a good relationship with the Area Coordinator. That's been really positive*.

The activities provided were regarded as being of high quality and relevant to students' needs. The students were reported to have gained a lot of insights from the activities and they had stretched their abilities, which was an important aspiration for the target students in preparing them to apply to, and subsequently study, mathematics at university. The students were reportedly highly animated and motivated by the AMSP activities. The students themselves reported feeling more prepared and confident to take university entrance exams, having received information about the process and past papers. The sessions had also helped to deepen their understanding and confidence in specific mathematics topics. One student commented on how valuable it was to work with students from other schools, to gain a new perspective of how problems could be approached:

> *Sometimes when you go out and do problems that aren't from a set exam board, it's good to see how other schools teach certain bits of maths so you get a better understanding of things.*

Students also commented on how their learning from AMSP activities could be applied in the classroom, for example, the geometric reasoning skills taught during the problem solving activities can support the trigonometry topics taught as part of the syllabus. The students all said they would recommended the AMSP activities to other students, describing them as a 'good learning opportunity': *'Even if you don't do well in some of them, it's still a good learning opportunity, it's not like you're losing anything, just gaining stuff if you do well.'*

The teacher interviewees said that they thought the impacts on students would not have been realised without the help of the AMSP and the access provided to bespoke activities for the

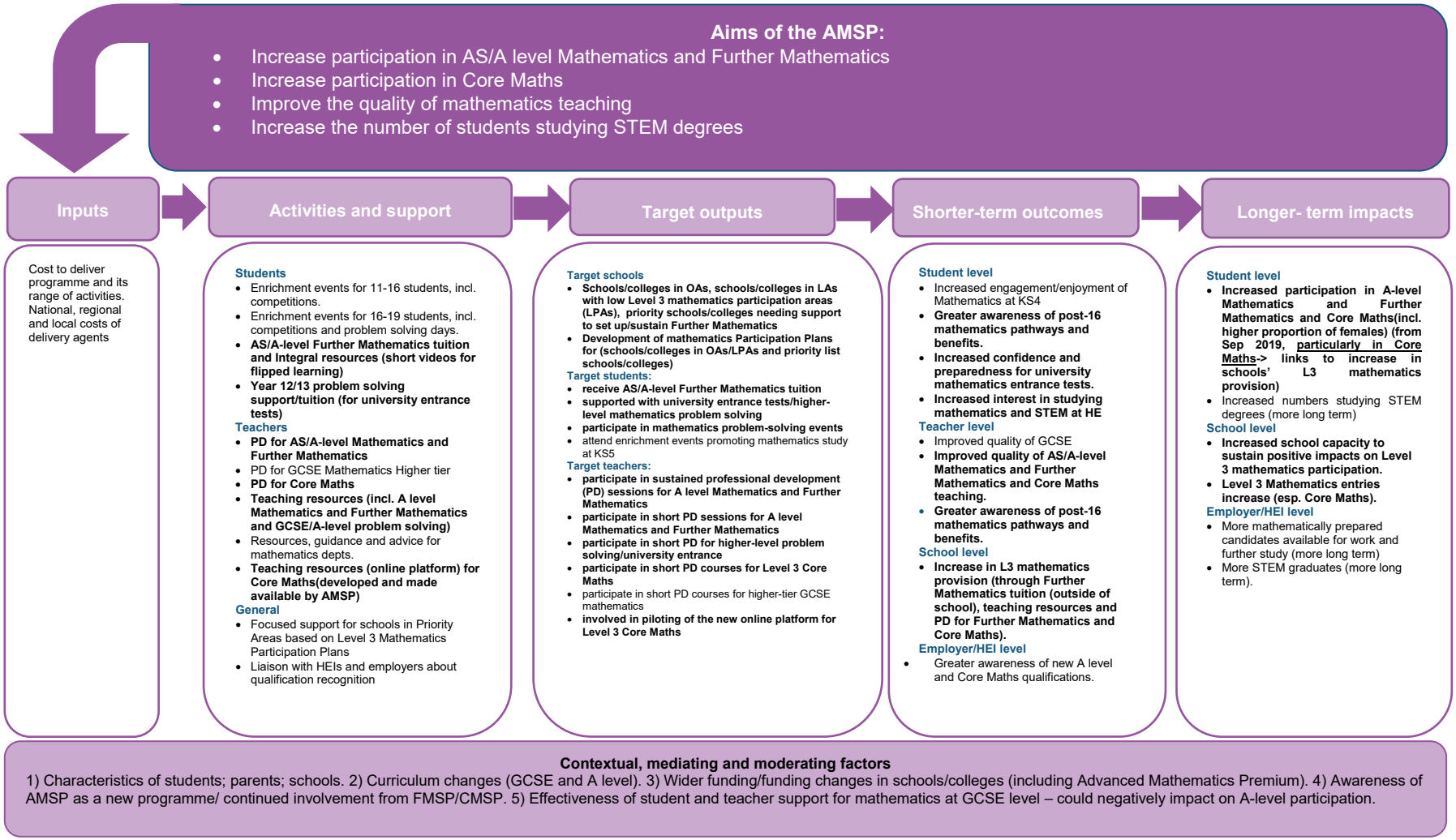
academy's students. The senior mathematics teachers also added that the support had been so useful and made such a difference to their department that they hoped there was equivalent support in other A level subject areas, commenting:

> *AMSP is inspiring for them* [the students]. *A couple of students were ready to do A level in Year 11. They* [AMSP] *offer support we maybe couldn't give. I had to find new ways to challenge these students last year, which is where the problem-solving course was really good.*

Reflections

On the whole, interviewees were very positive about the support received through the AMSP. However, teacher interviewees acknowledged the challenges of encouraging more girls to participate in advanced mathematics, and that while some progress had been made, this remained an issue for this school and would require ongoing and sustained effort.

Appendix 2: AMSP Theory of Change



Appendix 3: Selected characteristics of schools and colleges in the dispatch sample and the achieved sample

	Dispatch sample	Achieved sample
	%	%
Type of school/college		
All-through	4	3
FE college	6	5
School 11-18	84	86
Sixth form colleges	5	6
AMSP region		
East Midlands	8	10
East of England	13	13
London and South East	21	18
North East	5	4
North West	11	11
South	12	14
South West	11	12
West Midlands	11	11
Yorkshire and the Humber	9	8
Priority Schools/Colleges		
Priory School/College	20	21
Not a Priority School/College	80	79
Free school meal eligibility in the last 6 years ('FSMever') quintiles		
Highest (highest proportion of students eligible for FSM)	10	7
2nd highest	14	13
Middle	20	19

	Dispatch sample	Achieved sample
2nd lowest	22	21
Lowest (low proportion of students eligible for FSM)	36	40
Attainment quintiles – Average point score per A level entry		
Highest	25	29
2nd highest	23	22
Middle	20	21
2nd lowest	18	17
Lowest	14	12
Attainment quintiles – % Achieving A or A* in A level Mathematics		
Highest	18	21
2nd highest	26	26
Middle	20	19
2nd lowest	21	21
Lowest	16	13
Attainment quintiles – Average Attainment 8 score in GCSE Mathematics		
Highest	31	34
2nd highest	22	22
Middle	20	21
2nd lowest	14	12
Lowest	13	12
Totals	N=1566	N=717

Percentages may not sum to 100 due to rounding
The GCSE and A level data is from 2017/2018
Source: NFER survey of teachers that have received support from the AMSP, 2019

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Appendix 4: Selected characteristics of case-study schools and colleges

School number	School type	Ofsted rating	Progress 8 score	Progress score and average grade: A levels	Eligible for Free School Meals proportion at any time during past 6 years (28.6% national average)	Involvement in the evaluation
1	Community School, 11-18	3	-0.44 Well below average	-0.01 Average C	40%	Initial telephone interview and follow-up case study visit
2	Academy converter, 16-18	2	Not applicable	0.17 Above average C+	Not available	Initial telephone interview and follow-up case study visit
3	Academy converter, 11-18	2	-0.26 Below average	0.02 Average C+	13.5%	Initial telephone interview and follow-up case study visit
4	Academy sponsor-led 11-18	1	0.22 Above average	0.3 Above average C	50.9%	Initial telephone interview and follow-up case study visit

School number	School type	Ofsted rating	Progress 8 score	Progress score and average grade: A levels	Eligible for Free School Meals proportion at any time during past 6 years (28.6% national average)	Involvement in the evaluation
5	Academy converter, 11-18	4	0.45 Above average	-0.03 Average B-	7.5%	Initial telephone interview and follow-up case study visit
6	Academy sponsor led, 5-18	2	0.14 Average	-0.09 Average B-	12.5%	Initial telephone interview and follow-up case study visit
7	Voluntary aided school, 11-18	2	0.14 Average	-0.16 Below average C-	23.7%	Initial telephone interview and follow-up case study visit
8	Academy converter, 11-18	1	0.05 Average	-0.03 Average C+	13.6%	Initial telephone interview and follow-up case study visit
9	Academy converter, 11-18	2	-0.16 Average	-0.13 Average C	21.6%	Initial telephone interview and follow-up case study visit
10	Academy sponsor led, 11-18	2	-0.42 Below average	-0.05 Average C+	36.7%	Initial telephone interview and

School number	School type	Ofsted rating	Progress 8 score	Progress score and average grade: A levels	Eligible for Free School Meals proportion at any time during past 6 years (28.6% national average)	Involvement in the evaluation
						follow-up case study visit
11	Academy converter, 11-18	1	1.18 Well above average	0.10 Average A-	2.7%	Initial telephone interview and follow-up case study visit
12	Free school, 16-18	Not available	Not applicable	Not available	Not available	Initial telephone interview and follow-up case study visit
13	Academy sponsor led, 16-18	2	-0.2 Average	-0.24 Below average D+	64.1%	Initial telephone interview
14	General FE College, 16-18	2	Not applicable	-0.28 Below average C-	Not available	Initial telephone interview and follow-up case study visit
15	Academy sponsor led, 11-16	3	-0.91 Well below average	Not applicable	42.2%	Initial telephone interview and follow-up case study visit
16	Academy converter,	1	0.25 Above average	-0.06 Average C+	8%	Initial telephone interview

School number	School type	Ofsted rating	Progress 8 score	Progress score and average grade: A levels	Eligible for Free School Meals proportion at any time during past 6 years (28.6% national average)	Involvement in the evaluation
	11-18					
17	Academy converter, 11-18	4	-0.64 Below average	-0.22 Below average D+	31.7%	Initial telephone interview
18	Academy converter, 11-18	2	Not applicable	-0.03 Average C-	27.7%	Initial telephone interview and follow-up case study visit

All performance data is taken from 2018/19

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Public

The Mere, Upton Park, Slough, Berks SL1 2DQ

T: +44 (0)1753 574123 • **F:** +44 (0)1753 691632 • enquiries@nfer.ac.uk

www.nfer.ac.uk

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