Evaluation of King's Maths School GCSE+ Maths Outreach Programme 2017/18 – 2021/22

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1. Executive summary

1.1 Main findings

- This evaluation analyses the impact of the GCSE+ Maths Outreach Programme on two outcomes: attainment in maths GCSE and progression to A-Level maths, between 2017/18 and 2021/22.
- It also looks at the impact on participants broken down into subgroups. This includes subgroups based on their level of engagement with the programme, and subgroups based on their characteristics (gender, disadvantage and ethnicity).
- This report found evidence that the programme had a positive effect on GCSE maths grade. We would estimate that participants would achieve between 1.0 and 1.6 grades higher than a matched non-participant, on average.
- We also found evidence for a positive effect on the likelihood of progressing to A-Level maths. We would estimate that the odds of a participant going on to enter A-Level maths are between 2.7 and 9.9 times higher than those of a matched non-participant, on average.
- The impact varied considerably during the period covered by this evaluation; it tended to be higher before 2020. From 2020 onwards, the effects of the COVID-19 pandemic caused changes to the way that the programme was delivered and the participant profile.
- We found some evidence to suggest that the programme had a stronger effect on those who participated in a high number of sessions or who participated for more than one year, but this was not conclusive.
- We did not find any evidence to suggest that the impact of the programme varied by the type of participation (online only / mixture), although again this analysis was inconclusive.
- We found some evidence to suggest that the programme may have a slightly lower impact on female pupils than male pupils, and on Black pupils than on pupils of other ethnic backgrounds, but this was not conclusive. We found some evidence to suggest that the programme may have a higher impact on GCSE grade for disadvantaged pupils than for their peers, but a lower impact on the likelihood of progressing to A-Level, but again this was not conclusive.

1.2 Methodology

- This evaluation follows a quasi-experimental design. We used pupil-level data from the National Pupil Database (NPD) to create a matched comparison group, similar to those pupils who participated in the programme with respect to a set of pupil and school level variables.
- Participants were matched to non-participants using on nearest neighbour matching based on propensity scores. In the appendix, we present results obtained from an alternative matching method.
- We then used regression models to compare the outcomes of the matched comparison group to participants.

1.3 Limitations

- This evaluation uses a quasi-experimental design, which relies on creating a matched comparison group based on data from the NPD. This means that we are unable to control for factors not recorded in the NPD, for example parental occupation.

- Because of the nature of the programme, participants are likely to have a particular interest in maths. This interest may have led to them achieving strong GCSE maths grades and being more likely to progress to A-Level maths, rather than the effect of the programme. This could have led us to overestimate the effect of the programme.
- The programme prioritises pupils from backgrounds that are underestimated in mathematical sciences at HE, but we were unable to determine the levels of some of the selection criteria. This may have led us to underestimate the effects of the programme.
- The fact that participants achieved higher GCSE grades than matched comparison pupils, on average, may explain some of the differences in likelihood to go on to enter A-Level maths, rather than the direct influence of the programme.
- Relatively few participants took part in the programme over two years rather than one year, and relatively few attended any sessions in person during 2021 and 2022. Because of this, we are less able to detect smaller effects for these groups and more likely to produce inconclusive results than with a larger sample. Similar issues affected our analysis of the impact of the programme by ethnic background and disadvantage.
- This evaluation covers the period of the onset of the COVID-19 pandemic. It includes the years in which public examinations were cancelled in England. This may have affected the impact of the programme on attainment at GCSE. We have presented estimates of impact based solely on the pre-pandemic years to attempt to mitigate for this.
- The pandemic also affected the way that the programme was delivered. Following a move to online delivery, participant numbers increased and their profile changed. This may mean that pooled estimates, and estimates of the effect of the programme based on the pre-pandemic years, may not reflect the impact of the programme in its current form.

2. Introduction

King's Maths School is a sixth form for students who have a fascination for mathematics, run in partnership with King's College London. The school also runs outreach programmes and events for both students and teachers. This report focuses on the school's GCSE+ Maths outreach programme, which works with students from Years 9-11.

We analyse the impact of the programme on two outcomes: attainment in maths GCSE and progression to A-Level maths. Analysis of the first outcome includes all participants who completed Key Stage 4 between 2017/18 and 2021/22, and analysis of the second includes participants who went on to complete Key Stage 5 between 2019/20 and 2021/22. Using data from the National Pupil Database (NPD), we compare the outcomes of pupils who participated in the programme to those of a matched comparison group of similar pupils who did not.

2.1 Methodology

This evaluation uses a quasi-experimental design. This involves comparing the outcomes of programme participants to those of a matched comparison group of pupils who are statistically similar. This approach mimics what would be done in a formal experiment such as a randomised control trial.

We use 1:1 nearest neighbour matching based on propensity scores. Pupils in the matched comparison group are similar to participants with respect to the following matching variables.

Pupil characteristics

- Prior attainment at Key Stage 2
- Gender
- Ethnicity
- Measures of disadvantage (whether the pupil has been eligible for free school meals in the last six years, IDACI score)

School characteristics

- Region
- % of pupils eligible for FSM6
- Average KS2 prior attainment

We then use regression models to compare outcomes for the participants to those in the matched comparison group. We control again for prior attainment variables used for matching. Controlling again for matching variables is known as a doubly robust approach. In this case, we do not control again for all of the matching variables used to avoid overfitting our regression models. Rather, we control solely for prior attainment, which is the strongest predictor of attainment and progression.

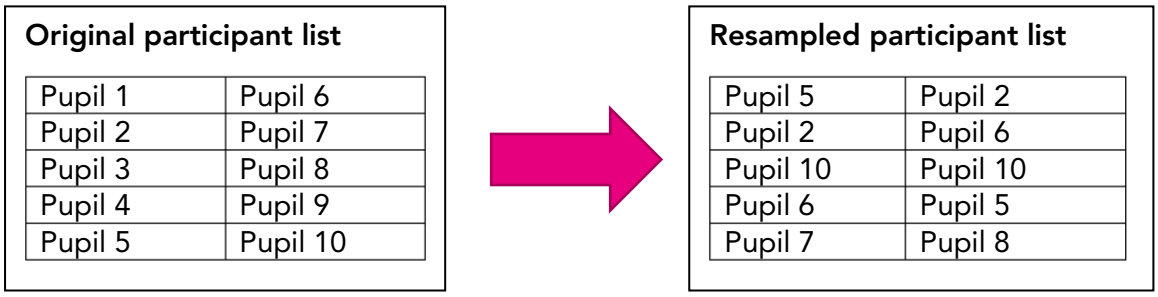
Confidence intervals are estimated using bootstrapping. While it is possible to construct confidence intervals simply by using the standard errors estimated by the regression

models, this method only accounts for the uncertainty around the estimate made by the regression model; it does not account for the uncertainty in the matching process. Therefore, confidence intervals created in this way are likely to underestimate the standard errors and produce artificially narrow confidence intervals.

Bootstrapping allows us to take account of both sources of uncertainty. It involves repeatedly creating a new dataset by taking a random sample of participants from the original list, with replacement, then repeating the analysis using the fresh data. The random sample size will be the same as the size of the original list; if there were 100 participants in a given year, the random sample would also include 100 pupils, although some participants would be included in the resampled list more than once, and some not at all.

The figure below shows an example of a resampled participant list, drawn from an original list of ten participants.

Figure 1: Resampling example



We repeat the process of creating and analysing new datasets 1,000 times. Our point estimates are found by taking the average of these 1,000 estimates, and the 95% confidence intervals are simply the range in which 95% of the 1,000 estimates lie.

We present estimates of the impact of the programme on both outcomes overall, and also broken down by the level and type of engagement with the programme. This will include estimates for length of participation (one/two years), level of engagement (none/low/mid/high, determined by proportion of sessions attended) and type of engagement (online/in person/mixture), as well as estimates broken by pupil characteristics.

We will also present estimates obtaining from the use of an alternative matching method as an appendix.

2.1.1 Accounting for the effects of the COVID-19 pandemic

During the first three years of the period covered by this evaluation, the programme focused on in-person delivery to pupils who could attend regular sessions at King's Maths School in London, effectively limiting the programme to participants based in or near London. During the COVID-19 pandemic, the programme turned to online delivery. Participant numbers increased following this change and participants from around the country began to take part.

The timeframe of this evaluation includes 2019/20 and 2020/21, the years in which public exams were cancelled and grades were awarded via centre-assessed grades (CAGs) and teacher-assessed grades (TAGs) respectively. In these years, both GCSE and A-Level

grades were higher, on average, than those awarded in previous years. It also includes 2021/22, when public exams were reinstated but grade boundaries were adjusted to a level halfway between the last year before the pandemic, 2018/19, and 2020/21.

To take account of both the changes in the programme itself and the changes in the ways in which exam grades were awarded during the pandemic, we will present analysis of the GCSE attainment outcome both for the entire timeframe of the evaluation, and separately for the pre-pandemic years (2017/18 and 2018/19).

2.2 Data

King's Maths School supplied data on 2,597 named participants, some of whom participated in the programme across more than one year. This data included student identifiers, the school they attended and information on their participation in the programme. Where possible, these were matched to corresponding records in the National Pupil Database (NPD), and to publically available school level data.

The National Pupil Database is an administrative dataset maintained by the Department for Education, and includes records of achievements in national tests and examinations for all pupils who have been in state-funded education since 2002. For this evaluation, we used data on attainment at Key Stage 2, GCSE and A-Level entries, as well as some demographic variables.

The majority (95%) of the participants in the dataset supplied by King's Maths School were matched to records in the National Pupil Database. Those that were not matched were those for whom identifying information was incomplete or missing in the data supplied, or where the student did not attend a state-funded school in England – for example, if a pupil was home-schooled.

The evaluation covers two outcomes: attainment in maths GCSE and progression to A-Level maths. Analysis of the first outcome includes all participants who completed Key Stage 4 during the timeframe of the evaluation (2017/18 – 2021/22) and analysis of the second includes all participants who completed Key Stage 5 during the same timeframe. However, we excluded any pupils for whom data on KS2 prior attainment was unable; this will include any pupils who did not complete KS2 in a state-funded school in England.

The majority of participants in the supplied data completed KS4 during the relevant timeframe, although some did not. These include pupils who started the programme during Year 10 in 2021/22 and have not yet completed KS4, and those who completed KS4 in 2016/17.

A smaller number of participants completed KS5 during the relevant timeframe; those who participated after 2019/20 will not yet have completed this stage.

The final datasets for analysis include 1,793 participants for the outcome on GCSE maths attainment, and 439 participants for the outcome on progression to A-Level maths. The table below shows the number of participants in the dataset by the year in which they completed KS4.

Table 1: Number of participants included in analysis, by year

	No. participants included in analysis of GCSE outcome	No. participants included in analysis of A-Level outcome
2017/18	196	196
2018/19	135	135
2019/20	108	108
2020/21	345	NA
2021/22	1009	NA
TOTAL	**1793**	**439**

We divided these pupils into groups based on three criteria: level of engagement (based of % of sessions attended), years of participation (one / two) and type of attendance (online only / mixture of online and in person).

The table below shows the number of participants in each group.

Table 2: Number of participants by subgroup and year

		2018	2019	2020	2021	2022
Dosage level						
	None	38	12	<25	70	365
	Low	33	18	<25	162	351
	Mid	47	22	35	71	132
	High	78	83	42	42	161
Years participated						
	1	136	117	70	283	793
	2	60	18	38	62	186
	3	0	0	0	0	30
Participation type						
	Online only				217	883
	Mixture				128	126

Dosage levels were determined by the proportion of possible sessions that participants attended. The table below shows the range of proportions attended by year and dosage level.

Table 3: Range of dosage levels

	Range
None	Attended 0 or 1 session
Low	Attended at least one and up to 33% of sessions
Mid	Attended 33-50%
High	Attended 50% or more

As table 2 shows, the level of participation was considerably higher in 2018-20 than in 2021 and 2022.

A relatively small number of participants took part in the programme for two years. A small number of those who completed KS4 in 2022 had taken part over three years. As this number is small and only occurs among this cohort, we do not analyse the impact of taking part for three years separately.

The figures for type of participation are given for 2021 and 2022 only; these are the years in which online participation became the prevalent type, and are the only years in which we will analyse the impact by participation type.

3. Mitigation of confounding effects

This section begins with an overview of how the programme participants compared to other pupils before matching was carried out. It will go on to describe the matching process used and how successful it was in creating a group of similar pupils for comparison purposes.

3.1 Differences between participants and other pupils before matching

In this section, we will review how the characteristics and outcomes of programme participants compared to non-participants before any matching was carried out.

The profile of participants was fairly consistent between 2018 and 2020. However, in 2021 and 2022, the programme was opened up to online participants during the pandemic; in 2021, just 36% attended any sessions in person, and in 2022 just 12% did so. The move to online learning led to some changes in the profile of participants. Before 2021, the programme was limited to participants who could attend regular sessions, which took place at King's Maths School in London, effectively limiting the programme to participants based in or near to London. In 2021 and 2022, participants from around the country joined the programme online; in 2021, 12% came from outside the capital and 21% in 2022. The number of participants overall also increased; from 2018-20, there were an average of 157 participants per year, while in 2021 there were 345 and in 2022 there were over 1,000.

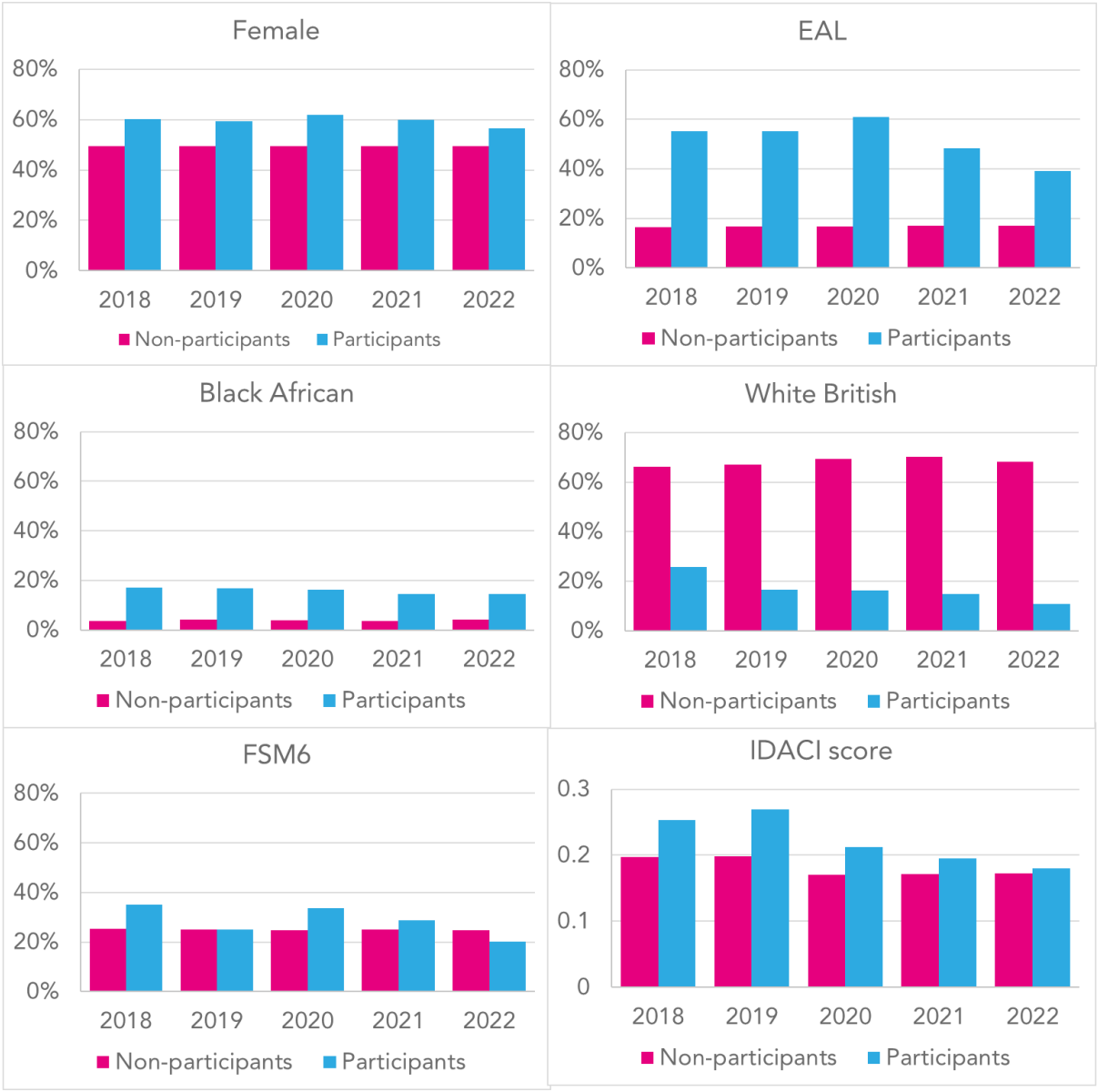
Figure 2 (overleaf) summarises how the characteristics of participating pupils who completed KS4 between 2018 and 2022 compare to non-participating pupils.

Around 60% of participating pupils were female in each year, compared to around 50% of non-participants. Participating pupils were more likely than non-participating pupils to be from an ethnic minority background[1] and to have English as an additional language, although the difference was smaller among those who completed KS4 in 2022 than in earlier years. Participating pupils were particularly likely to be from a Black African background.

Participants also tended to have higher levels of disadvantage than non-participants; in every year, the average IDACI score of participants was higher than non-participants, although the difference was smaller in more recent years. Among those who completed KS4 in 2018-21, the proportion of participants eligible for pupil premium funding was higher than that of non-participants, although this was reversed among those who completed KS4 in 2022. Participants tended to attend schools with a higher proportion of pupils who were eligible for pupil premium, although again the difference between participants and non-participants was lower in more recent years. Among those who completed KS4 in 2018, for example, the average proportion of FSM6 pupils in a participant's school was 37%, compared to 25% in a non-participant's school. In 2022, the average proportion in a participant's school was 29% compared to 25% in a non-participant's school.

[1] For data protection reasons, we are unable to include any statistics based on fewer than ten pupils. This prevents us from reporting more fully on the ethnic background of participants, as in many cases there were fewer than ten pupils from some backgrounds participating in a given year. Instead, we report on the proportion of participants from the two most common ethnic backgrounds: White British and Black African.

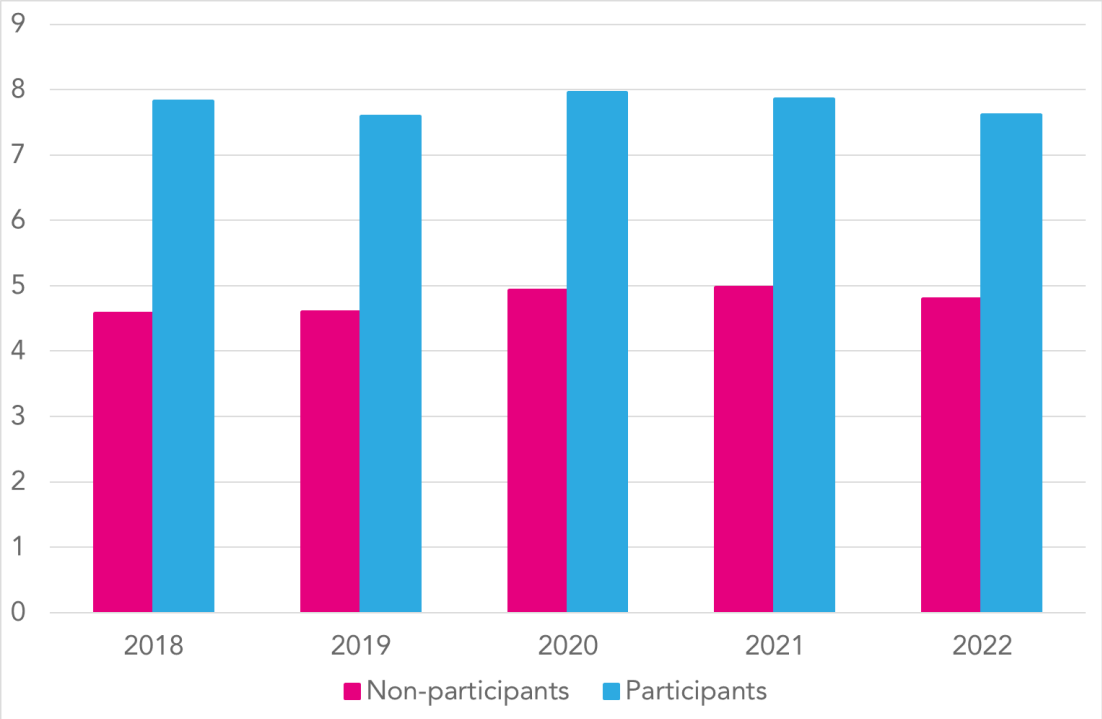
Figure 2: Characteristics of participating and non-participating pupils, by year



The programme targets pupils with an interest in maths, so it is perhaps not surprising to find that participants tended to have high prior attainment in maths at Key Stage 2. Among participants who completed Key Stage 4 in 2022, for example, the average participant's KS2 maths attainment was in the 81th percentile; that is, higher than 81% of KS2 pupils. They also tended to attend schools with slightly higher levels of prior attainment in maths than average.

Given their high prior attainment, it is again not surprising to find that participants tended to achieve higher grades in GCSE maths than non-participants, as shown in the chart below.

Figure 3: Average GCSE maths grades for participants and non-participants, 2018-22



Among those who took maths GCSE in 2022, the average grade among non-participants was 4.8, compared to 7.6 for participants. The average grade for both participants and non-participants increased in 2020 and 2021, when grades were awarded by CAGs and TAGs respectively.

Participating pupils were also far more likely to go on to enter an A-Level in maths, as shown in figure 4a (overleaf).

Among participants who completed KS4 in 2018, three-quarters went on to complete an A-Level in maths by 2020. Among those who completed KS4 in 2019, 67% went on to take A-Level maths, as did 64% of those who completed in 2020. This compares to 13% of non-participating pupils who completed KS4 in 2018 and 2019, and 12% in 2020.

Similarly, participants were far more likely to go on to enter A-Level further maths, as shown in figure 4b. A quarter of participants who completed KS4 in 2018 went on to enter A-Level further maths, as did 22% of those who completed KS4 in 2019 and 20% of those who completed in 2020. This compares to just 2% of non-participants in all three years.

Figure 4a: Proportion of participants and non-participants who went on to enter A-Level maths, pupils who completed KS4 2018-22

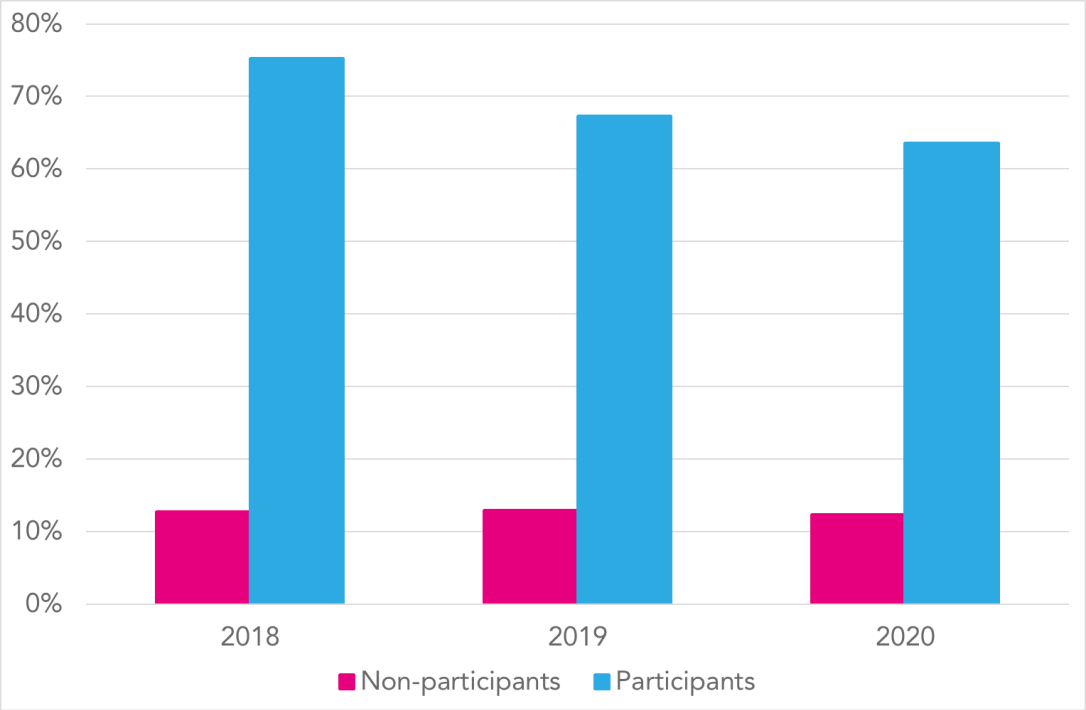
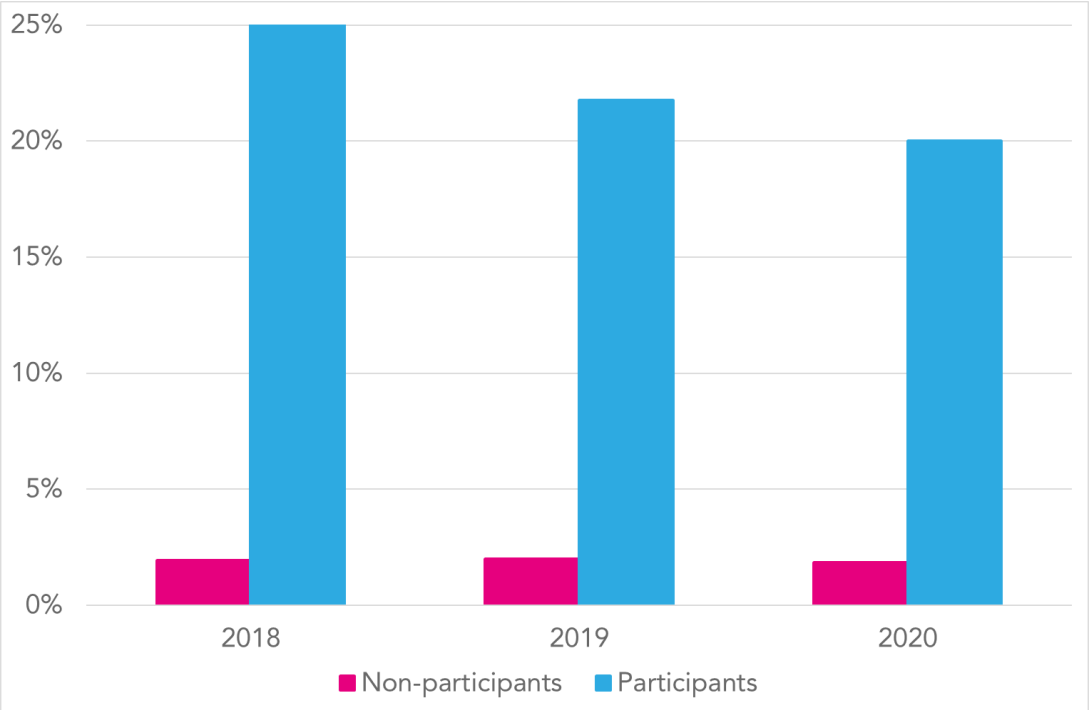


Figure 4b: Proportion of participants and non-participants who went on to enter A-Level further maths, pupils who completed KS4 2018-22



3.2 Extent of success in creating matched comparisons

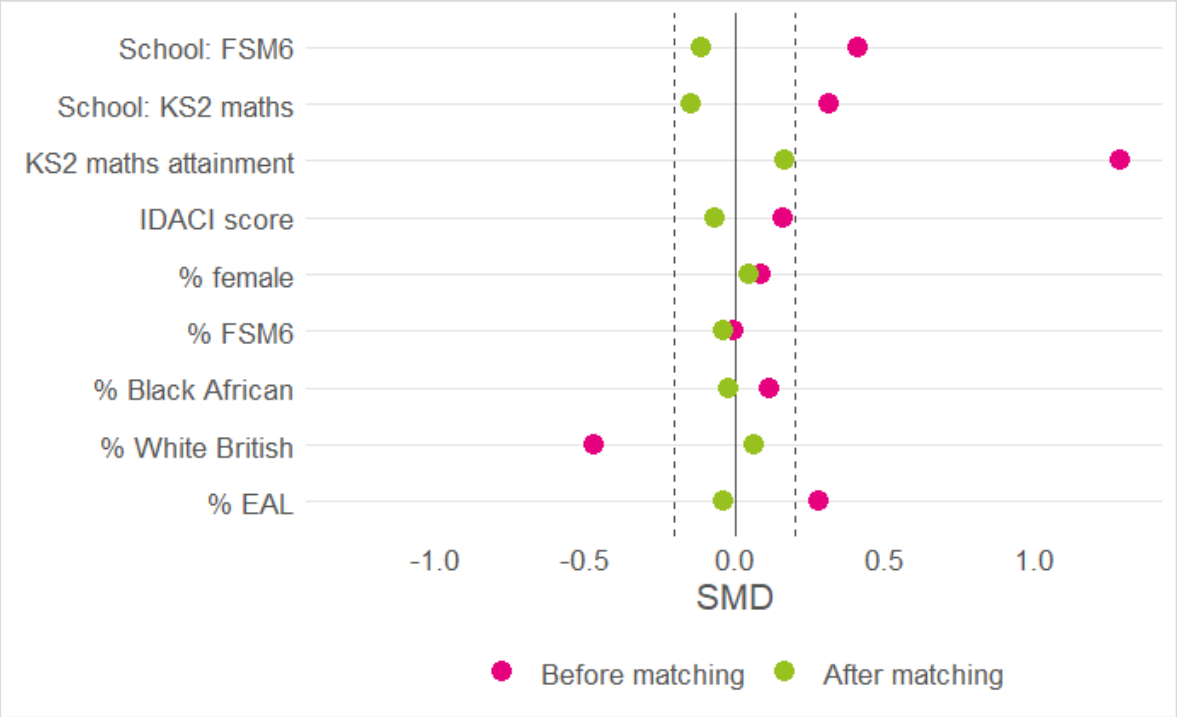
The matching process is intended to create a group of non-participants who are similar to the participating pupils with respect to pupil and school characteristics. Any differences in the outcomes of this comparison group and the participating pupils can then be assumed to be due to the programme.

We used 1:1 nearest neighbour matching based on propensity scores to create a matched comparison group for participants in each cohort. Pupils were matched on the variables described in section 2.1. Results obtained using an alternative matching method are presented in the appendix.

The graphs in figure 4, known as love plots,[2] show how similar the treated and comparison pupils were to one another, before and after matching, using a measure called the standardised mean difference. The mean difference is simply the difference between the average value of the variable for the treated students, and the average value for the comparison students. Standardising this measure means that we can compare balance across different variables. Generally, a standardised mean difference of 0.2 or below is considered to indicate good balance. This threshold is shown on the graphs as a dotted line.

As shown in figure 5, the matching process successfully created a well-matched comparison group, with all standardised mean differences below the level of +- 0.2 that indicates good balance. The +-0.2 boundaries are shown on the chart as dotted lines.

Figure 5: Standardised mean differences between participants and non-participants, before and after matching



[2] Loveplots are named for Professor Thomas E. Love, who first developed them along with colleagues (https://academic.oup.com/eurheartj/article/27/12/1431/647407)

4. Results

Results are given in several different forms: estimated impact, odds ratios, predicted probabilities, effect size, and months of progress.

In this report, we look at two outcomes: GCSE maths attainment, and the likelihood of progressing to A-Level maths.

The estimated impact on GCSE maths attainment is reported in grades; an estimated impact of one would suggest that we'd expected a programme participant to achieve one grade higher than a matched non-participant.

We also include estimates of effect size. Effect size is a standardised version of the estimated impact. That is, it is the estimated impact divided by the standard deviation in the outcome measure. Because it is a standardised measure, it can be compared across different outcomes, so may be useful for comparing the magnitude of the programme's impact with that of other projects that have different outcomes.

However, effect sizes can be difficult to interpret; it is not immediately obvious whether an effect size of, for example, 0.5 is large or small. Months of progress are a measure used in education research to try and help with this. In this report, effect sizes were translated into equivalent months of progress using guidance developed by the Education Endowment Foundation, as shown in table 3.[3] In our example, an effect size of 0.5 would be the equivalent of six months of additional progress; expressed using the months of progress measure, it is clear that this is a large effect.

Table 3: Effect sizes and equivalent months of progress

Effect size from	To	Months of progress
-0.04	0.04	0
0.05	0.09	1
0.10	0.18	2
0.19	0.26	3
0.27	0.35	4
0.36	0.44	5
0.45	0.52	6
0.53	0.61	7
0.62	0.69	8
0.70	0.78	9
0.79	0.87	10
0.88	0.95	11

The second outcome, the likelihood of entering A-Level maths, is binary; either a student enters the A-Level or they do not. We report the estimated effect on this outcome using odds ratios. These ratios tell us the relative odds of a pupil entering A-Level maths, depending on whether they took part in the programme or not. An odds ratio of one would mean that a programme participant had exactly the same odds of entering as a

[3] https://educationendowmentfoundation.org.uk/projects-and-evaluation/evaluation/evaluation-guidance-and-resources/reporting-templates, accessed March 2023

comparison pupil. An odds ratio above one means that a participant is more likely to enter, and an odds ratio of below one means that they are less likely.

As with effect sizes, odds ratios are not always easy to interpret. To aid with interpretation, we have also included the predicted probability of a participant going on to enter A-Level maths and the predicted probability of a matched comparison pupil doing so, for comparison.

4.1 GCSE maths attainment

Estimates of the impact of the programme on GCSE maths attainment, measured by grade, are given in table 4, with 95% confidence intervals. Effect size estimates and months of progress are also included.

Table 4: Estimated impact on GCSE maths grade

Year	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2018	1.3	1.7	2.0	0.8	9	392
2019	1.1	1.5	1.9	0.7	8	270
2020	1.0	1.5	1.9	0.7	9	216
2021	0.9	1.2	1.5	0.6	7	690
2022	1.0	1.2	1.3	0.5	6	2018
Pooled	1.0	1.3	1.6	0.6	7	3586
Pooled (pre-2020)	1.2	1.6	2.0	0.7	9	662

These results suggest that the programme has a positive effect on GCSE maths grade. We would estimate that, over the whole period covered by this evaluation, participants would achieve between 1.0 and 1.6 grades higher than a matched non-participant, on average, with an average difference of 1.5 grades.

When the years after the onset of the pandemic are omitted, the estimated effect is higher. We would estimate that during this period, participants would have achieved a grade between 1.2 and 2 grades higher than a non-participant, with an average difference of 1.6 grades.

4.1.1 By level of engagement

4.1.1.1 By sessions attended

Estimates of the impact of the programme on GCSE maths attainment, measured by grade, for none, low, mid and high proportions of sessions attended, are given in table 5, with 95% confidence intervals. Effect size estimates and months of progress are also included.

See section 2.2 for a full description of how the dosage groups were determined.

We have omitted dosage estimates for pupils who completed KS4 in 2019 and 2020 because of low numbers. These groups are omitted from the pooled estimates.

Table 5: Estimated impact on GCSE maths grade by dosage level

Year	Dosage	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2018	None	0.8	1.5	2.3	0.7	9	76
2018	Low	0.6	1.4	2.3	0.7	8	66
2018	Mid	0.5	1.3	2.1	0.6	7	94
2018	High	1.4	2.0	2.5	0.9	11	156
2019	None	NA	NA	NA	NA	NA	NA
2019	Low	NA	NA	NA	NA	NA	NA
2019	Mid	NA	NA	NA	NA	NA	NA
2019	High	NA	NA	NA	NA	NA	NA
2020	None	NA	NA	NA	NA	NA	NA
2020	Low	NA	NA	NA	NA	NA	NA
2020	Mid	NA	NA	NA	NA	NA	NA
2020	High	NA	NA	NA	NA	NA	NA
2021	None	0.2	0.8	1.5	0.4	5	140
2021	Low	0.7	1.0	1.4	0.5	6	324
2021	Mid	1.0	1.6	2.1	0.7	9	142
2021	High	1.2	1.9	2.8	0.9	NA	84
2022	Zero	0.6	0.8	1.1	0.4	5	730
2022	Low	1.0	1.2	1.5	0.6	7	702
2022	Mid	0.8	1.2	1.7	0.6	7	264
2022	High	1.1	1.6	2.0	0.9	NA	322
Pooled	None	0.5	0.9	1.2	0.4	5	946
Pooled	Low	0.9	1.2	1.5	0.5	7	1092
Pooled	Mid	0.8	1.3	1.9	0.6	8	500
Pooled	High	1.2	1.7	2.3	0.9	10	728

Over the whole period covered by the evaluation, the estimated impact on those who attended fewer sessions is lower than on those who attended a higher proportion of sessions. However, even those pupils in the 'no engagement' group, who attended either no sessions at all, or just one session, show a significant positive impact – on average, we would expect pupils in this group to achieve between 0.5 and 1.2 grades higher than a matched comparison pupil. This compares to between 1.2 and 2.3 grades higher for participants in the high engagement group, who attended at least half of the sessions.

We have not included pooled estimates from pre-2020 broken down by dosage. Because of the lower number of participants in 2019 and 2020s, and the fact that few participants in these years fell into the lower dosage groups in these years, we have not included dosage estimates for these years in this analysis. Therefore, the only pre-2020 estimates we have available are from just one year, 2018, so we cannot produce a pooled analysis.

4.1.1.2 By years participated

Estimates of the impact of the programme on GCSE maths attainment, measured by grade, for one and two years of participation, are given in table 6, with 95% confidence intervals. Effect size estimates and months of progress are also included.

We have omitted estimates for two years of participation for pupils who completed KS4 in 2019 because of low numbers. This group is also omitted from the pooled estimates.

Table 6: Estimated impact on GCSE maths grade by years participated

Year	Years attended	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2018	One	1.2	1.6	2.0	0.7	9	272
2018	Two	1.2	1.9	2.6	0.9	10	120
2019	One	1.1	1.5	2.0	0.7	9	234
2019	Two	NA	NA	NA	NA	NA	NA
2020	One	1.0	1.5	2.0	0.7	9	150
2020	Two	0.6	1.5	2.3	0.7	8	66
2021	One	0.9	1.2	1.5	0.6	7	582
2021	Two	0.7	1.2	1.8	0.6	7	108
2022	One	0.9	1.1	1.3	0.5	6	1596
2022	Two	0.9	1.3	1.6	0.6	7	348
Pooled	One	1.0	1.3	1.6	0.6	7	2834
Pooled	Two	0.9	1.4	1.9	0.6	8	642
Pooled (pre-2020)	One	1.1	1.6	2.0	0.7	9	506
Pooled (pre-2020)	Two	1.2	1.9	2.6	0.9	10	120

In most of the individual years covered, the point estimates for those who participated for one year are slightly lower than for those who participated for two years. However, the confidence intervals have very considerable overlap. When we look at pooled estimates across the entire period covered by this evaluation, we would estimate that the impact on a one year participant would be between 1.0 and 1.6 of a grade, and on a two year participant between 0.9 and 1.9.

4.1.1.3 By type of attendance (online only / mixture)

Estimates of the impact of the programme on GCSE maths attainment, measured by grade, by type of participation, are given in table 6, with 95% confidence intervals. Effect size estimates and months of progress are also included.

We have included estimates for 2021 and 2022. Prior to 2021, attendance was almost exclusively either in person or a mixture.

Table 7: Estimated impact on GCSE maths grade by type of attendance

Year	Type	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2021	Online only	0.9	1.2	1.6	0.6	7	458
2021	Mixture	0.7	1.1	1.5	0.5	6	232

2022	Online only	1.0	1.2	1.4	0.5	6	1752
2022	Mixture	0.6	1.0	1.5	0.5	6	266
Pooled	Online only	1.0	1.2	1.4	0.5	7	2210
Pooled	Mixture	0.7	1.1	1.5	0.5	6	498

Estimates for the two participation types are similar. The confidence intervals for those who attended a mixture of online and in-person sessions are wider than for those who attended online only; this likely reflects the larger sample size for those attending online only.

4.1.2 By pupil characteristics

4.1.2.1 By gender

Estimates of the impact of the programme on GCSE maths attainment for male and female students, measured by grade, are given in table 8, with 95% confidence intervals. Effect size estimates and months of progress are also included.

Table 8: Estimated impact on GCSE maths grade by gender

Year	Gender	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2018	Female	1.0	1.4	1.9	0.7	9	240
2018	Male	1.4	1.9	2.6	0.9	11	152
2019	Female	1.0	1.5	2.1	0.7	9	162
2019	Male	0.8	1.5	2.1	0.7	8	108
2020	Female	0.8	1.3	1.9	0.7	8	134
2020	Male	0.8	1.6	2.4	0.7	9	82
2021	Female	0.8	1.1	1.4	0.5	6	416
2021	Male	1.0	1.4	1.8	0.7	8	274
2022	Female	0.9	1.1	1.4	0.5	6	1144
2022	Male	0.9	1.2	1.4	0.5	6	874
Pooled	Female	0.9	1.2	1.6	0.6	7	2096
Pooled	Male	1.0	1.3	1.7	0.6	7	1490
Pooled (pre-2020)	Female	1.0	1.5	2.0	0.7	9	402
Pooled (pre-2020)	Male	1.1	1.7	2.4	0.8	10	260

These results suggest that the programme has a positive effect on GCSE maths grade for both male and female pupils. The effects on male pupils tend to be slightly higher than the effects on female pupils, although the estimates for male pupils have wider confidence intervals, reflecting the fact that the programme works with more female than male pupils.

We would estimate that, over the whole period covered by this evaluation, male participants would achieve between 1.0 and 1.7 grades higher than a matched male non-participant, on average. We would estimate that a female participant would achieve between 0.9 and 1.6 grades higher than a matched female non-participant.

4.1.2.2 By disadvantage

Estimates of the impact of the programme on GCSE maths attainment for disadvantaged and non-disadvantaged students, measured by grade, are given in table 9, with 95% confidence intervals. Effect size estimates and months of progress are also included. We define disadvantaged pupils as those who were eligible for free school meals in the last six years (FSM6).

Table 9: Estimated impact on GCSE maths grade, by disadvantage status

Year	FSM6 status	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2018	FSM6	1.2	1.9	2.5	0.9	11	142
2018	Not FSM6	1.0	1.5	1.9	0.7	9	250
2019	FSM6	0.6	1.5	2.5	0.8	9	68
2019	Not FSM6	1.0	1.5	1.9	0.7	9	202
2020	FSM6	1.0	1.7	2.5	0.9	10	74
2020	Not FSM6	0.8	1.3	1.9	0.6	8	142
2021	FSM6	0.9	1.4	1.9	0.7	8	204
2021	Not FSM6	0.8	1.1	1.4	0.5	7	486
2022	FSM6	1.0	1.4	1.7	0.6	8	412
2022	Not FSM6	0.9	1.1	1.3	0.5	6	1606
Pooled	FSM6	1.0	1.5	2.0	0.7	9	900
Pooled	Not FSM6	0.9	1.2	1.5	0.6	7	2686
Pooled (pre-2020)	FSM6	1.0	1.8	2.5	0.9	11	210
Pooled (pre-2020)	Not FSM6	1.0	1.5	1.9	0.7	9	452

These results suggest that the programme has a positive effect on GCSE maths grade for both disadvantaged pupils and their peers. The effect on disadvantaged pupils was higher than the effect on their peers, although the estimates for disadvantaged pupils have wider confidence intervals, reflecting the fact that the programme works with fewer disadvantaged than non-disadvantaged pupils.

Over the whole period covered by this evaluation, we would estimate that a disadvantaged participant would achieve between 1.0 and 2.0 grades higher than a matched disadvantaged non-participant. We would estimate that a non-disadvantaged participant would achieve between 0.9 and 1.5 grades higher than a comparison pupil.

4.1.2.3 By ethnicity

Estimates of the impact of the programme on GCSE maths attainment for Black pupils and their peers, measured by grade, are given in table 10, with 95% confidence intervals. Effect size estimates and months of progress are also included. Estimates from 2020 are omitted due to a low number of Black participants. This year is also omitted from the pooled estimates.

Table 10: Estimated impact on GCSE maths grade, by ethnicity

Year	Ethnicity	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2018	Black	0.8	1.7	2.6	0.8	10	72
2018	Not Black	1.2	1.5	1.9	0.7	9	320
2019	Black	0.1	1.0	1.9	0.5	6	60
2019	Not Black	1.2	1.6	2.1	0.8	9	210
2020	Black	NA	NA	NA	NA	NA	46
2020	Not Black	NA	NA	NA	NA	NA	170
2021	Black	0.4	1.0	1.6	0.5	6	144
2021	Not Black	0.9	1.2	1.5	0.6	7	546
2022	Black	0.7	1.1	1.4	0.5	6	398
2022	Not Black	0.9	1.0	1.2	0.5	6	1620
Pooled	Black	0.6	1.1	1.6	0.5	7	720
Pooled	Not Black	0.9	1.2	1.4	0.5	7	2866
Pooled (pre-2020)	Black	0.4	1.3	2.2	0.7	8	132
Pooled (pre-2020)	Not Black	1.2	1.6	2.0	0.7	9	530

These results suggest that the programme has a positive effect on GCSE maths grade for both Black pupils and their peers. The pooled point estimates for Black pupils are slightly lower than for their peers, but in some individual years – 2018 and 2022 – the point estimates for Black pupils are slightly higher. Given these inconsistencies and the relatively low number of Black pupils participating in the programme, these results are inconclusive.

Over the whole period covered by this evaluation, we would estimate that a Black participant would achieve between 0.6 and 1.6 grades higher than a matched Black non-participant. We would estimate that participant from any other ethnic background would achieve between 0.9 and 1.4 grades higher than a comparison pupil.

4.2 Progression to A-Level maths

Estimates of the impact of the programme on the likelihood of going on to enter A-Level maths, measured in odds ratios, are given in table 11, with 95% confidence intervals.

Table 11: Estimated impact on odds of progressing to A-Level maths

Year	Lower CI	Estimate	Upper CI	No. pupils
2018	4.0	6.8	11.9	392
2019	2.8	5.1	9.9	270
2020	1.8	3.8	8.5	216
Pooled	2.7	5.1	9.9	878

These results suggest that the programme has a positive effect on the likelihood of going on to complete A-Level maths. We would estimate that, over the entire period covered by this evaluation, the odds of a participant going on to enter A-Level maths are between 2.7 and 9.9 times higher than those of a matched non-participant, on average, with an average difference of 5.1.

The table below shows the average predicted probabilities of participations and non-participants going on to enter A-Level maths. These probabilities may be easier to interpret than odds ratios.

Table 12: Predicted probability of progressing to A-Level maths

Year	Participants	Comparison	No. pupils
2018	76.9%	32.1%	392
2019	72.4%	32.8%	270
2020	67.3%	34.6%	216
Pooled	73.8%	33.0%	878

Our pooled analysis predicted that 33% of comparison pupils would go on to enter A-Level maths, compared to 74% of participants. For context, as noted in section 3.1 above, around 12% of all KS4 pupils go on to enter A-Level maths; both the comparison group pupils and participants are far more likely to do so than the average pupil.

4.2.1 By level of engagement

4.2.1.1 By sessions attended

Estimates of the impact of the programme on the likelihood of going on to enter A-Level maths, measured in odds ratios, for none, low, mid and high levels of engagement are given in table 13, with 95% confidence intervals.

See section 2.2 for a full description of how the dosage groups were determined.

We have omitted dosage estimates for pupils who completed KS4 in 2019 and 2020 because of low numbers.

Table 13: Estimated impact on odds of progressing to A-Level maths, by dosage level

Year	Dosage	Lower CI	Estimate	Upper CI	No. pupils
2018	None	2.4	7.2	31.4	76
2018	Low	1.6	6.5	41.7	66
2018	Mid	2.1	5.4	19.8	94
2018	High	3.2	7.4	20.2	156
2019	None	NA	NA	NA	NA
2019	Low	NA	NA	NA	NA
2019	Mid	NA	NA	NA	NA
2019	High	NA	NA	NA	NA
2020	None	NA	NA	NA	NA
2020	Low	NA	NA	NA	NA
2020	Mid	NA	NA	NA	NA
2020	High	NA	NA	NA	NA

We have not included pooled estimates broken down by dosage. Because of the lower number of participants in 2019 and 2020s, and the fact that few participants in these years fell into the lower dosage groups in these years, we have not included dosage estimates for these years in this analysis. Therefore, the estimates we have available are from just one year, 2018, so we cannot produce a pooled analysis.

The point estimates for 2018 are highest for the high dosage group, in which participants attended at least 50% of sessions. While the point estimate for the 'no engagement' group, in which participants attended none or just one session, is nearly as high, the confidence interval for this group and the low engagement group is very wide, and overlaps with that of the other groups.

The table below shows the average predicted probabilities of participations and non-participants going on to enter A-Level maths. These probabilities may be easier to interpret than odds ratios.

Table 14: Predicted probability of progressing to A-Level maths, by dosage level

Year	Dosage	Participants	Comparison	No. pupils
2018	None	75.0%	28.2%	76
2018	Low	71.7%	30.5%	66
2018	Mid	76.0%	36.1%	94
2018	High	80.7%	35.7%	156
2019	None	NA	NA	NA
2019	Low	NA	NA	NA
2019	Mid	NA	NA	NA
2019	High	NA	NA	NA
2020	None	NA	NA	NA
2020	Low	NA	NA	NA
2020	Mid	NA	NA	NA

2020	High	NA	NA	NA

We would estimate that 75% of non-engaging participants, 72% of low dosage participants, 76% of mid dosage, and 80.7% of high dosage pupils would go on to enter an A-Level in maths.

Pupils in the matched comparison groups for no and low engagement participants were less likely to go on to take an A-Level in maths than those in the matched comparison groups for mid and high engagement participants.

4.2.1.2 By years participated

Estimates of the impact of the programme on the likelihood of progressing to A-Level maths, measured in odds ratios, for one and two years of participation, are given in table 15, with 95% confidence intervals.

We have omitted estimates for two years of participation for pupils who completed KS4 in 2019 because of low numbers. This group is also omitted from the pooled estimates.

Table 15: Estimated impact on odds of progressing to A-Level maths, by years participated

Year	Years attended	Lower CI	Estimate	Upper CI	No. pupils
2018	One	3.2	6.2	12.2	272
2018	Two	3.5	9.7	32.7	120
2019	One	3.2	6.0	12.6	234
2019	Two	NA	NA	NA	NA
2020	One	1.7	4.3	13.2	150
2020	Two	0.9	3.5	19.6	66
Pooled	One	2.8	5.7	12.6	656
Pooled	Two	2.1	6.3	25.4	186

These results provide some evidence that the programme has a stronger effect on those who participate for two years rather than one year. However, the confidence intervals for those who participated over two years are extremely wide, overlapping with those who participated for one year. This may reflect the relatively low numbers who participated for more than one year, and / or more variability in their outcomes.

The table below shows the average predicted probabilities of participations and non-participants going on to enter A-Level maths. These probabilities may be easier to interpret than odds ratios.

Table 16: Predicted probability of progressing to A-Level maths, by years participated

Year	Years	Participants	Comparison	No. pupils
2018	One	74.9%	31.9%	272
2018	Two	82.1%	32.2%	120
2019	One	75.3%	32.7%	234

2019	Two	NA	NA	NA
2020	One	68.1%	32.4%	150
2020	Two	65.4%	35.2%	66
Pooled	One	72.9%	32.3%	656
Pooled	Two	80.6%	33.1%	186

We would estimate that 81% of pupils who took part in the programme for two years would go on to enter A-Level maths, compared to 73% of participants who took part for one year.

4.2.2 By student characteristics

4.2.2.1 By gender

Estimates of the impact of the programme on the likelihood of progressing to A-Level maths, measured in odds ratios, for male and female students, are given in table 17, with 95% confidence intervals.

Table 17: Estimated impact on odds of progressing to A-Level maths, by gender

Year	Gender	Lower CI	Estimate	Upper CI	No. pupils
2018	Female	2.7	5.4	10.8	240
2018	Male	4.6	11.2	35.5	152
2019	Female	2.5	5.4	13.5	162
2019	Male	2.2	6.1	22.3	108
2020	Female	1.1	3.0	9.6	134
2020	Male	2.0	6.5	28.2	82
Pooled	Female	2.1	4.6	11.0	536
Pooled	Male	3.0	7.6	26.3	342

These results suggest that the programme has a positive effect on the likelihood of progressing to A-Level maths for both male and female students. They provide some evidence that the programme has a stronger effect on male students than on female students. However, the confidence intervals for male students are wide, reflecting the relatively small number of male participants. A larger sample size may provide more reliable estimates.

The table below shows the average predicted probabilities of participants and non-participants going on to enter A-Level maths. These probabilities may be easier to interpret than odds ratios.

Table 18: Predicted probability of progressing to A-Level maths, by years participated

Year	Gender	Participants	Comparison	No. pupils
2018	Female	71.5%	31.3%	240
2018	Male	86.1%	36.0%	152
2019	Female	66.6%	26.4%	162
2019	Male	80.9%	39.7%	108

2020	Female	55.9%	27.6%	134
2020	Male	83.6%	43.9%	82
Pooled	Female	66.2%	28.7%	536
Pooled	Male	84.3%	39.4%	342

Over the whole period covered by this evaluation, the average predicted probability of a male participant going on to take A-Level maths is 84.3%, 44.9 percentage points higher than a matched non-participant. The average predicted probability of a female participant going on to take A-Level maths is 66.2%, 37.5 percentage points higher than a matched non-participant.

4.2.2.2 By disadvantage

Estimates of the impact of the programme on the likelihood of progressing to A-Level maths, measured in odds ratios, for disadvantaged students and their peers, are given in table 19, with 95% confidence intervals. We define disadvantaged pupils as those who were eligible for free school meals in the last six years (FSM6).

Table 19: Estimated impact on odds of progressing to A-Level maths, by disadvantage status

Year	Disadvantage	Lower CI	Estimate	Upper CI	No. pupils
2018	FSM6	2.4	5.7	14.4	142
2018	Not FSM6	3.5	6.8	14.3	250
2019	FSM6	0.7	3.0	12.2	68
2019	Not FSM6	3.3	6.6	15.3	202
2020	FSM6	0.9	3.7	17.9	74
2020	Not FSM6	1.5	3.6	9.5	142
Pooled	FSM6	1.6	4.4	13.3	284
Pooled	Not FSM6	2.5	5.3	12.3	594

These results suggest that the programme has a positive effect on the likelihood of progressing to A-Level maths for both disadvantaged students and their peers. However, in some individual years (2019 and 2020), the confidence interval for disadvantaged students includes one. This means that we cannot be confident that the programme had a positive impact on this group in those years. The wide confidence intervals for estimates in these years may reflect the relatively small sample size and the relatively low likelihood of disadvantaged students studying A-Level maths.

Both the fact that we cannot be confident that the programme had a positive impact on disadvantaged pupils in some individual years, and the differences in the pooled estimates for disadvantaged students and their peers, suggest that the programme had a lower impact on disadvantaged students than their peers for this outcome.

The table below shows the average predicted probabilities of participants and non-participants going on to enter A-Level maths. These probabilities may be easier to interpret than odds ratios.

Table 20: Predicted probability of progressing to A-Level maths, by disadvantage status

Year	Disadvantage	Participants	Comparison	No. pupils
2018	FSM6	71.1%	28.9%	142
2018	Not FSM6	80.0%	37.2%	250
2019	FSM6	60.8%	34.8%	68
2019	Not FSM6	76.1%	32.0%	202
2020	FSM6	61.0%	28.2%	74
2020	Not FSM6	70.2%	38.2%	142
Pooled	FSM6	65.8%	30.1%	284
Pooled	Not FSM6	77.6%	36.0%	594

Over the whole period covered by this evaluation, the average predicted probability of a disadvantaged participant going on to take A-Level maths is 65.8%, 35.7 percentage points higher than a matched non-participant. The average predicted probability of a non-disadvantaged participant going on to take A-Level maths is 77.6%, 41.6 percentage points higher than a matched non-participant.

4.2.2.3 By ethnicity

Estimates of the impact of the programme on the likelihood of progressing to A-Level maths, measured in odds ratios, for Black students and their peers, are given in table 21, with 95% confidence intervals. Estimates for 2020 are omitted due to a low number of Black participants. Estimates from this year have been omitted for the pooled estimates.

Table 21: Estimated impact on odds of progressing to A-Level maths, by ethnicity

Year	Ethnicity	Lower CI	Estimate	Upper CI	No. pupils
2018	Black	1.2	4.4	22.4	72
2018	Not Black	3.9	6.7	12.8	320
2019	Black	1.3	4.5	22.4	60
2019	Not Black	3.0	6.0	13.0	210
2020	Black	NA	NA	NA	NA
2020	Not Black	NA	NA	NA	NA
Pooled	Black	1.3	4.5	22.4	132
Pooled	Not Black	3.5	6.4	12.8	530

These results suggest that the programme has a positive effect on the likelihood of progressing to A-Level maths for both Black students and their peers. While the estimated impact on Black students is lower than that on their peers, the confidence intervals for Black students are very wide, overlapping with those for their peers.

The table below shows the average predicted probabilities of participants and non-participants going on to enter A-Level maths. These probabilities may be easier to interpret than odds ratios.

Table 22: Predicted probability of progressing to A-Level maths, by years participated

Year	Gender	Participants	Comparison	No. pupils
2018	Black	63.9%	29.0%	72
2018	Not Black	79.2%	36.4%	320
2019	Black	64.2%	27.5%	60
2019	Not Black	74.9%	34.2%	210
2020	Black	NA	NA	NA
2020	Not Black	NA	NA	NA
Pooled	Black	64.0%	28.3%	132
Pooled	Not Black	78.4%	35.6%	530

Over the whole period covered by this evaluation (omitting 2020), the average predicted probability of a Black participant going on to take A-Level maths is 64.0%, 35.7 percentage points higher than a matched non-participant. The average predicted probability of a participant from any other ethnic background going on to take A-Level maths is 78.4%, 42.8 percentage points higher than a matched non-participant.

5. Conclusions

5.1 Overview

This evaluation suggests that the project has a positive effect on both attainment in GCSE maths and the likelihood of going on to enter A-Level maths. Over the whole period covered by the evaluation, we would estimate that programme participants would achieve a GCSE maths grade between 1.0 and 1.6 grades higher than a similar pupil who did not participate, and their odds of going on to enter A-Level maths would be between 2.7 and 9.9 higher.

However, the impact of the programme varied somewhat between the years evaluated. While still positive in every year, the impact was lower in more recent years, and particularly high in the first year covered; that is, for pupils who completed KS4 in 2018.

These changes over time may reflect changes to the programme. The number and profile of participants changed considerably following the onset of the COVID-19 pandemic, as did the delivery of the programme, which moved online. The pandemic also caused widespread disruption to education and assessment, and the ways that this may have affected this evaluation are discussed more fully in the limitations section.

We also broke down the estimated impact for participants by the level of attendance at sessions, the years they participated and the type of attendance (online only / some sessions in person). We found some evidence that the programme had a higher impact on those participants who attended a higher than average proportion of sessions. However, this finding is complicated by the fact that average levels of attendance differed considerably between years. Among participants who completed KS4 in 2019, for the example, the median proportion of sessions attended was 53%; among those who completed in 2022, it was just 13%. This means that the sample size in some of the dosage groups was too low to obtain reliable estimates in several of the years included in this evaluation.

We also found some evidence that the impact was higher for those who participated who two years rather than just one, but this was not conclusive. This may be because of the lower sample size for participation over two years.

We found little difference in the impact on those attending the programme exclusively online during 2021 and 2022 and those attending some sessions in person, although again this finding is inconclusive due to the relatively small numbers attending in person. The fact that the estimated impact pre-pandemic, when sessions were held almost exclusively in person, is higher than those from 2020 onwards, may suggest that in person sessions did have more impact. However, the difference in impact may be due to other factors, for example, the change in the profile of the participants or the widespread upheaval in education during the pandemic.

Finally, we looked at the impact broken down by pupil characteristics. This was largely inconclusive, but we did find some evidence to suggest that the programme may have a slightly lower impact on female pupils than male pupils, and on Black pupils than on pupils of other ethnic backgrounds. A larger sample size, particularly when looking at different ethnic backgrounds, may provide more conclusive evidence on this point. When looking at the impact of the programme on disadvantaged pupils, again our analysis was inconclusive, but we did find some evidence to suggest that the programme may have a higher impact

on GCSE grade for disadvantaged pupils than for their peers. But conversely, it may have had a lower impact on the likelihood of progressing to A-Level for disadvantaged pupils than for their peers.

5.2 Limitations

This evaluation uses a quasi-experimental design; it relies on creating a matched comparison group that is statistically similar to the programme participants, based on data from the NPD. Creating a comparison group in this way means that we are unable to control for factors not recorded in the NPD, for example pupil motivation, social class or parental occupation.

Because of the nature of the programme, participants are likely to have a particular interest in maths. This interest may explain some of their relatively high attainment in GCSE maths and likelihood to progress to A-Level maths, rather than the effect of the programme. This could have led us to overestimate the effect of the programme. On the other hand, the programme prioritises pupils from backgrounds that are underestimated in mathematical sciences at HE, but we were unable to determine the levels of some of the selection criteria, namely whether a pupil is or has ever been in local authority care, whether they are a carer, or whether they are disabled. This may have led us to underestimate the effects of the programme.

This evaluation looks at the two outcomes separately. However, the fact that participants achieved higher GCSE grades than matched comparison pupils, on average, may explain some of the differences in likelihood to go on to enter A-Level maths, rather than the direct influence of the programme.

While the sensitivity analysis (described in the appendix) generally agreed with the analysis in the main body of the report, there were some differences in the estimated impact on high dosage pupils who completed KS4 in 2018. Although the average predicted probability of a participant going on to take an A-Level in maths is similar to that in the main analysis, the predicted probability of the average comparison student doing is so is considerably lower. This may mean that the estimates for this particular group of overly sensitive to the matching method used and may be less reliable.

The timeframe of the evaluation includes the onset of the COVID-19 pandemic. This affected both the nature of the programme, in that it moved to online delivery and widened its reach beyond London, and the outcomes, in that grades were awarded differently in some of the years covered. This may mean that pooled estimates, and estimates of the effect of the programme based on the pre-pandemic years, may not reflect the impact of the programme under pre-pandemic conditions. However, this is a limitation common to most evaluations of programmes delivered during this period. We have presented estimates of impact based solely on the pre-pandemic years to attempt to mitigate for this.

Finally, relatively few participants took part in the programme over two years rather than one year, and relatively few attended any sessions in person during 2021 and 2022. Because of this, we are less able to detect smaller effects for these groups and more likely to produce inconclusive results than with a larger sample. Similar issues affected our analysis of the impact of the programme by ethnic background and disadvantage.

Appendix: Sensitivity analysis

In this appendix we present results obtained using an alternative matching method as a sensitivity analysis. If the results obtained from the alternative method did not agree with those obtained from the primary method, this would suggest that the analysis is sensitive to the matching method used and may not be reliable.

The matching method used is nearest neighbour matching based on an alternative distance measure: Mahalanobis distance, rather than propensity scores as used in the main analysis.

All of the effect size estimates given in the results below are within +- 0.2 of those shown in the main analysis. All of the predicted probabilities for participants going on to enter an A-Level are within +- 6 percentage points of those given in the main analysis, with the majority less than +- 1 percentage point. These differences are small enough to suggest that the analysis is not overly sensitive to the matching method used.

The one exception are the predicted probabilities for students in the high dosage group in 2018. Although the average predicted probability of a participant going on to take an A-Level in maths is similar to that in the main analysis, the predicted probability of the average comparison student doing is so is considerably lower.

GCSE maths attainment

Table 23: Estimated impact on GCSE maths grade Table 4: Estimated impact on GCSE maths grade

Year	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2018	1.4	1.7	2.0	0.8	10	392
2019	1.2	1.5	1.8	0.7	9	270
2020	1.0	1.5	1.9	0.7	9	216
2021	0.9	1.2	1.5	0.6	7	690
2022	1.0	1.2	1.3	0.5	6	2018
Pooled	1.1	1.4	1.6	0.6	8	3586
Pooled (pre-2020)	1.4	1.6	1.9	0.8	9	662

Table 24: Estimated impact on GCSE maths grade by dosage level

Year	Dosage	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2018	None	1.0	1.5	2.1	0.7	9	76
2018	Low	0.8	1.5	2.1	0.7	8	66
2018	Mid	0.8	1.3	1.8	0.6	8	94
2018	High	1.6	1.9	2.3	0.9	11	156
2019	None	NA	NA	NA	NA	NA	NA

2019	Low	NA	NA	NA	NA	NA	NA
2019	Mid	NA	NA	NA	NA	NA	NA
2019	High	NA	NA	NA	NA	NA	NA
2020	None	NA	NA	NA	NA	NA	NA
2020	Low	NA	NA	NA	NA	NA	NA
2020	Mid	NA	NA	NA	NA	NA	NA
2020	High	NA	NA	NA	NA	NA	NA
2021	None	0.5	0.9	1.4	0.4	5	140
2021	Low	0.7	1.0	1.2	0.5	6	324
2021	Mid	0.8	1.1	1.5	0.5	6	142
2021	High	1.0	1.4	1.9	0.7	8	84
2022	None	0.7	0.9	1.1	0.4	5	730
2022	Low	0.9	1.1	1.2	0.5	6	702
2022	Mid	0.7	1.0	1.3	0.4	5	264
2022	High	1.0	1.3	1.6	0.7	8	322
Pooled	None	0.7	0.9	1.2	0.4	5	946
Pooled	Low	0.8	1.1	1.3	0.5	6	1092
Pooled	Mid	0.7	1.1	1.4	0.5	6	500
Pooled	High	1.2	1.5	1.9	0.7	9	728

Table 25: Estimated impact on GCSE maths grade by years participated

Year	Years attended	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2018	One	1.3	1.6	1.9	0.8	9	272
2018	Two	1.4	1.8	2.3	0.9	10	120
2019	One	1.3	1.7	2.0	0.8	9	234
2019	Two	NA	NA	NA	NA	NA	NA
2020	One	1.0	1.5	2.0	0.7	9	150
2020	Two	0.6	1.5	2.3	0.7	9	66
2021	One	0.9	1.2	1.5	0.6	7	582
2021	Two	0.7	1.2	1.8	0.6	7	108
2022	One	0.9	1.1	1.3	0.5	6	1596
2022	Two	0.9	1.3	1.6	0.6	7	348
Pooled	One	1.1	1.3	1.6	0.6	8	2834
Pooled	Two	1.0	1.4	1.9	0.7	8	642
Pooled (pre-2020)	One	1.3	1.6	2.0	0.8	9	506
Pooled (pre-2020)	Two	1.4	1.8	2.3	0.9	10	120

Table 26: Estimated impact on GCSE maths grade by type of attendance

Year	Type	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. pupils
2021	Online only	0.9	1.2	1.6	0.6	7	458
2021	Mixture	0.7	1.1	1.5	0.5	7	232
2022	Online only	1.0	1.2	1.4	0.5	7	1752
2022	Mixture	0.6	1.0	1.5	0.5	6	266
Pooled	Online only	1.0	1.2	1.4	0.5	7	2210
Pooled	Mixture	0.7	1.1	1.5	0.5	6	498

Progression to A-Level maths

Table 18: Estimated impact on odds of progressing to A-Level maths

Year	Lower CI	Estimate	Upper CI	No. pupils
2018	5.8	8.8	13.6	392
2019	3.6	5.7	9.7	270
2020	1.8	3.8	8.5	216
Pooled	3.5	5.8	10.3	878

Table 19: Predicted probability of progressing to A-Level maths

Year	Participants	Comparison	No. pupils
2018	76.9%	27.6%	392
2019	72.1%	31.2%	270
2020	67.3%	34.6%	216
Pooled	73.5%	29.9%	878

Table 20: Estimated impact on odds of progressing to A-Level maths, by dosage level

Year	Dosage	Lower CI	Estimate	Upper CI	No. pupils
2018	None	2.8	6.7	17.6	76
2018	Low	2.4	5.4	15.0	66
2018	Mid	2.1	4.9	13.8	94
2018	High	7.1	14.8	34.1	156
2019	None	NA	NA	NA	NA
2019	Low	NA	NA	NA	NA
2019	Mid	NA	NA	NA	NA
2019	High	NA	NA	NA	NA
2020	None	NA	NA	NA	NA

2020	Low	NA	NA	NA	NA
2020	Mid	NA	NA	NA	NA
2020	High	NA	NA	NA	NA

Table 21: Predicted probability of progressing to A-Level maths, by dosage level

Year	Dosage	Participants	Comparison	No. pupils
2018	None	74%	30%	38
2018	Low	72%	34%	33
2018	Mid	76%	40%	47
2018	High	81%	22%	78
2019	None	NA	NA	NA
2019	Low	NA	NA	NA
2019	Mid	NA	NA	NA
2019	High	NA	NA	NA
2020	None	NA	NA	NA
2020	Low	NA	NA	NA
2020	Mid	NA	NA	NA
2020	High	NA	NA	NA

Table 22: Estimated impact on odds of progressing to A-Level maths, by years participated

Year	Years attended	Lower CI	Estimate	Upper CI	No. pupils
2018	One	5.3	8.7	14.6	272
2018	Two	4.9	10.2	27.0	120
2019	One	4.3	7.4	12.8	234
2019	Two	NA	NA	NA	NA
2020	One	1.7	4.3	13.2	150
2020	Two	0.9	3.5	19.6	66
Pooled	One	4.0	7.2	13.5	656
Pooled	Two	3.5	7.9	24.4	186

Table 23: Predicted probability of progressing to A-Level maths, by years participated

Year	Years	Participants	Comparison	No. pupils
2018	One	75.1%	25.8%	272
2018	Two	82.0%	31.2%	120
2019	One	75.2%	29.0%	234
2019	Two	NA	NA	NA
2020	One	68.1%	32.4%	150

2020	Two	65.4%	35.2%	66
Pooled	One	73.0%	28.0%	656
Pooled	Two	80.6%	31.8%	186