Evaluation of the MA*ths Online Programme

2019/20 – 2021/22

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1. Executive summary

1.1 Main findings

- This report evaluates the effect of participating in the mA*ths Online Programme on students who completed their A-Levels between 2019/20 and 2021/22.
- We look at three outcomes: A-Level maths grade, likelihood of achieving A or above, and likelihood of achieving A*. Where the sample size is sufficient, impact is also broken by level of engagement with the project.
- This report found evidence to show that participants who completed A-Levels in 2020 and 2021 achieved around half a grade higher than matched comparison students.
- It also found evidence to show that participants who completed A-Levels in 2020 and 2021 were more likely to achieve a grade A or above, and more likely to achieve an A*, than matched comparison students.
- We did not find conclusive evidence of any impact on participants who completed A-Levels in 2022. This was the only year covered by this evaluation in which A-Levels were assessed via public examinations; in both 2020 and 2021, public exams were cancelled during the COVID-19 pandemic.
- We did not find conclusive evidence to show that there was a difference in impact by level of engagement with the project.

1.2 Methodology

- This evaluation follows a quasi-experimental design. We used student-level data from the National Student Database (NPD) to create a matched comparison group, similar to those students who participated in the programme with respect to a set of student and school level variables.
- Participants were matched to non-participants using on nearest neighbour matching based on propensity scores.
- 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, such as motivation.
- In particular, we are unable to match based on some of the programme's selection criteria: it targets students who are considering studying a maths-related degree at university, but we have no way of knowing if matched comparison students have similar ambitions.
- The period covered by this evaluation includes the onset of the COVID-19 pandemic. The disruption caused to education in general, to programme delivery and to public examinations, which were cancelled in 2020 and 2021, may mean that this evaluation does not reflect the impact of the programme under less exceptional circumstances.
- While participants who completed A-Levels in 2022 did receive their A-Level grades via public examinations, they would have taken their GCSEs in 2020, when public examinations were cancelled and grades were awarded via centre-assessed grades. This may have affected the matching and modelling process, in which we controlled for prior attainment at GCSE.

- Due to relatively low sample sizes, we were unable to provide estimates of effect for some of the subgroups, particularly for subgroups by dosage. The low sample size also means that inconclusive results are more likely.
- Achieving an A* in A-Level maths is a relatively rare event. This means that the minimum detectable effect sizes are smaller for a given sample size than for other outcomes, and means that inconclusive results are more likely.

2. Introduction

The mA*ths Online Programme aims to assist A-level mathematics students who are considering studying a maths-related degree at university. Participating students receive tailored online support, including online mentoring and face-to-face masterclasses at Imperial College London, which runs the programme in collaboration with Mathematics in Education and Industry (MEI). Students can receive support in Year 12, Year 13 or both.

In this report, we evaluate the impact of the programme on A-Level maths grade, and specifically on the likelihood of achieving either A or above, or an A* at A-Level maths. It includes cohorts who completed A-Levels between 2019/20 and 2021/22.

We will look at the impact on all participants, at the impact broken down by their level of engagement in the project.

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 students who are statistically similar. This approach tries to mimic what would be done in a formal experiment such as a randomised control trial.

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

- Attainment at Key Stage 4 (Maths GCSE grade, average overall GCSE grade, Attainment 8 score)
- Student-level measures of disadvantage (% of school terms from Reception to Year 11 in receipt of free school meals, IDACI score)
- Student characteristics (ethnicity, first language, gender)
- School level prior attainment

Participating students were matched to students who completed A-Level maths in the same year. We then used regression models to compare outcomes for the participants to those in the matched comparison group. We control again for the matching variables in the model; this is known as a doubly robust approach.

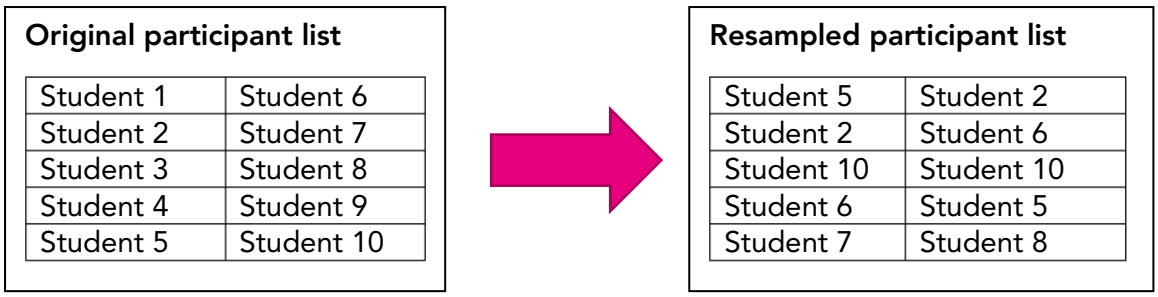
Confidence intervals are estimated using bootstrapping. While it is possible to construct confidence intervals simply by using the standard errors estimated by the regression models, this method only accounts for the uncertainty around the estimate made by the regression model; it does not account for 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 students, 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.

2.2 Data

Imperial College provided a dataset consisting of information on all participating students who completed A-Levels in 2019/20, 2020/21 and 2021/22. This included student identifiers (name and gender) and information on their participation in the programme. This was linked to corresponding records in the National Student Database (NPD) and publicly available school level data.

The National Student Database is an administrative dataset maintained by the Department for Education, which includes records of achievements in national tests and examinations for all students who have been in state-funded education since 2002. For this evaluation, we used data on attainment at Key Stage 4 and Key Stage 5, as well as some demographic variables.

The original dataset supplied by Imperial consisted of 414 students in total. A small number of students in this dataset could not be matched to data in the NPD, could not be found in the relevant years, or had no data on outcomes available. We excluded these students from this analysis. We also excluded students with no data on available on prior attainment or disadvantage status; this will include any students who did not complete KS4 in a state-funded school in England. The final dataset used consisted of 377 students.

Participants were also broken down by two measures of their engagement with the programme: number of years of participation (one or two), and dosage (zero, low, medium and high). Dosage was defined according to Imperial's own definition based on the number of sessions attended by participants. In some cases, notably the zero dosage group, sample sizes were too low for models to be fitted to the data.

The number of participants in each group are shown in the table below.

Table 1: Participants by level of engagement and cohort

	Years of participation		Dosage			
Cohort	One year	Two years	Zero	Low	Mid	High
2020	79	39	3	24	71	20
2021	75	58	11	51	23	48
2022	73	53	3	67	36	20
TOTAL	227	150	17	142	130	88

3. Summary statistics and matching

This section begins with some summary statistics about participating students and schools. It will go on to describe the matching process used and how successful it was in creating a group of similar students for comparison purposes.

3.1 Summary statistics

We begin by presenting some statistics on the demographics of programme participants and how they compare to maths A-Level students nationally.

Table 2: Demographics of participants compared to other maths A-Level students in state-funded schools in England

		2020		2021		2022	
		M*ths	Other	M*ths	Other	M*ths	Other
Gender	Female	54%	39%	57%	38%	52%	37%
	Male	46%	61%	43%	62%	48%	63%
EAL	EAL	66%	23%	64%	25%	63%	26%
	Not EAL	34%	77%	36%	75%	37%	74%
Ever Eligible for FSM	Never	49%	88%	44%	88%	54%	88%
	0-50% terms	30%	5%	40%	6%	25%	6%
	50%+ terms	21%	7%	15%	7%	21%	6%
IDACI		0.29	0.16	0.30	0.16	0.25	0.14

While maths students nationally are mostly male, programme participants were mostly female. Programme participants were more likely to have English as an additional language than maths A-Level students nationally, and more likely to have been eligible for FSM at some point in their school career. Between 15-20% of each cohort of participants had been eligible for free school meals for at least half of their school career, compared to 6-7% nationally. Reflecting this, participants also had higher IDACI scores, on average, than maths students nationally.

The next table summarises the prior attainment of participants at Key Stage 4.

Table 3: Prior attainment of participants compared to other maths A-Level students in state-funded schools in England

	2020		2021		2022	
	M*ths	Other	M*ths	Other	M*ths	Other
Average maths GCSE grade	8.13	7.77	8.21	7.75	8.25	7.88
Average overall GCSE grade	7.56	6.87	7.58	6.87	7.71	7.17
Average Attainment 8 score	78.79	72.33	78.71	72.04	79.92	74.22

Participants tended to have higher prior attainment than their peers, particularly the cohort who completed A-Levels in 2021.

Finally, we look at how participants' attainment in A-Level maths compared to A-Level maths students nationally.

Average A-Level grade is reported in points, with points relating to grade as follows: 60 = A*, 50 = A, 40 = B, 30 = C, 20 = D, 10 = E.

Table 4: Attainment in A-Level maths compared to other maths A-Level students in state-funded schools in England

	2020		2021		2022	
	M*ths	Other	M*ths	Other	M*ths	Other
Average points score	52.12	41.85	52.90	42.35	46.17	39.14
% achieving A or above	81%	48%	83%	51%	65%	44%
% achieving A*	51%	22%	54%	25%	22%	21%

Among participants and non-participants, grades were higher than in typical years for all three years included. In 2020 and 2021, public exams were cancelled during the pandemic, and grades were awarded via alternative methods, resulting in an overall increase in grades. In 2022, public exams returned but grade boundaries were adjusted upwards slightly to prevent a drastic fall in grades.

In every year, the average grade of participants was higher than their peers, and participants were more likely to achieve top grades. However, the difference between participants and non-participants was smaller in 2022 than in the earlier years, particularly for the percentage achieving A*.

However, as shown in this section, the characteristics and prior attainment of participants are different from that of maths students nationally, so comparing their outcomes to national averages may be misleading.

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 students with respect to student and school characteristics. Any differences in the outcomes of this comparison group and the participating students 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.

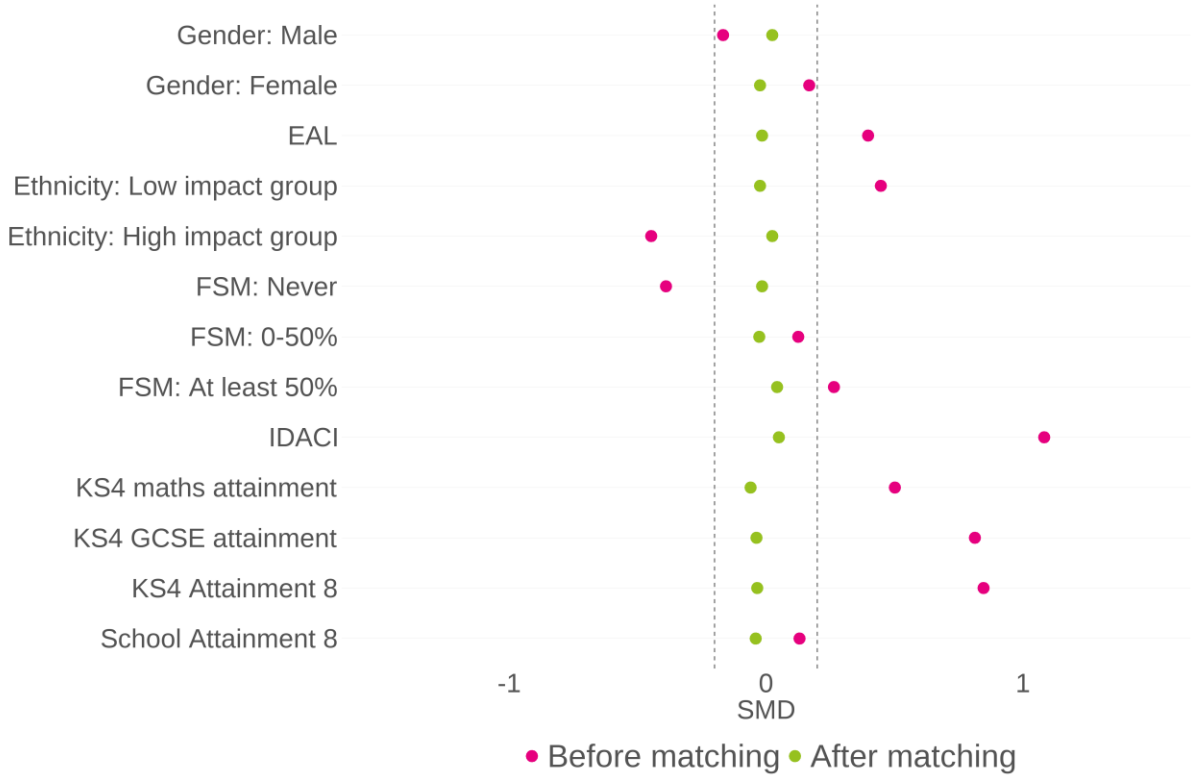
The graphs in figure 1, known as love plots,[1] show how similar the treated and comparison students were to one another, before and after matching, using a measure called the standardised mean difference. The mean difference is simply the difference between the average value of the variable for the 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.

[1] 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)

Where standardised mean differences relate to fewer than ten students, figures are suppressed for data protection reasons and are not displayed on the plots.

As shown in figure 1, the matching process successfully created a well-matched comparison group. The +-0.2 boundaries are shown on the chart as dotted lines.

Figure 2: Standardised mean differences between participants and non-participants, before and after matching



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 outcomes in three areas:

- A-Level grade (measured in points score)
- Likelihood of achieving an A or above in A-Level maths
- Likelihood of achieving an A* in A-Level maths

The estimated impact on A-Level grade is reported in points, with points relating to grade as follows: 60 = A*, 50 = A, 40 = B, 30 = C, 20 = D, 10 = E. An estimated impact of ten 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 for this outcome. 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.[2] 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 5: 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

[2] https://educationendowmentfoundation.org.uk/projects-and-evaluation/evaluation/evaluation-guidance-and-resources/reporting-templates, *Evaluation report template*, accessed May 2023

The final two outcomes, on the likelihood of achieving top grades in A-Level maths, are binary; either a student achieves an A*, for example, or they do not. We report the estimated effect on these outcomes using odds ratios. These ratios tell us the relative odds of a student achieving the relevant grade, 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 achieving the grade as a comparison student. An odds ratio above one means that a participant is more likely to achieve the grade, 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 achieving the relevant grade and the predicted probability of a matched comparison student doing so, for comparison. The predicted probabilities are calculated by producing two predicted probabilities for each student in the dataset, based on their prior attainment and characteristics. The first predicted probability is based on the assumption that the student took part in the programme, and the second on the assumption that they did not. We then calculate the average predicted probability if students were assumed to have taken part, and the average predicted probability if students were assumed not to have done so, and compare the two. If the predicted probability when students are assumed to have taken part is higher, that indicates that the programme had a positive effect.

Overall

A-Level points score

Estimates of the impact of programme participation on A-Level grade are shown in the table below, with 95% confidence intervals (all to two decimal places). Also included in the tables are estimates of effect size and equivalent months of progress.

Note that an estimated effect of ten is the equivalent of a participant achieving one grade higher than a non-participant.

Table 6: Estimated effect of programme participation on A-Level grade, by group

Cohort	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. students
2020	2.24	5.09	7.91	0.33	4	236
2021	2.57	5.25	8.47	0.34	4	266
2022	-0.41	3.17	6.75	0.20	3	252

These results provide evidence to show that the programme had an impact on A-Level grade for students that completed A-Levels in both 2020 and 2021. We would estimate that participants in these years would achieve around half a grade higher than matched non-participants. For students that completed A-Levels in 2022, while the estimate is positive, the lower confidence interval is less than zero. This means that the result is not statistically significant, and we cannot be confident that the programme had any effect for participants in this year. However, the relatively high positive point estimate does give a positive indication.

Achieving A or above

Estimates of the impact of programme participation on the likelihood of a student achieving an A or above in A-Level maths are shown in the table below are shown in the tables below, with 95% confidence intervals (all to two decimal places).

We report the estimated effect on this outcome using odds ratios. These ratios tell us the relative odds of a student achieving an A or above, depending on whether their school took part in the programme or not. An odds ratio of one would mean that a programme participant had exactly the same odds of achieving the grade as a comparison student. An odds ratio above one means that a participant is more likely to achieve the grade, and an odds ratio of below one means that they are less likely.

Table 7: Estimated effect of participation on likelihood of achieving A or above

Cohort	Lower CI	Estimate	Upper CI	No. students
2020	1.43	4.23	14.70	236
2021	1.48	3.51	9.78	266
2022	0.86	2.01	4.93	252

Similarly to the previous outcome, these results provide evidence to show that the programme had an impact on the likelihood of achieving an A or above on students that completed A-Levels in both 2020 and 2021. For students that completed A-Levels in 2022, while the estimate is above one, the lower confidence interval is below one. This means

that the result is not statistically significant, and we cannot be confident that the programme had any effect for participants in this year.

The table below shows the predicted probabilities of all of the students in our sample achieving an A or above in A-Level maths had they taken part in the programme, and if they had not. These probabilities may be easier to interpret than odds ratios.

Table 8: Predicted probabilities of participating students and matched comparison students achieving A or above

	Predicted probability		No. students	
Cohort	Treated	Comparison	Treated	Comparison
2020	79%	63%	118	118
2021	82%	67%	133	133
2022	66%	55%	126	126

Achieving A*

Estimates of the impact of programme participation on the likelihood of a student achieving an A* in A-Level maths are shown in the table below are shown in the tables below, with 95% confidence intervals (all to two decimal places).

We report the estimated effect on this outcome using odds ratios. These ratios tell us the relative odds of a student achieving an A or above, depending on whether their school took part in the programme or not. An odds ratio of one would mean that a programme participant had exactly the same odds of achieving the grade as a comparison student. An odds ratio above one means that a participant is more likely to achieve the grade, and an odds ratio of below one means that they are less likely.

Table 9: Estimated effect of participation on likelihood of achieving A*

Cohort	Lower CI	Estimate	Upper CI	No. students
2020	1.71	5.49	25.06	236
2021	1.39	2.96	7.34	266
2022	0.27	0.77	2.02	252

As with the other two outcomes, these results provide evidence to show that the programme had an impact on the likelihood of achieving an A* on students that completed A-Levels in both 2020 and 2021. For students that completed A-Levels in 2022, the estimate is below one. However, the upper confidence interval is above one. This means that the result is not statistically significant, and we cannot be confident that the programme had any effect for participants in this year.

The table below shows the predicted probabilities of all of the students in our sample achieving an A* in A-Level maths had they taken part in the programme, and if they had not. These probabilities may be easier to interpret than odds ratios.

Table 10: Predicted probabilities of participating students and matched comparison students achieving an A*

	Predicted probability		No. students	
Cohort	Treated	Comparison	Treated	Comparison

2020	51%	32%	118	118
2021	54%	26%	133	133
2022	23%	27%	126	126

By years of participation

This section looked at the estimated impact on participants broken down by their length of participant in the programme.

A-Level points score

Estimates of the impact of programme participation on A-Level grade are shown in the table below, with 95% confidence intervals (all to two decimal places). Also included in the tables are estimates of effect size and equivalent months of progress.

Note that an estimated effect of ten is the equivalent of a participant achieving one grade higher than a non-participant.

Table 11: Estimated effect of programme participation on A-Level grade, by years of participation

Cohort	Participation	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. students
2020	One year	0.43	4.32	8.35	0.28	4	158
	Two years	1.70	5.94	11.06	0.38	5	78
2021	One year	2.97	6.36	10.48	0.41	5	150
	Two years	-1.03	3.79	9.10	0.24	3	116
2022	One year	-0.73	3.68	8.29	0.24	3	146
	Two years	-2.66	2.48	8.38	0.16	2	106

These results do not provide much evidence for a difference in impact on those who participated for one or two years. For the 2020 cohort, both estimates are significant and, while the point estimate for those participating for two years is slightly higher, the confidence interval is also much wider, meaning we can't be sure that the impact is different. For the 2021 and 2022 cohorts, the point estimates for those participating for two years are slightly lower, but again the confidence intervals for both estimates largely overlap.

Achieving A or above

Estimates of the impact of programme participation on the likelihood of a student achieving an A or above in A-Level maths are shown in the table below are shown in the tables below, with 95% confidence intervals (all to two decimal places).

We report the estimated effect on this outcome using odds ratios. These ratios tell us the relative odds of a student achieving an A or above, depending on whether their school took part in the programme or not. An odds ratio of one would mean that a programme participant had exactly the same odds of achieving the grade as a comparison student. An odds ratio above one means that a participant is more likely to achieve the grade, and an odds ratio of below one means that they are less likely.

In some cases, the sample size was not large enough to fit a reliable model. Where this was the case, the relevant fields are greyed out and marked with 'NA' in the table below.

Table 12: Estimated effect of participation on likelihood of achieving A or above

Cohort	Dose	Lower CI	Estimate	Upper CI	No. students
2020	One year	0.69	3.78	36.37	158
	Two years	NA	NA	NA	78
2021	One year	1.22	4.38	29.68	150
	Two years	0.68	4.11	106.22	116
2022	One year	0.71	2.18	8.01	146
	Two years	0.40	2.16	15.20	106

Unfortunately, we were unable to fit a reliable model for both groups in the 2020 cohort. For the 2021 and 2022 cohorts, the point estimates for those participating for one year are very similar to those participating for two, but the confidence intervals are wide and overlap one another, making it difficult to be sure if there is any difference between the groups.

The table below shows the predicted probabilities of all of the students in our sample achieving an A or above in A-Level maths had they taken part in the programme, and if they had not. These probabilities may be easier to interpret than odds ratios.

Table 13: Predicted probabilities of participating students and matched comparison students achieving A or above

		Predicted probability		No. students	
Cohort	Dose	Treated	Comparison	Treated	Comparison
2020	One year	77%	63%	79	79
	Two years	NA	NA	39	39
2021	One year	84%	67%	75	75
	Two years	80%	65%	58	58
2022	One year	68%	55%	73	73
	Two years	64%	54%	53	53

Achieving A*

Estimates of the impact of programme participation on the likelihood of a student achieving an A* in A-Level maths are shown in the table below are shown in the tables below, with 95% confidence intervals (all to two decimal places).

We report the estimated effect on this outcome using odds ratios. These ratios tell us the relative odds of a student achieving an A or above, depending on whether their school took part in the programme or not. An odds ratio of one would mean that a programme participant had exactly the same odds of achieving the grade as a comparison student. An odds ratio above one means that a participant is more likely to achieve the grade, and an odds ratio of below one means that they are less likely.

In some cases, the sample size was not large enough to fit a reliable model. Where this was the case, the relevant fields are greyed out and marked with 'NA' in the table below.

Table 14: Estimated effect of participation on likelihood of achieving A*

Cohort	Dose	Lower CI	Estimate	Upper CI	No. students

2020	One year	1.05	5.18	74.49	158
	Two years	NA	NA	NA	78
2021	One year	1.96	6.44	46.58	150
	Two years	0.37	1.50	8.41	116
2022	One year	0.21	0.86	4.18	146
	Two years	0.03	0.65	8.13	106

Unfortunately, we were unable to fit a reliable model for both groups in the 2020 cohort. For the 2021 and 2022 cohorts, the point estimates for those participating for one year are higher than those participating for two, but again the confidence intervals are wide and overlap one another, making it difficult to be sure if there is any difference between the groups.

The table below shows the predicted probabilities of all of the students in our sample achieving an A* in A-Level maths had they taken part in the programme, and if they had not. These probabilities may be easier to interpret than odds ratios.

Table 15: Predicted probabilities of participating students and matched comparison students achieving an A*

		Predicted probability		No. students	
Cohort	Dose	Treated	Comparison	Treated	Comparison
2020	One year	51%	33%	79	79
	Two years	NA	NA	39	39
2021	One year	63%	37%	75	75
	Two years	41%	34%	58	58
2022	One year	25%	27%	73	73
	Two years	21%	26%	53	53

By dosage

A-Level points score

Estimates of the impact of programme participation on A-Level grade are shown in the table below, with 95% confidence intervals (all to two decimal places). Also included in the tables are estimates of effect size and equivalent months of progress.

Note that an estimated effect of ten is the equivalent of a participant achieving one grade higher than a non-participant.

In some cases, the sample size was not large enough to fit a reliable model. Where this was the case, the relevant fields are greyed out and marked with 'NA' in the table below.

Table 16: Estimated effect of programme participation on A-Level grade, by dosage

Cohort	Dose	Lower CI	Estimate	Upper CI	Effect size	Months of progress	No. students
2020	Zero	NA	NA	NA	NA	NA	6
	Low	-4.41	6.25	16.58	0.40	5	48
	Mid	0.99	4.73	8.25	0.30	4	142
	High	-4.20	4.06	13.56	0.26	3	40
2021	Zero	NA	NA	NA	NA	NA	22
	Low	0.99	5.49	10.79	0.35	4	102
	Mid	-3.14	3.49	11.86	0.22	3	46
	High	0.95	6.02	11.90	0.39	5	96
2022	Zero	NA	NA	NA	NA	NA	6
	Low	-1.91	2.92	7.42	0.19	2	134
	Mid	-6.13	1.48	9.98	0.09	1	72
	High	-0.53	7.60	17.04	0.49	6	40

These results are mixed, and it is unclear whether higher dosage translated into a higher impact. For the 2020 cohort, the point estimate for the high dosage group is lower than for the other groups. For the 2021 and 2022 cohorts, however, the point estimate for the high dosage group is high than for the other groups.

However, for all three cohorts, the confidence intervals for some dosage groups are wide and overlap one another, making it impossible to be sure that there is any difference in impact between the groups.

Achieving A or above

Estimates of the impact of programme participation on the likelihood of a student achieving an A or above in A-Level maths are shown in the table below are shown in the tables below, with 95% confidence intervals (all to two decimal places).

We report the estimated effect on this outcome using odds ratios. These ratios tell us the relative odds of a student achieving an A or above, depending on whether their school took part in the programme or not. An odds ratio of one would mean that a programme participant had exactly the same odds of achieving the grade as a comparison student. An odds ratio above one means that a participant is more likely to achieve the grade, and an odds ratio of below one means that they are less likely.

In some cases, the sample size was not large enough to fit a reliable model. Where this was the case, the relevant fields are greyed out and marked with 'NA' in the table below.

Table 17: Estimated effect of participation on likelihood of achieving A or above

Cohort	Dose	Lower CI	Estimate	Upper CI	No. students
2020	Zero	NA	NA	NA	6
	Low	NA	NA	NA	48
	Mid	0.89	4.10	37.54	142
	High	NA	NA	NA	40
2021	Zero	NA	NA	NA	22
	Low	1.05	8.52	16973.57	102
	Mid	NA	NA	NA	46
	High	NA	NA	NA	96
2022	Zero	NA	NA	NA	6
	Low	0.55	2.09	8.36	134
	Mid	NA	NA	NA	72
	High	NA	NA	NA	40

Unfortunately, due to the relatively small sample sizes, we were unable to fit reliable models for the majority of subgroups for this outcome, so we are unable to draw any useful conclusions about differences in impact by dosage.

The table below shows the predicted probabilities of all of the students in our sample achieving an A or above in A-Level maths had they taken part in the programme, and if they had not. These probabilities may be easier to interpret than odds ratios.

Table 18: Predicted probabilities of participating students and matched comparison students achieving A or above

		Predicted probability		No. students	
Cohort	Dose	Treated	Comparison	Treated	Comparison
2020	Zero	NA	NA	3	3
	Low	NA	NA	24	24
	Mid	78%	63%	71	71
	High	NA	NA	20	20
2021	Zero	NA	NA	11	11
	Low	88%	67%	51	51
	Mid	NA	NA	23	23
	High	NA	NA	48	48
2022	Zero	NA	NA	3	3
	Low	64%	54%	67	67
	Mid	NA	NA	36	36
	High	NA	NA	20	20

Achieving A*

Estimates of the impact of programme participation on the likelihood of a student achieving an A* in A-Level maths are shown in the table below are shown in the tables below, with 95% confidence intervals (all to two decimal places).

We report the estimated effect on this outcome using odds ratios. These ratios tell us the relative odds of a student achieving an A or above, depending on whether their school took part in the programme or not. An odds ratio of one would mean that a programme participant had exactly the same odds of achieving the grade as a comparison student. An odds ratio above one means that a participant is more likely to achieve the grade, and an odds ratio of below one means that they are less likely.

In some cases, the sample size was not large enough to fit a reliable model. Where this was the case, the relevant fields are greyed out and marked with 'NA' in the table below.

Table 19: Estimated effect of participation on likelihood of achieving A*

Cohort	Dose	Lower CI	Estimate	Upper CI	No. students
2020	Zero	NA	NA	NA	NA
	Low	NA	NA	NA	NA
	Mid	1.21	5.26	56.92	142
	High	NA	NA	NA	NA
2021	Zero	NA	NA	NA	NA
	Low	0.75	4.27	57.90	102
	Mid	NA	NA	NA	NA
	High	NA	NA	NA	NA
2022	Zero	NA	NA	NA	NA
	Low	0.20	0.99	4.14	134
	Mid	NA	NA	NA	NA
	High	NA	NA	NA	NA

Again, due to the relatively small sample sizes, we were unable to fit reliable models for the majority of subgroups for this outcome, so we are unable to draw any useful conclusions about differences in impact by dosage.

The table below shows the predicted probabilities of all of the students in our sample achieving an A* in A-Level maths had they taken part in the programme, and if they had not. These probabilities may be easier to interpret than odds ratios.

Table 20: Predicted probabilities of participating students and matched comparison students achieving an A*

		Predicted probability		No. students	
Cohort	Dose	Treated	Comparison	Treated	Comparison
2020	Zero	NA	NA	3	3
	Low	NA	NA	24	24
	Mid	50%	32%	71	71
	High	NA	NA	20	20
2021	Zero	NA	NA	11	11
	Low	56%	37%	51	51
	Mid	NA	NA	23	23
	High	NA	NA	NA	NA
2022	Zero	NA	NA	3	3
	Low	235	26%	67	67
	Mid	NA	NA	36	36
	High	NA	NA	20	20

5. Conclusions

5.1 Overview

This report found evidence to show that participants who completed A-Levels in 2020 and 2021 achieved around half a grade higher than matched comparison students.

We also found evidence to show that participants who completed A-Levels in 2020 and 2021 were more likely to achieve a grade A or above. Our models predicted that, for the 2020 cohort, 81% would achieve this level, compared to 62% of comparison students. For the 2021 cohort, the predictions were similar: 83% of participants were predicted to achieve a grade A or above, compared to 66% of comparison students.

And finally, we found evidence to show that participants who completed A-Levels in 2020 and 2021 were more likely to achieve an A* grade than matched comparison students. Our models predicted that, for the 2020 cohort, 51% would receive an A*, compared to 33% of comparison students. For the 2021 cohort, 51% of participants were predicted to achieve a grade A or above, compared to 36% of comparison students.

However, for the cohort who completed A-Levels in 2022, we did not find any conclusive evidence of an impact on any of the outcomes. While the point estimates were positive, none of the estimates were statistically significant, meaning we cannot be confident that the programme had any impact on this cohort.

We did not find conclusive evidence to show that there was a difference in impact by level of engagement with the project. However, we were unable to fit reliable models for a significant number of the subgroups due to low sample sizes.

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. In particular, we are unable to match based on some of the programme's selection criteria: it targets students who are considering studying a maths-related degree at university, but we have no way of knowing if matched comparison students have similar ambitions.

The period covered by this evaluation includes the onset of the COVID-19 pandemic. The disruption caused to education in general, to programme delivery and to public examinations, which were cancelled in 2020 and 2021, may mean that this evaluation does not reflect the impact of the programme under less exceptional circumstances.

While participants who completed A-Levels in 2022 did receive their A-Level grades via public examinations, they would have taken their GCSEs in 2020, when public examinations were cancelled and grades were awarded via centre-assessed grades. This may have affected the matching and modelling process, in which we controlled for prior attainment at GCSE.

Due to relatively low sample sizes, we were unable to provide estimates of effect for some of the subgroups, particularly for subgroups by dosage. The low sample size also means that inconclusive results are more likely.

Achieving an A* in A-Level maths is a relatively rare event. This means that the minimum detectable effect sizes are smaller for a given sample size than for other outcomes, and means that inconclusive results are more likely.