Observatory for Mathematical Education

Evaluation of pupil attainment and progression in Maths Schools

October 2025

Evidence
Excellence
Equity

Abstract

University Maths Schools are specialist state-funded sixth-forms which focus on mathematics and related STEM subjects. They receive enhanced government funding to prepare high-attaining pupils for mathematical undergraduate programmes and careers whilst tackling disadvantage and under-representation of minority groups (such as female students and those with low socio-economic status) within the mathematics community. The aim of this report is to evaluate whether student outcomes at Maths Schools are significantly higher than in non-specialist sixth-forms. This evaluation uses a quasi-experimental design to evaluate the outcomes of Maths School pupils compared to a matched control group of pupils such that both groups have equivalent demographic backgrounds and education history up to age 16. This approach is intended to control for many confounding effects which may also influence pupil outcomes such that the main source of variation after pairing is the type of sixth-form attended. The main outcomes considered in this report are A level performance, undergraduate degree subject, and enrolment at different types of university.

Key findings

- Maths School pupils are more diverse, in terms of sex and socio-economic status, than pupils studying A level Further Mathematics in other settings.
- Maths School pupils are significantly more likely to achieve an A* in A level Mathematics compared to similar pupils in other settings. The 'value added' by Maths Schools is even greater for A level Further Mathematics.
- Maths Schools help to keep more of their pupils in the mathematics 'pipeline' for longer, with significantly more pupils progressing to mathematical sciences degrees and mathematically intensive STEM degrees than their counterparts in the matched control group.
- The uplift in A level mathematics grades is highest for under-represented ethnicities (0.76 grades), those with low socio-economic status (0.6 grades) and female pupils (0.36 grades). These three groups also progress to mathematically intensive STEM degrees at a higher rate from Maths Schools than equivalent pupils in other settings.
- The proportion of Maths School pupils who enrol at Oxbridge is almost twice the national average for A level Further Mathematics pupils, and significantly higher than the matched control group for enrolling at the 10 universities with the highest STEM entry tariff.
- For pupils with lower socio-economic status, there is no significant difference in the progression rate to Oxbridge from Maths Schools compared to non-specialist sixth-forms.
- Establishing the longer-term impact of Maths Schools, in terms of graduate outcomes and career earnings, is not possible until further cohorts of students have finished their education.

Introduction

University Maths Schools are specialist state-funded sixth-forms which focus on mathematics and related STEM subjects. They have a mandate to widen participation in the mathematical sciences through working with students from under-represented backgrounds. To achieve this, Maths Schools run outreach programmes and events for pupils in primary and secondary schools, as well as recruiting students from diverse backgrounds to their 16-19 schools.

Each Maths School is founded by, and is partnered with, a university mathematics department. These collaborations aim to provide students with extra-curricular enrichment opportunities and support progression to mathematically intensive degrees. Maths Schools are also supported by the University Maths Schools Network (U-Maths), the umbrella body which represents Maths Schools to external stakeholders and promotes knowledge sharing between the schools. The ambition is to have at least one Maths School in each English region (Table 1).

School	Year opened	Capacity
Exeter Mathematics School	2014	64
King's College London Mathematics School	2014	70
University of Liverpool Maths School	2020	80
Lancaster University School of Mathematics	2022	130
Cambridge Maths School	2023	100
Imperial College London Mathematics School	2023	80
Leeds Mathematics School	2023	120
Surrey Maths School	2024	100
Aston University Mathematics School	2025	75

Table 1 The opening dates and capacities (planned or actual) of University Maths Schools.

University Maths Schools were introduced under the coalition Conservative-Liberal Democrat government of 2010-2015. They each receive an additional £350,000 per year from the Department of Education on top of their post-16 funding allocation. This extra funding is to:

1. Provide a greater focus on wider mathematical problem solving to help prepare students for university mathematics degrees.
2. Create a learning community to support top-performing mathematics students.
3. Tackle disadvantage and under-representation through outreach and influencing mathematics teaching in pre- and post-16 settings.

Two further Maths Schools in Nottingham and Durham are planned to open in future but the provision of free schools is being reviewed by the current Labour government. It is therefore of interest to establish if Maths Schools are fulfilling their intended function.

Figure 1 shows there has been a modest increase in the number of students studying A level Further Mathematics in England since the first Maths Schools were opened. The number of A level Further Mathematics entries for the 2020 GCSE cohort is 5% higher than for the 2014 GCSE cohort[1]. Over the same time period, the proportion of those students studying at Maths Schools has increased by over 50%, and this proportion will increase further due to the five Maths Schools that opened between 2022 and 2024. Even with this expansion, however, Maths Schools will continue to be a relatively small provider of A level Further

Mathematics entries in England. For the GCSE cohort of 2021, around 1.5% of A level Further Mathematics pupils studied at Maths Schools.

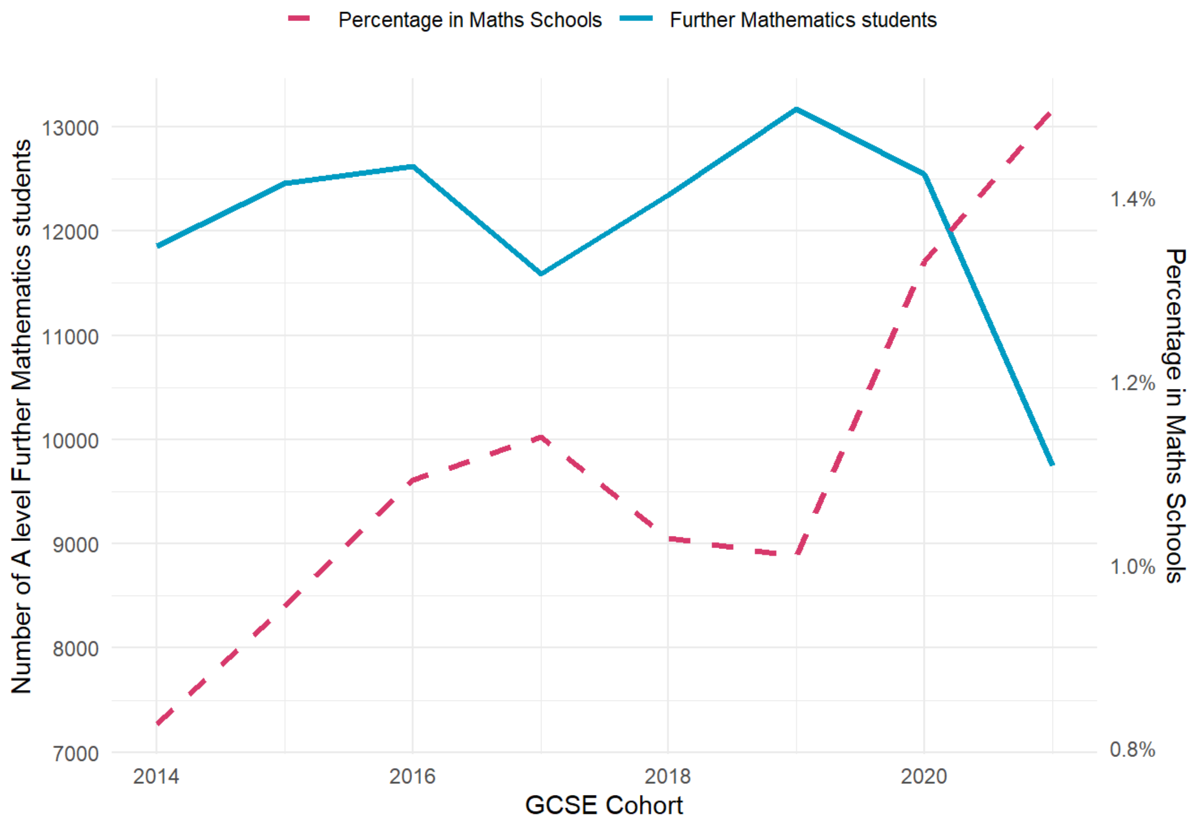

Figure 1 The number of students in the National Pupil Database taking A level Further Mathematics per GCSE cohort and the percentage of those pupils in Maths Schools. Note: Some students from the 2021 GCSE cohort will not have completed A level Further Mathematics at the time of data collection, with the final number expected to be similar to the 2020 cohort.

The aim of this report is to evaluate whether student outcomes at Maths Schools are significantly higher than in non-specialist sixth-forms. Student outcomes will be measured in terms of achieved A level grades and progression to university courses. To achieve a fair comparison the analysis will need to account for the selective entry requirements of Maths Schools.

This report makes use of the National Pupil Database from the Department for Education and data on university participation and attainment supplied by the Higher Education Statistics Agency. This work was undertaken in the Office for National Statistics (ONS) Secure Research Service using data from ONS, and other data owners, and does not imply the endorsement of the ONS or other data owners.

Methodology

Quasi-experimental design

Analysis of the National Pupil Database shows there were 1070 pupils awarded A level grades following attendance at Maths Schools between 2016 and 2023 inclusive. Of these, 970 have complete or near-complete records and are included in the analysis. The majority of pupils excluded from the analysis attended independent schools at Key Stage 4 and therefore their GCSE records and demographic data are absent.

This evaluation uses a quasi-experimental design to evaluate the outcomes of Maths School pupils compared to a matched control group. In the analysis, each Maths School pupil is paired with a control pupil who did not attend a Maths School but has similar demographics and educational background up to the point of A level enrolment. This approach is intended to control for confounding effects which may also influence pupil outcomes such that the main source of variation after pairing is the type of sixth-form attended. School-level characteristics are controlled for by restricting control group pupils to those who attend Key Stage 5 institutions where more than 60% of pupils use English as their first language (more than 77% of Maths School pupils in the analysis use English as a first language) and fewer than 15% of pupils are eligible for free school meals (fewer than 11% of Maths School pupils in the analysis are FSM eligible).

The pairing of pupils is performed using coarsened exact matching. The variables used to perform the pairing are shown in Table 2. Prior attainment is known to be the strongest predictor of A level outcomes so an exact match on GCSE Mathematics grade is prioritised, with GCSE English grade also used as a measure for non-mathematical attainment. An exact match is also sought for participation in A level Mathematics and A level Further Mathematics to control for mathematical motivation and to ensure that A level outcomes are comparable across both Maths School pupils and the control group. Matching also takes account of demographic variables including binary indicators, such as Sex, Special Education Needs (SEN) and Free School Meals (FSM) status, and categorical variables Ethnicity, Income Deprivation Affecting Children Index (IDACI) quintile and English region (using the nine Government office regions).

Variable	Step 1	Step 2	Step 3
Sex	Exact	Exact	Exact
Ethnicity	Exact	Coarsened	Coarsened
SEN status	Exact	Exact	Exact
FSM status	Exact	Exact	Exact
IDACI quintile	Exact	Coarsened	Coarsened
Region	Exact	Exact	Exact
GCSE year	Exact	Exact	Coarsened
GCSE Mathematics grade	Exact	Exact	Exact
GCSE English grade	Exact	Coarsened	Coarsened
A level Mathematics enrolment	Exact	Exact	Exact
A level Further Mathematics enrolment	Exact	Exact	Exact

Table 2 The variables used in the matching process to create a control group.

At the initial step, exact matches are found on all variables for 70% of Maths School pupils. For the remaining minority of pupils, levels within the categorical variables ethnicity, IDACI quintile and GCSE English grade were merged to produce ‘coarsened’ categories. For example, IDACI scores were divided into 3 groups (low/middle/high) rather than quintiles. This minor relaxation of the pairing criteria enabled matching for a further 20% of Maths School pupils. In both the first two steps, only matches in the same GCSE cohort as the corresponding Maths School pupil are permitted to control for temporal effects, such as the use of centre-assessed grades and teacher-assessed grades during the Covid-19 pandemic. Relaxing this assumption, where necessary, to permit matches to pupils in cohorts immediately before or after enabled a matching for a further 3% of Maths School pupils. In total 905 Maths School pupils are paired with at least one control group pupil, with only 7% unmatched. To check the validity of using ‘coarsened’ matching for 23% of pupils, the analysis was repeated using only the 70% of pupils with ‘exact’ matching in Step 1. It was determined that the results from ‘exact’ and ‘coarsened’ matching were not notably different and the results from all pupils matched via Steps 1 to 3 are presented. Similarly, the effect of the pandemic was investigated by only considering A level results awarded prior to 2020 but there were no notable differences in the results and the analysis from all years is presented.

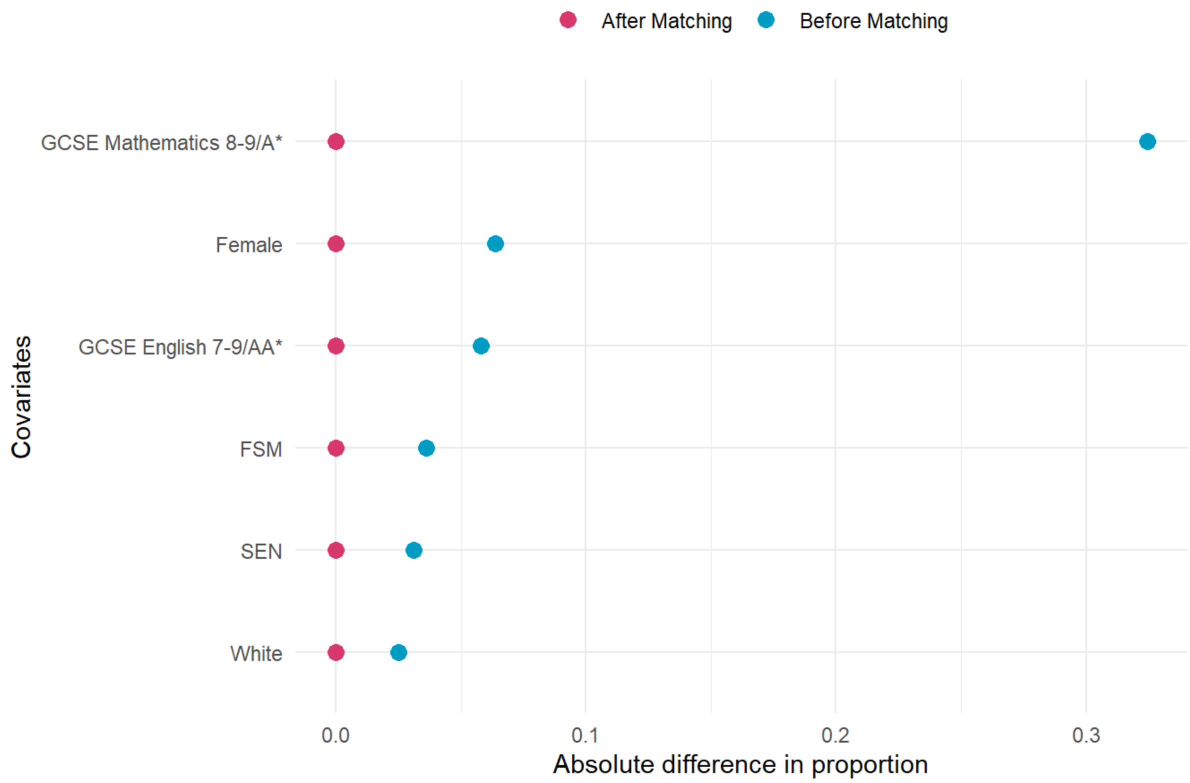

Figure 2 The absolute difference in proportion between Maths School pupils and the control group pre- and post-matching for six different covariates.

Figure 2 shows that the matching procedure is successful in eliminating differences between Maths School pupils and the control group. For example, prior to matching 6.7% of Maths School pupils in the data are eligible for free school meals compared to the potential control group where 3.1% of pupils are eligible. This gives a pre-matching difference of 3.6 percentage points. Post-matching, because an exact match is required for FSM status, the proportion of Maths School pupils which are FSM-eligible is identical to the proportion in the paired control group. While this exact match is desirable to satisfy the quasi-experimental design, it means around half of FSM-eligible Maths School pupils in the data are unmatched.

Nevertheless, balancing the FSM status of Maths School and control group pupils in the analysis means one source of variability is controlled for as much as possible.

Statistical inference

The outcomes for Maths School pupils are compared against the performance of a control group created from the matching process (see above). Statistical significance of observed differences is assessed using a bootstrap procedure. The bootstrap procedure accounts for both the natural variation in the uncertainty of outcome measure estimates but also the uncertainty in the matching process. On each bootstrap iteration the matching process is conducted for each Maths School pupil, with a match selected at random if there is more than one potential candidate. The pairs consisting of Maths School and control pupils are then sampled with replacement to create a resampled list with the same number of pupils as the original. The outcome measure for both groups (Maths School and control group) is then calculated. The bootstrap process is repeated for 1000 iterations, with the point estimate being the mean of the 1000 control group estimates and 90% confidence intervals being constructed from the 5th and 95th percentiles. Each outcome measure is quoted for all pupils and, where the sample size is large enough, for sub-groups such as male and female pupils. For ethnicity, the sample size is not sufficient to report results for each group, so ethnicities which are typically over-represented in post-16 mathematics (White and Chinese) are compared to under-represented ethnicities (e.g. Black, Mixed and other Asian).

The outcomes considered for analysis are:

- A level Mathematics grade
- A level Further Mathematics grade
- UCAS points
- Starting a mathematical sciences degree
- Starting a mathematically intensive STEM degree
- Starting a STEM degree
- Enrolling at Oxbridge
- Enrolling at a top-tariff STEM university
- Enrolling at a Russell Group university
- Obtaining a first-class degree

UCAS points are based on the best three A levels including Mathematics and Further Mathematics, and calculated using the points score of 56 for grade A*, 48 for grade A, etc. For degree subject, university courses are classified (see Table 3) as mathematical sciences, mathematically intensive STEM, or STEM based on their coding under HESA’s common aggregation hierarchy (CAH). Mathematical sciences degrees are programmes with at least 50% coded as CAH09 which includes single-honours programmes such as BSc Mathematics and joint-honours programmes such as BSc Mathematics and Physics. ‘Mathematically intensive STEM’ degrees are programmes with at least 50% coded as CAH07, CAH09, CAH10, CAH11 and CAH15-02. These degrees typically contain advanced mathematical content and usually require or highly recommend A level Mathematics in the entry requirements. The broader definition of STEM degree are programmes coded CAH01 to CAH13. Note that the coding of degree subjects changed from the Joint Academic Coding System (JACS) to the Higher Education Classification of Subjects (HECoS) in 2020. The CAH allows for comparison over time between the two systems although a few degree courses may shift categorisation at the transition.

Degree type	CAH codes	Example degree subjects
Mathematical sciences	CAH09 (mathematical sciences)	Mathematics Mathematics and Physics
Mathematically intensive STEM	CAH07 (physical sciences) CAH09 (mathematical sciences) CAH10 (engineering and technology) CAH11 (computing) CAH15-02 (economics)	Physics Statistics Mechanical Engineering Computer Science Economics
STEM	CAH01 to CAH13	Medicine Biology Psychology Architecture

Table 3 Classification of degree courses based on HESA's common aggregation hierarchy (CAH).

University enrolment is also considered in terms of the type of institution attended. Traditional groupings such as Oxbridge (Oxford and Cambridge) and Russell Group are considered. However, a bespoke grouping based on entry criteria is also considered with 'top-tariff STEM' universities defined as the 10 universities where the average UCAS points, based on best three A levels of first year STEM students, is 152 points or higher (equivalent to A*AA or higher).

Composition of Maths Schools

Table 4 shows the number of Maths School pupils per GCSE cohort over time, together with the number progressing to university. Note that from 2014 to 2019 inclusive only Exeter and King's Maths Schools were open, with Liverpool Maths School accepting its first cohort in 2020. With data available up to summer 2023, Maths School pupils in later cohorts have not had sufficient time to finish their education journey[2]. In the analysis pupils are given a minimum of two years following A levels to enrol on a degree programme, and a minimum of five years following A levels to achieve a degree classification, before they are deemed to have not started or completed, respectively.

GCSE cohort	Completed A level	Undergraduate enrolment	Awarded undergraduate degree
2014	100	90	85
2015	120	115	105
2016	140	130	115
2017	130	130	90
2018	125	120	35
2019	135	125	-
2020	165	130	-
2021	145	-	-
Total	1060	840	430

Table 4 The number of students per cohort who have reached each education stage. (Note that not all students in the 2018 GCSE cohort will have completed their undergraduate degree by the time of data collection.)

Figure 3 shows the demographic composition and prior attainment of Maths School pupils over time compared to the national proportions out of all pupils studying A level Further Mathematics and all pupils studying A level Mathematics. In every year to date the gender balance within Maths Schools is less biased than the national A level Further Mathematics cohort. Nationally the proportion of A level pupils in Mathematics and Further Mathematics recorded as White ethnicity fell every year, but Maths Schools have not followed this trend. It should be noted, however, that the recruitment pool for King's College London Mathematics School in central London and Exeter Mathematics School in south-west England are different and may not match the ethnic diversity of England overall. The proportion of students of low socio-economic status (defined as the 3 most deprived IDACI deciles) in Maths Schools is consistently above the proportion for A level Further Mathematics students in England and is on par with the national proportion for A level Mathematics. Meanwhile the proportion of Maths School pupils with very high GCSE English grades is above the national proportion for both A level Mathematics and Further Mathematics. With Maths Schools free to determine their admissions criteria, the composition of Maths School pupils in Figure 3 suggests that their selection policies are effective in recruiting a more diverse and more academically able cohort compared to the population of all A level Further Mathematics students in England.

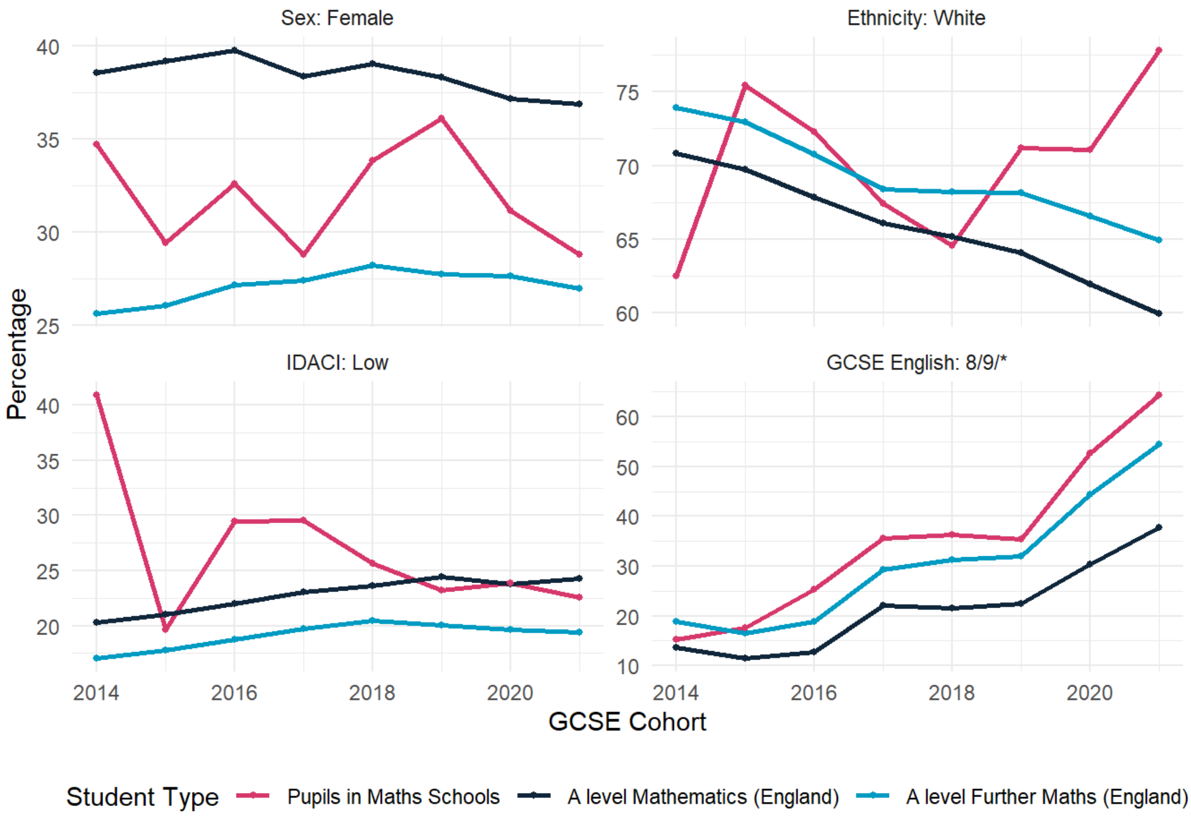

Figure 3 The proportion of students who are (a) female, (b) White, (c) have low socio-economic status, or (d) have high GCSE English grades (A* up to 2016, grade 9 or 8 from 2017) in Maths Schools compared to A level Mathematics and A level Further Mathematics pupils in England.

Results

The sections below compare the performance of Maths School pupils with their matched control group for each outcome. The percentage of Maths School pupils and the percentage of control group pupils are plotted alongside the percentages for all A level Mathematics pupils and all A level Further Mathematics pupils in England to give a national benchmark. The 90% confidence intervals for Maths Schools and the control group are based on 1000 iterations of the bootstrap resampling. When comparing the differences, we record the average difference between Maths School pupils and their paired control group pupils, with 90% confidence intervals based on the bootstrap resampling.

A level attainment

A level Mathematics

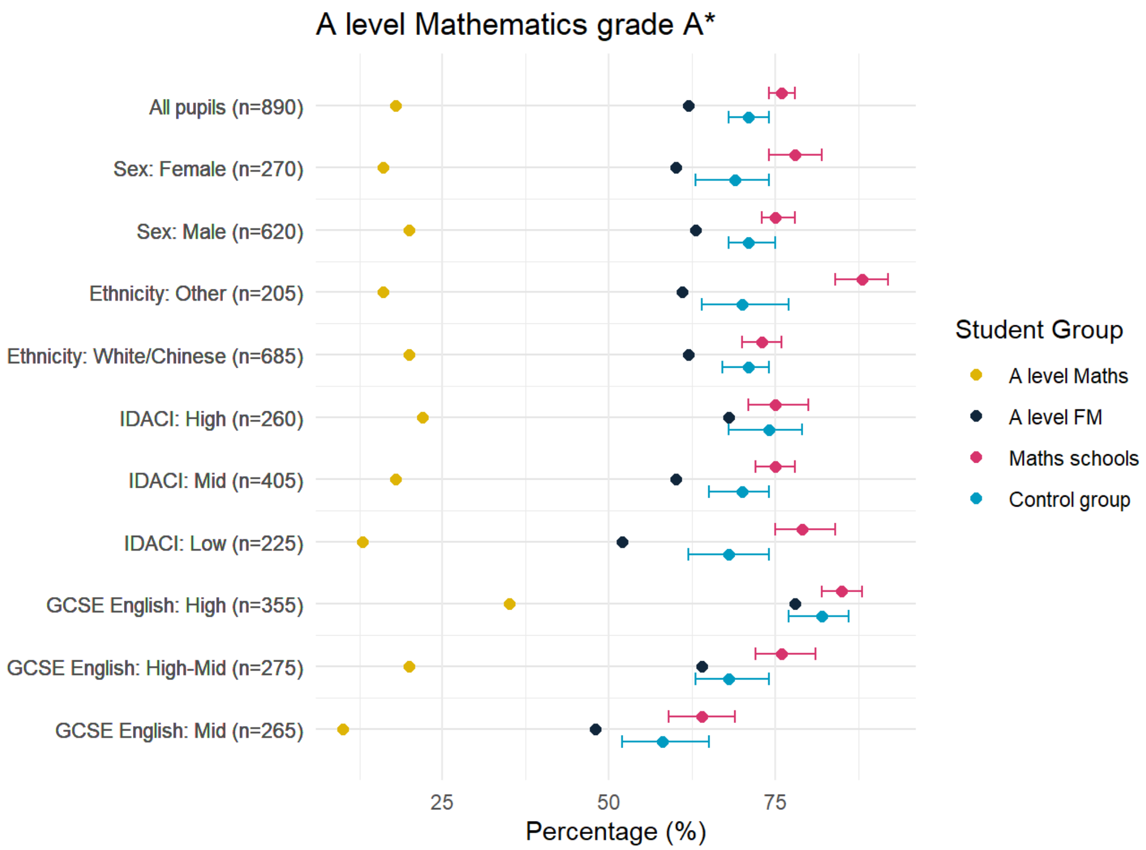

Figure 4 The proportion of students achieving grade A* in A level Mathematics for all A level Mathematics students in England, those studying A level Further Mathematics in England, Maths School pupils and the control group. The reported sample sizes are the number of Maths School (and their paired control group) pupils in each demographic group.

Over all the years included in this study, just under 20% of all pupils in England who attempted A level Mathematics were awarded an A* grade. Figure 4 shows this percentage was higher for male students (compared to females) and White/Chinese students (compared to under-represented ethnicities). Socio-economic status is also a determining factor in A level outcomes, with those from the 30% least deprived council wards[3] (IDACI: high) notably outperforming those from the 30% most deprived council wards (IDACI: low), as is GCSE English grade[4]. These differences are largely repeated when just considering pupils who also take A level Further Mathematics, although the proportion of students achieving a grade A* in A level Mathematics is much higher, over 60%, for this sub-group. This is to be expected given those taking both A level Mathematics and Further Mathematics are likely to have better GCSE performance and be more mathematically motivated than their single-mathematics counterparts.

Figure 4 shows that the proportion of Maths School pupils achieving a grade A* in A level Mathematics is 6 percentage points higher than those control group pupils taking A level Mathematics and Further Mathematics in other settings. The performance of Maths School pupils is significantly higher than the matched control group suggesting that Maths Schools are adding value compared to pupils with equivalent GCSE performance and demographic backgrounds in other schools and colleges. In the demographic breakdown, the largest differences between Maths Schools and the control group are observed for female students, under-represented ethnicities and low socio-economic status students. Overall, Maths Schools are successful in reversing the gender, ethnicity and socio-economic gaps observed among the national cohort with female, under-represented ethnicities and low socio-economic status pupils at Maths Schools outperforming their respective counterparts in A level Mathematics. GCSE English, however, continues to be a determining factor for both Maths School pupils and the control group.

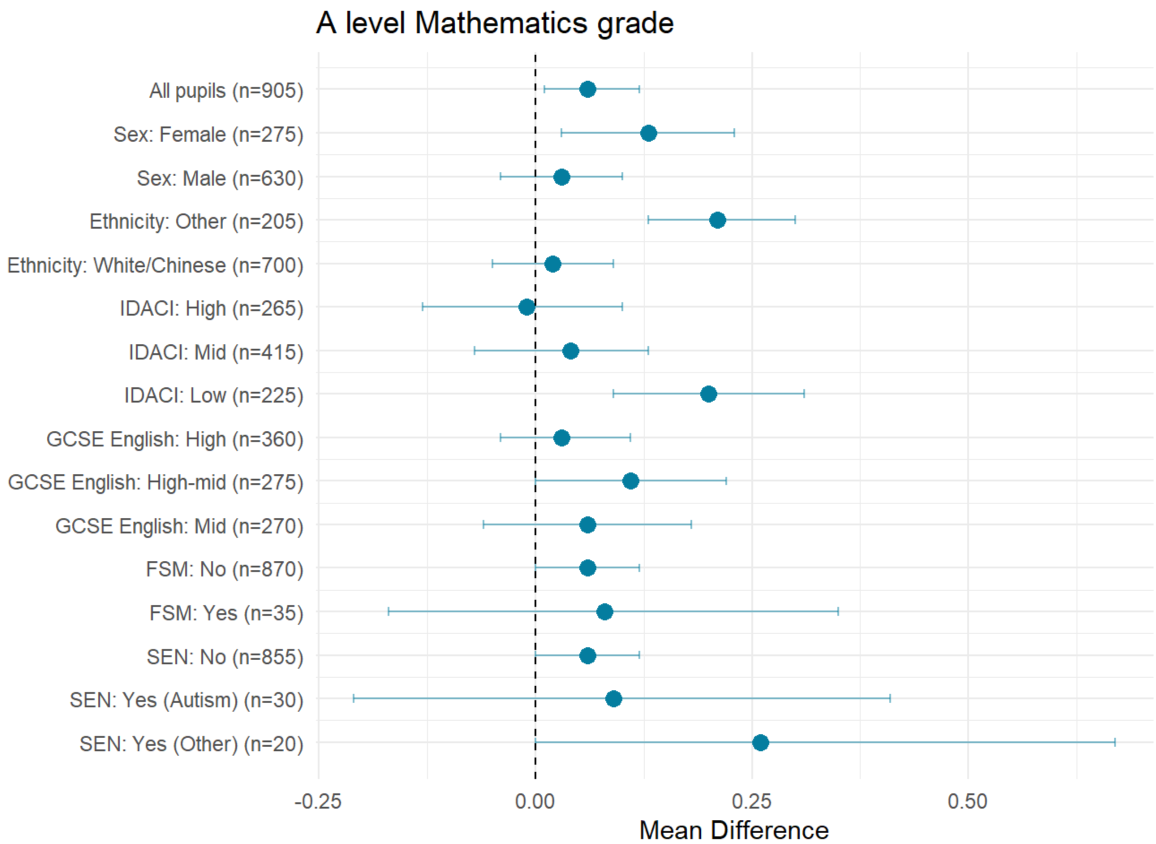

Figure 5 The mean difference in A level Mathematics grade between Maths School pupils and their control group counterparts. The reported sample sizes are the number of Maths School (and their paired control group) pupils in each demographic group.

Figure 5 shows the mean difference in A level Mathematics grade between each Maths School pupil and their control group counterpart. Given the matching process controlled for prior academic ability and other demographic factors, it can be concluded that pupils at Maths Schools make significantly more progress than equivalent pupils in other settings. However, this gain is not uniform across the demographic groups, with under-represented ethnicities, those of lower socio-economic status, and pupils with some forms of SEN making the greatest gain of more than 0.2 grades on average. Female pupils also make significantly more progress at Maths Schools, on average, than other settings.

A level Further Mathematics

Nationally, over 30% of pupils who take A level Further Mathematics achieve a grade A*. As with A level Mathematics, the percentage of pupils in England achieving the highest grade is higher for male students, those of higher socio-economic status, and those with high GCSE English grades, compared to female students, those of lower socio-economic status and those with lower GCSE English grades, respectively. There is only a very small awarding gap between White/Chinese students and under-represented ethnicities.

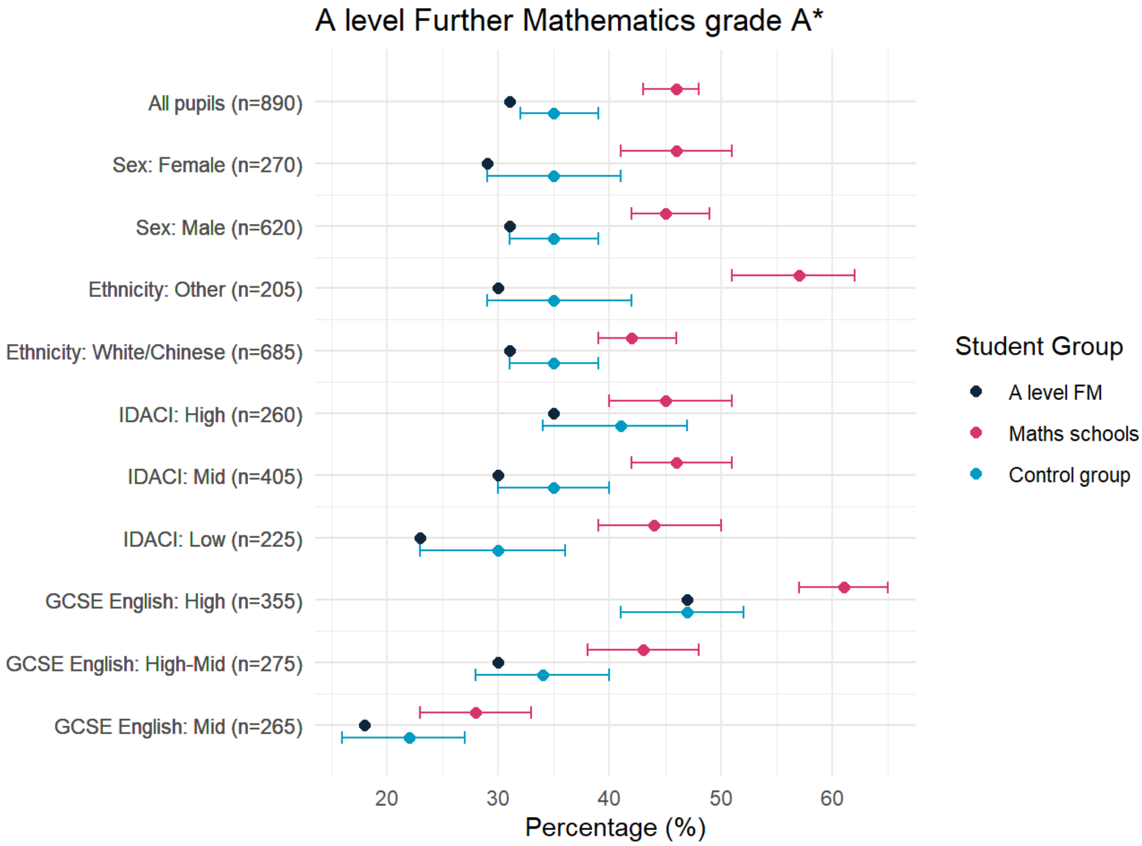

Figure 6 The proportion of students achieving grade A* in A level Further Mathematics for all A level Further Mathematics students in England, Maths School pupils and the control group.

Overall, Maths School pupils are 11 percentage points more likely to achieve a grade A* compared to A level Further Mathematics pupils in other contexts. Figure 6 shows that this pattern is repeated, to a greater or lesser extent, for all demographic sub-groups considered. The performance of control group pupils, who have equivalent education history and demographic background as Maths School pupils, is slightly above the national average suggesting that the type of pupils who might be recruited to Maths Schools typically achieve above average. However, the students who attend Maths Schools outperform the control group pupils suggesting that Maths Schools add value beyond the effect of their recruitment policies. This is particularly notable for female pupils, under-represented ethnicities and those of lower socio-economic status. Although Maths Schools do not reverse the national gender and socio-economic status gaps (as was seen for A level Mathematics), they do remove these gaps with students equally likely to achieve A* in A level Further Mathematics irrespective of sex or IDACI measure. As was seen for A level Mathematics, GCSE English continues to be a determining factor, although pupils perform better in Maths Schools than the control group for all GCSE English grades considered.

Figure 7 shows that Maths School pupils make greater gains in A level Further Mathematics than their control group partners. On average, this gain is around 0.2 grades across all pupils, a greater gain than was observed for A level Mathematics (see previous section). As with A level Mathematics the greatest gains are made by those of lower socio-economic status (0.4 grades), under-represented ethnicities (>0.5 grades) and pupils with some form of SEN (>0.7 grades), although the latter result is not statistically significant because of the small sample size. The difference is positive for all demographic groups, although not all differences reach the threshold for statistical significance.

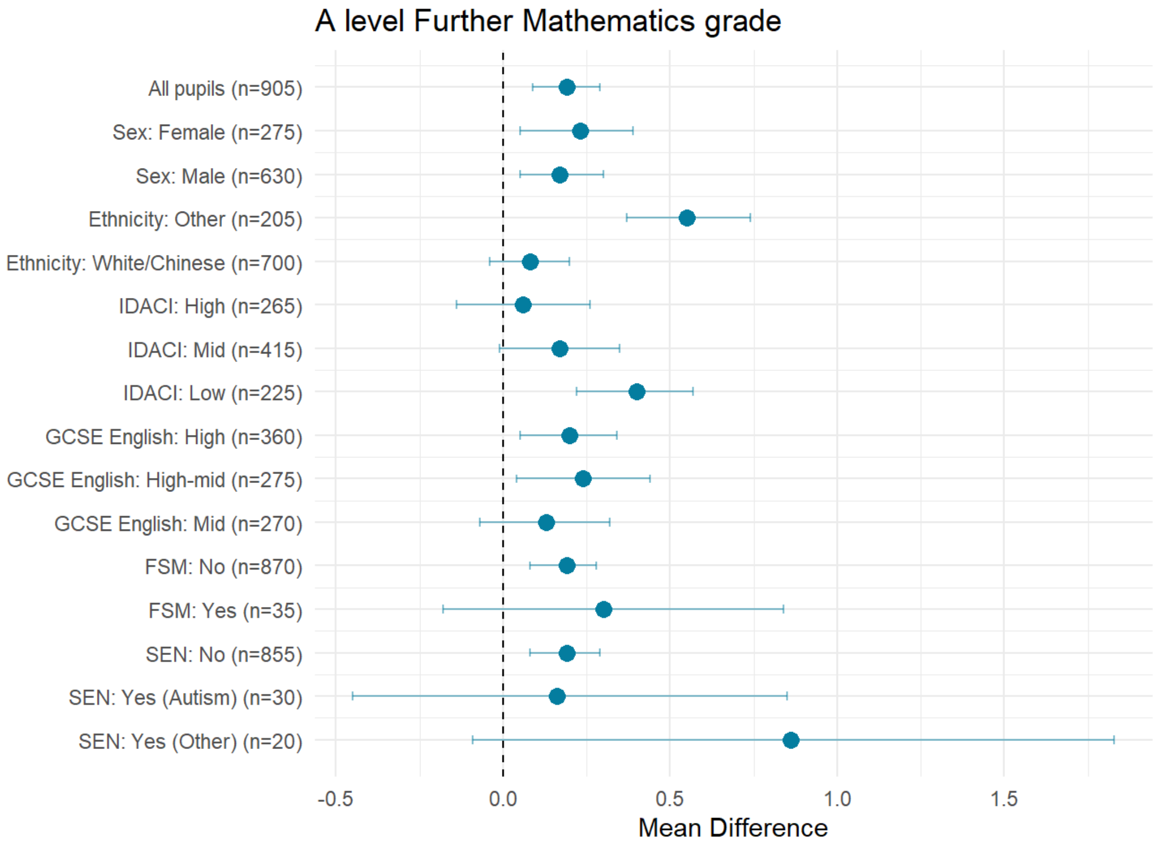

Figure 7 The mean difference in A level Further Mathematics grade between Maths School pupils and their control group counterparts.

UCAS points

Figure 8 considers the UCAS points achieved from 3 A levels for each pupil. This gives a measure of overall A level outcome extending beyond just Mathematics and Further Mathematics to include their best 3rd subject. On average, pupils at Maths Schools achieve marginally more UCAS points than their control group counterparts, although this gain is not statistically significant. Most of this gain corresponds to the gain in A level Mathematics and Further Mathematics grades observed above suggesting that the 3rd A level grade is broadly similar between Maths School pupils and other pupils. Note, however, that the choice of 3rd A level is very limited in Maths Schools (typically physics or computer science) whereas pupils in other contexts have more freedom and the grade distribution between subjects may vary. Furthermore, students in other contexts may have more freedom to pick four A levels so their ‘best 3rd’ grade will be the better of their two non-maths A levels. The higher A level Mathematics and Further Mathematics grades obtained by under-represented ethnicities and those from lower socio-economic backgrounds (see previous sections) is also reflected in their total UCAS points with them gaining up to 6 UCAS points on average (three-quarters of an A level grade) compared to their counterparts in the control group.

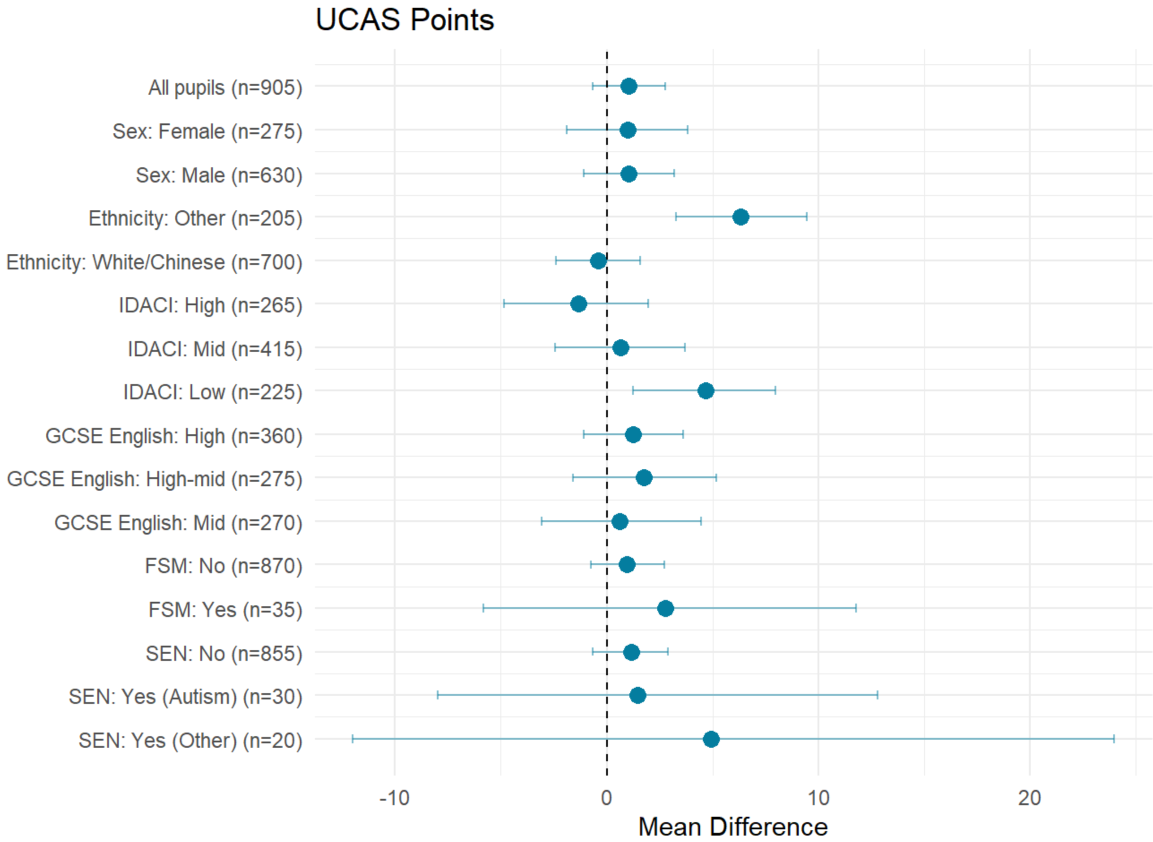

Figure 8 The mean difference in UCAS points between Maths School pupils and their control group counterparts. (UCAS points are calculated over their best 3 A levels including Mathematics and Further Mathematics, 8 points is the equivalent of one A level grade.)

Degree subject choice

Mathematical sciences degrees

Around 9% of A level Mathematics pupils in England progress to a mathematical sciences degree at university, rising to 35% for those also studying A level Further Mathematics. Figure 9 shows the progression to mathematical sciences degrees is higher for male pupils compared to female pupils for those studying A level Mathematics but, curiously, the pattern is reversed when considering those studying A level Further Mathematics as well. Nationally, progression to mathematical sciences degrees is higher for White/Chinese ethnicities compared to under-represented ethnicities. There is little variation by socio-economic status – the Observatory’s pipeline report[5] shows pupils with lower socio-economic status that achieve high A level grades are more likely to progress to mathematical sciences degrees than wealthier counterparts, but this effect is negated by them being less likely to achieve high A level grades (see previous section).

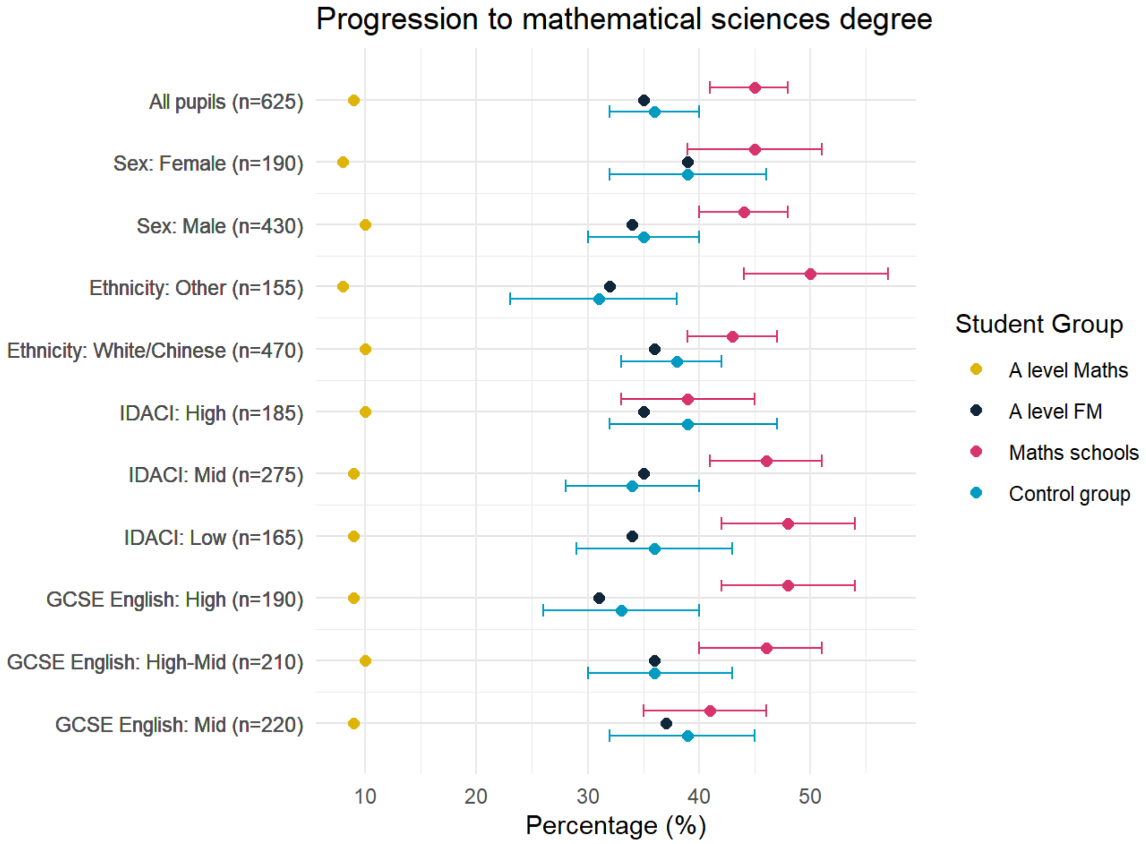

Figure 9 The proportion of students who progress to a mathematical sciences degree for all A level Mathematics students in England, those studying A level Further Mathematics in England, Maths School pupils and the control group.

Maths School pupils are more likely to progress to mathematical sciences degrees than the control group pupils. This may partly be explained by Maths School pupils having higher A level Further Mathematics grades (see previous section) so being more likely to satisfy entry requirements for mathematical sciences degree programmes. The enrichment programmes offered by Maths Schools, or being part of a mathematical community, or choosing to attend a Maths School with the intention of progressing to mathematical sciences degrees are other possible explanations. Figure 9 shows that the positive difference between Maths School pupils and the control group are most evident for under-represented ethnicities and pupils of lower socio-economic status, both of which are target groups for widening participation in mathematical sciences degrees. Maths Schools are also seen to reverse the trend with respect to GCSE English grades. Nationally, A level Further Mathematics pupils are more likely to progress to mathematical sciences degrees if they have lower GCSE English grades, perhaps because those with higher all-round academic ability have more undergraduate degree options to choose from. However, those with high GCSE English grades in a Maths School environment are more likely to stay within the mathematical sciences pipeline. Maths Schools add least value, in terms of progression to mathematical sciences degrees, to those of higher socio-economic status and those with lower GCSE English grades, and these are also the groups, identified in the previous section, where there is less uplift in A level Further Mathematics grade.

Figure 10 considers the net proportion of Maths School and control group matched pairs where the former progresses to a mathematical sciences degree but the latter does not. The percentage of pairs where the Maths School pupil progresses while their counterpart in a different setting does not is around 9 percentage points higher than the reverse scenario where the control group pupil progresses but the Maths School counterpart does not. This net increase rises to just under 20 percentage points for under-represented ethnicities. There is no net increase for Maths School pupils from the most affluent 30% of council wards (as measured by IDACI) but there is evidence of an increase for pupils from less affluent areas. Large increases are also observed for those with free school meals and those with special educational needs, but the sample sizes are too small to be statistically significant. Overall, there is clear evidence that Maths Schools keep more pupils within the mathematical sciences pipeline than equivalent pupils studying A level Mathematics and Further Mathematics in other settings.

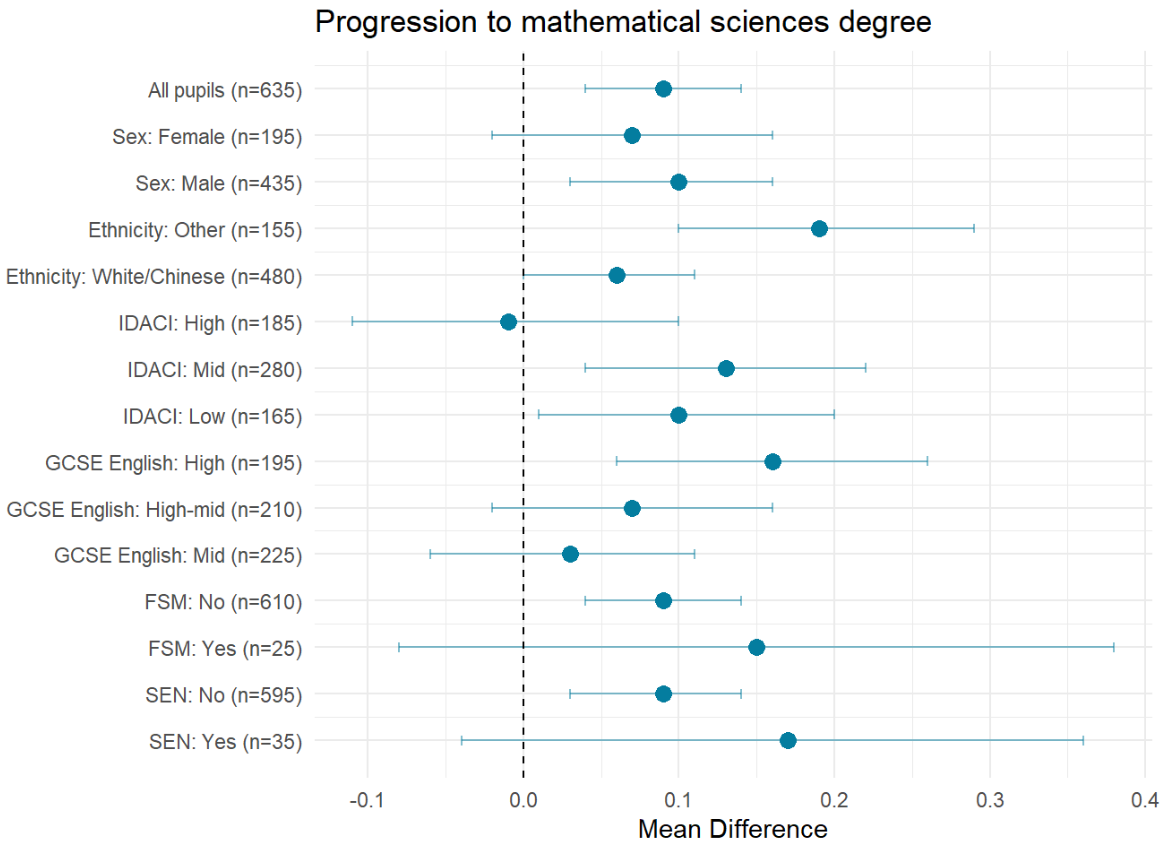

Figure 10 The mean difference between Maths School pupils and their control group counterparts for progression to a mathematical sciences degree (where 1 means they progressed and 0 means they did not).

Mathematically intensive STEM degrees

Figure 11 shows that the majority of A level Mathematics pupils in England do not progress to study a degree in mathematics or even a subject aligned to mathematics such as physics or computer science. This is particularly true for female pupils, where three-quarters of pupils do not make strong use of their mathematical knowledge and ability in their undergraduate study. Those who also study A level Further Mathematics are about twice as likely to study mathematically intensive STEM degrees as their single-mathematics counterparts and this pattern holds for many of the demographic groups considered.

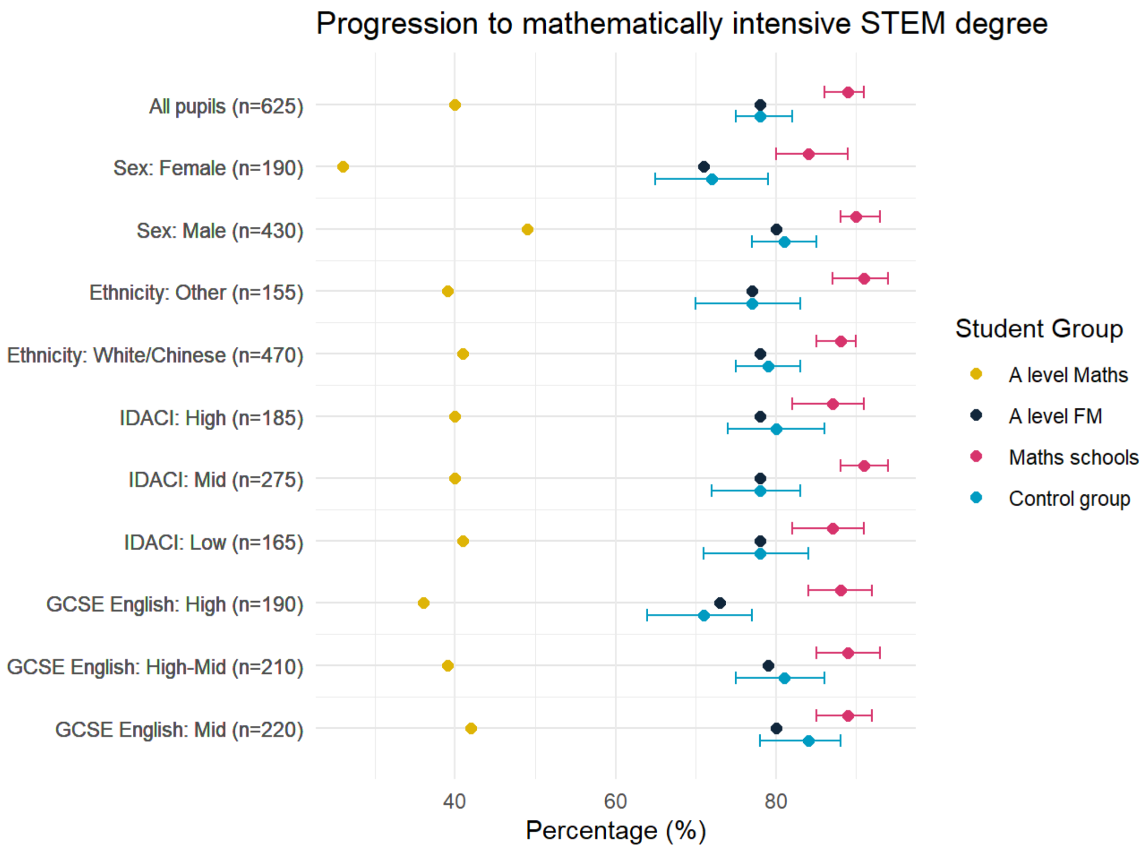

Figure 11 The proportion of students who progress to a mathematically intensive STEM degree for all A level Mathematics students in England, those studying A level Further Mathematics in England, Maths School pupils and the control group.

As seen for mathematical sciences degrees, the progression to mathematically intensive STEM degrees is higher for Maths School pupils than their control group counterparts. The difference is greatest for under-represented ethnicities and those with moderate socio-economic status, where the proportion of Maths School pupils progressing to mathematical intensive STEM degrees is around 90%.

Figure 12 also shows this higher progression rate for Maths School pupils by considering the net proportion of Maths School and control group pairs where the former progresses but the latter does not. Overall, the net increase for mathematically intensive STEM degrees is around 11 percentage points which is higher than the 9 percentage points for mathematical sciences degrees in the previous section. Particularly large increases are observed for female pupils (14 percentage points) and under-represented ethnicities (13 percentage points) with nearly all other demographic groups being statistically significant. The largest increase is observed for pupils with special educational needs where the percentage of pairs where the Maths School pupil progresses but their control group counterpart does not is 19 percentage points higher than would be expected if Maths Schools made no difference.

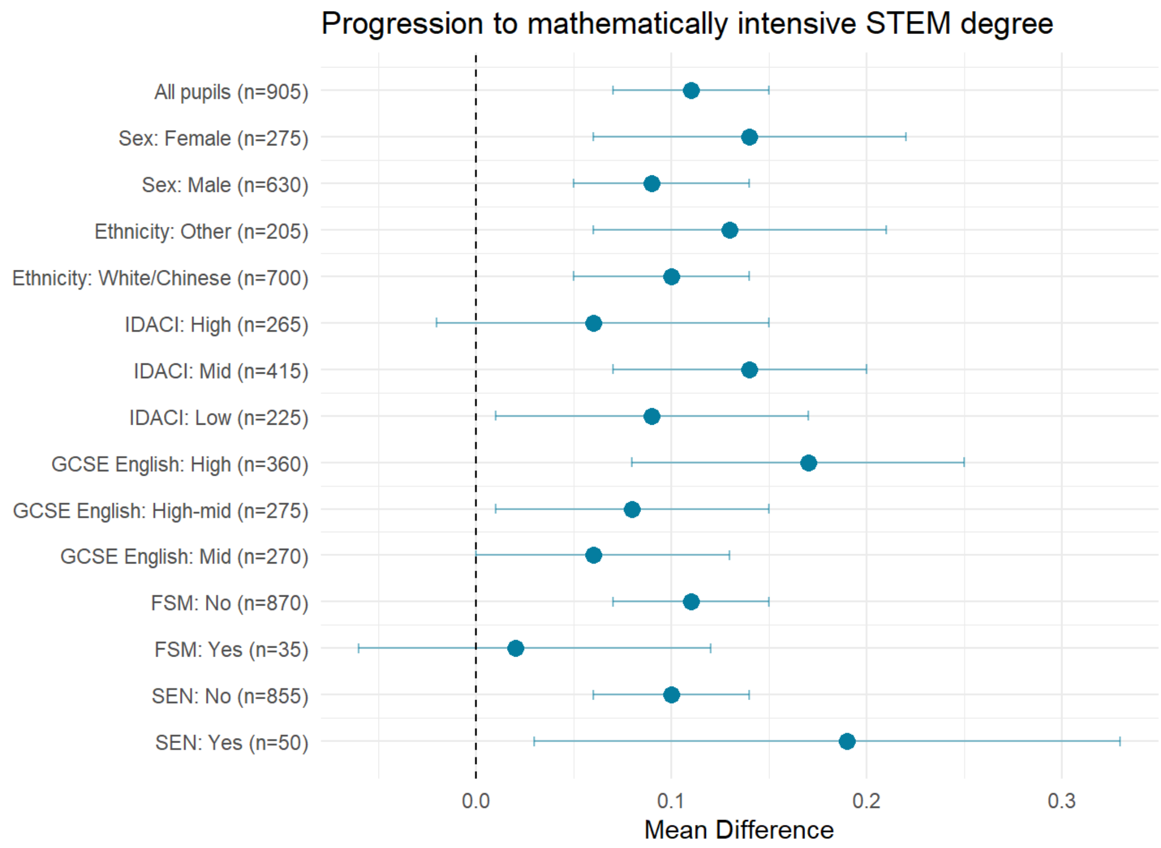

Figure 12 The mean difference between Maths School pupils and their control group counterparts for progression to a mathematically intensive STEM degree (where 1 means they progressed and 0 means they did not).

STEM degrees

Figure 13 shows that 5 out of every 6 A level Further Mathematics pupils progress to study a STEM degree at university. This proportion is similar for many of the demographic sub-groups considered, although the proportion remains higher for male students compared to female students. For all A level Mathematics pupils, the relationship between progression and GCSE English grade is reversed compared to mathematically intensive STEM degrees (see previous section). This suggests pupils with weaker GCSE English skills may want to stay more closely aligned to mathematical sciences. Unlike for mathematical sciences degrees or mathematically intensive STEM degrees, A level Mathematics pupils with lower socio-economic status are more likely to progress to a STEM degree than more affluent peers. Theory suggests pupils from lower socio-economic backgrounds are more likely to choose degree courses directly aligned to a particular career, so aspects of STEM outside of mathematically intensive STEM degrees may be more appealing.

Well over 80% of control group pupils progress to STEM degrees so there is less scope for Maths Schools to make a difference for this outcome. Nevertheless, Maths School pupils progress at a significantly higher rate than their control group peers, with the progression rate over 90% for male pupils and under-represented ethnicities. By comparing the results to the previous section, it is clear that not many Maths School pupils progress to STEM degrees which are not mathematically intensive.

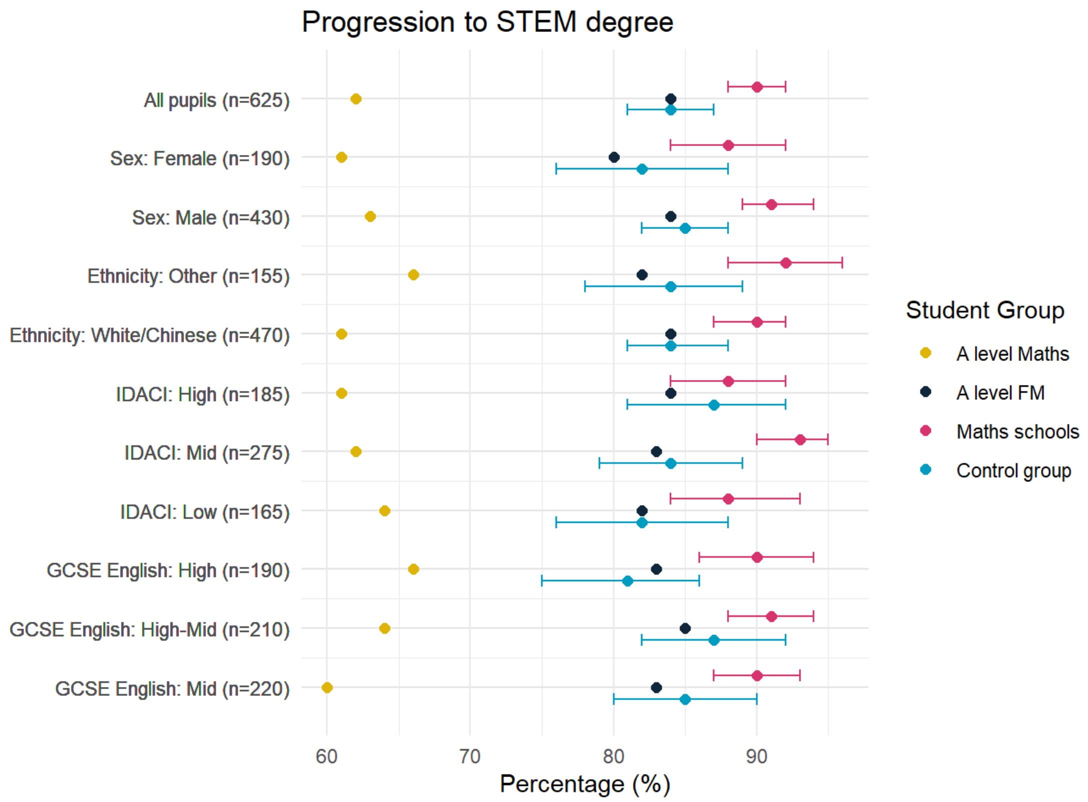

Figure 13 The proportion of students who progress to a STEM degree for all A level Mathematics students in England, those studying A level Further Mathematics in England, Maths School pupils and the control group.

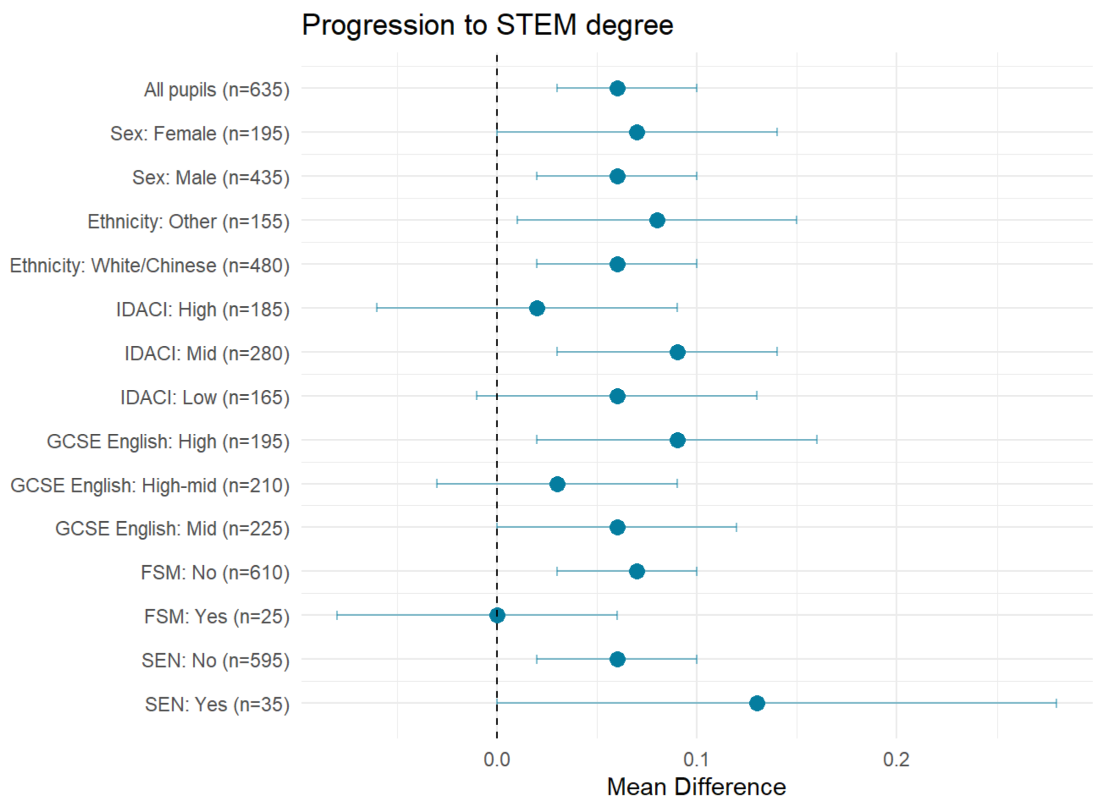

Figure 14 The mean difference between Maths School pupils and their control group counterparts for progression to a STEM degree (where 1 means they progressed and 0 means they did not).

Further insight into some of the demographic groups can be seen by considering the differences in progression rates in the pairs of Maths School and control group pupils. Figure 14 shows there is no significant advantage for Maths School pupils in some groups, such as pupils from more affluent council wards. This may be because the progression rate to STEM degrees amongst control group pupils is already very high and there is less room for improvement. The data suggests a positive impact from Maths Schools on pupils with moderate socio-economic status and those with special educational needs. Overall, the progression rate for Maths School pupils to STEM degrees is higher than for their control group counterparts but the effect is not as strong as seen in the progression to mathematically intensive STEM degrees (see previous section).

University enrolment

Oxbridge

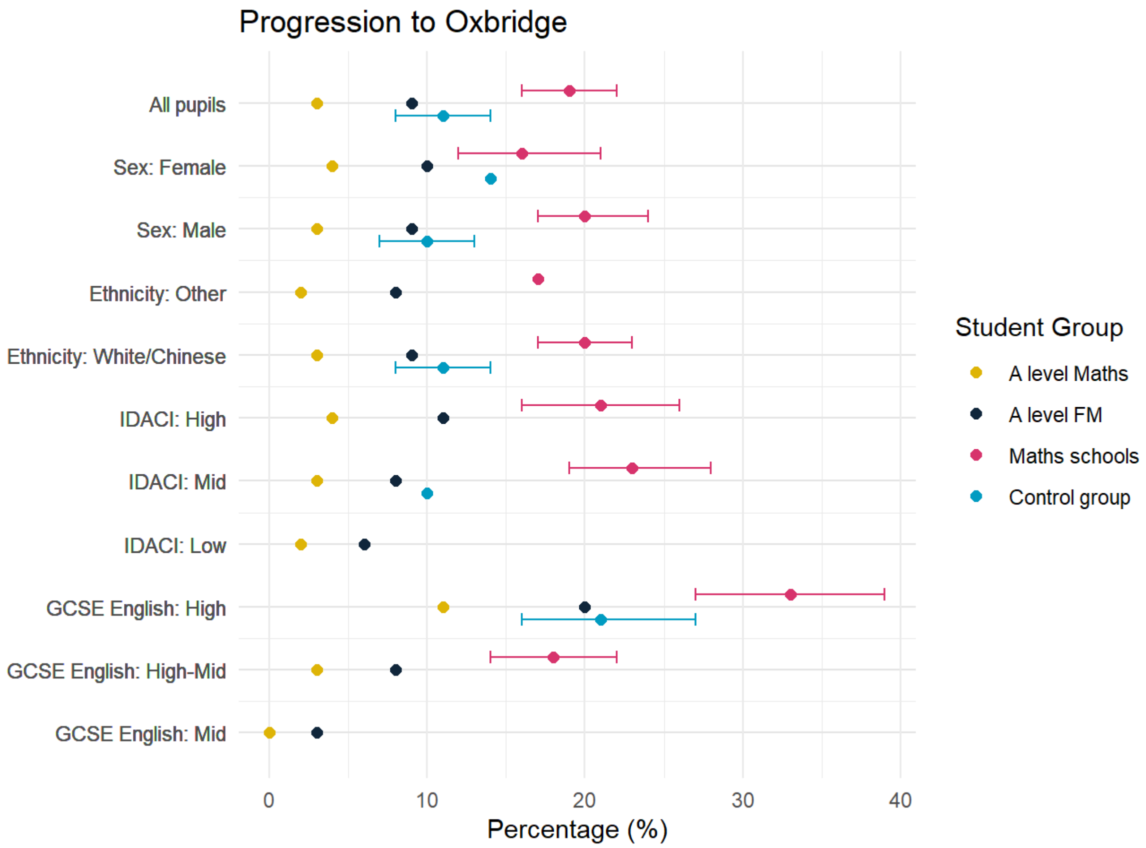

Figure 15 The proportion of students who progress to Oxbridge for all A level Mathematics students in England, those studying A level Further Mathematics in England, Maths School pupils and the control group. Note some statistics can not be reported due to the small sample size[6].

For A level Mathematics pupils in England, the factor with the greatest influence on whether an individual progresses to study (any subject) at either Cambridge or Oxford is academic ability. Using GCSE English grade as a proxy for this, around 11% of A level Mathematics pupils with grade 8 or 9 (or A*) progress to Oxbridge compared to a negligible number who have grade 6 (or B) and below in GCSE English. Around 9% of pupils studying A level Further Mathematics progress to Oxbridge compared to 3% of pupils studying A level Mathematics. This may reflect the A level Further Mathematics (or equivalent) entry requirement for studying mathematical sciences degrees at these institutions. Figure 15 also shows progression to Oxbridge is correlated with socio-economic status for both A level Mathematics pupils and those studying A level Further Mathematics as well.

Pupils who attend a Maths School are nearly twice as likely to progress to Oxbridge as A level Further Mathematics pupils in other settings. Figure 15 shows around 19% of Maths School pupils progress to Oxbridge compared to 11% of pupils in the control group. For some of the demographic groups considered, the number of pupils in the control group progressing to Oxbridge is too small to be reported[6], whereas the proportion of pupils progressing from Maths Schools is consistently above 15% for all demographic groups with two exceptions, those with lower socio-economic status and those with lower GCSE English grades.

Figure 16 shows that for these two demographic groups there is no significant increase in the progression rate to Oxbridge for Maths School pupils compared to their control group counterparts. For students with lower socio-economic status this is somewhat surprising given the uplift in A level grades these pupils achieve from attending Maths Schools. However, acceptance into Oxbridge is not something Maths Schools can directly control and this outcome may be a reflection of admissions policies and practices at these two institutions. Female pupils in both Maths Schools and the control group achieve a progression rate to Oxbridge above the national rate for A level Further Mathematics pupils so Maths Schools add less value on this measure for female pupils compared to male pupils. For most demographic groups, however, the progression rate to Oxbridge is significantly higher for Maths School pupils compared to the control group.

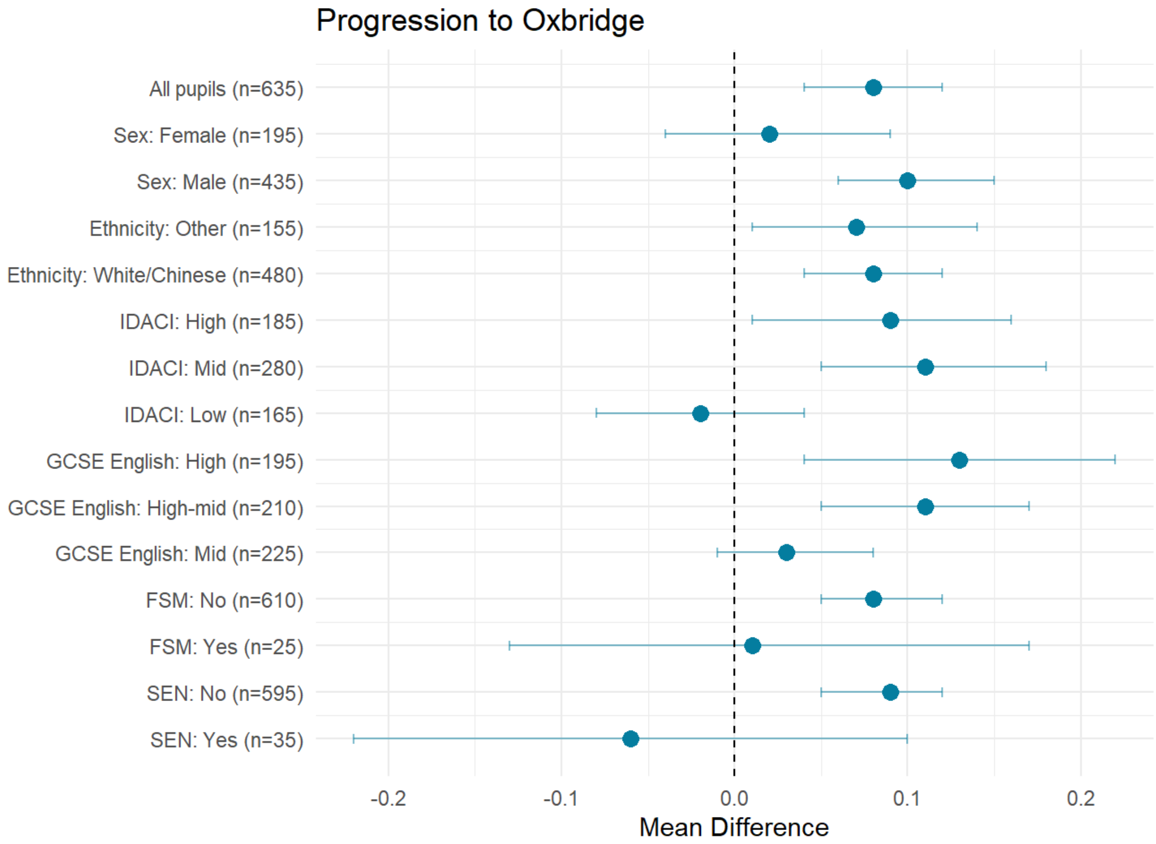

Figure 16 The mean difference between Maths School pupils and their control group counterparts for progression to Oxbridge (where 1 means they progressed and 0 means they did not).

Russell Group

Many of the national trends for progression to Oxbridge (see above) are repeated when considering progression to Russell Group universities. Figure 17 shows academic ability and socio-economic status have the strongest relationship with progression rate, with sex and ethnicity appearing to have less effect. Over 60% of pupils studying A level Further Mathematics progress to Russell Group universities compared to 40% of pupils studying A level Mathematics. It is unclear whether it is the A level Further Mathematics qualification itself which is attractive to universities and enhances the progression rate, or if it is that only pupils with higher academic ability enrol on A level Further Mathematics at age 16. The smaller gap for those with high GCSE English grades suggests it is largely the latter.

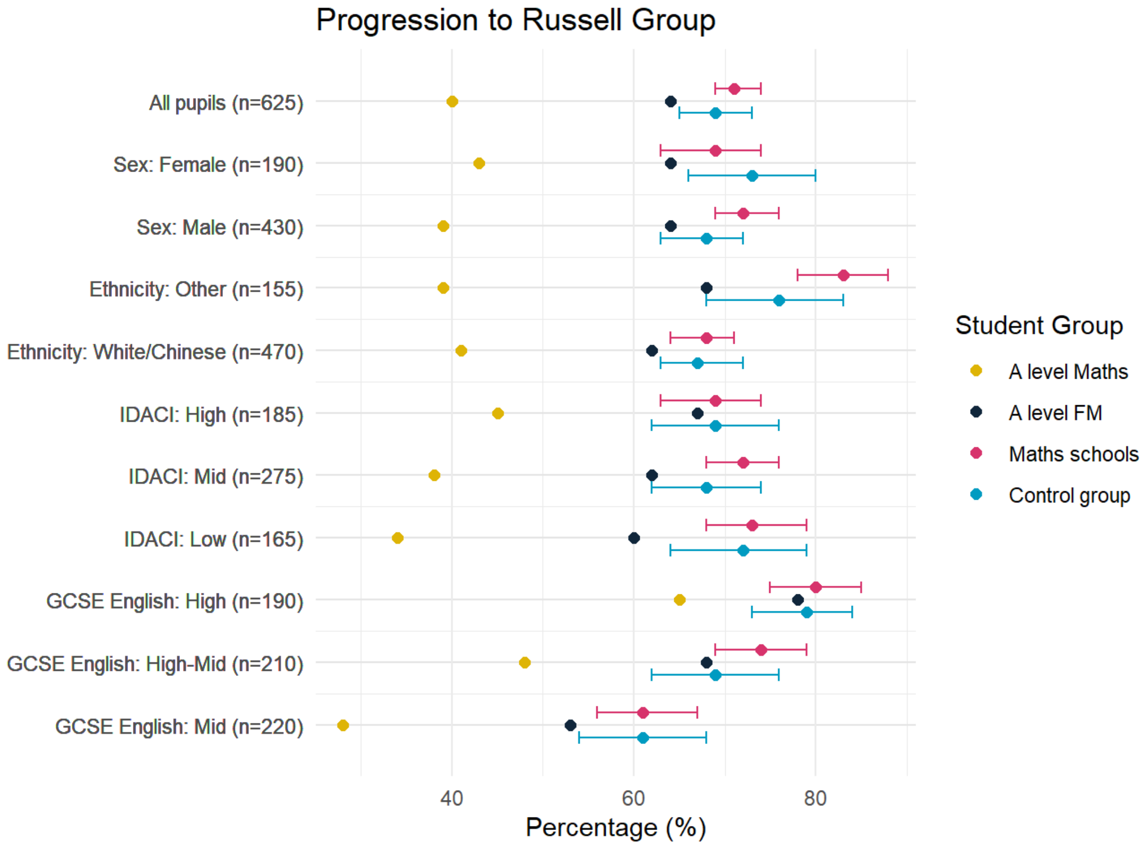

Figure 17 The proportion of students who progress to a Russell Group university for all A level Mathematics students in England, those studying A level Further Mathematics in England, Maths School pupils and the control group.

Unlike many of the other output measures considered above, Figure 18 shows Maths Schools are only marginally ahead of their control group in terms of the progression rate to Russell Group universities. This limited gain may be due to a ceiling effect – pupils with the academic ability to enrol on A level Further Mathematics age 16 may be on track to study at Russell Group universities regardless of which type of 16-18 institution they attend. Further, not all universities with high entry requirements are in the Russell Group. The University of Bath, for example, which may be an attractive destination for pupils based at Maths Schools in London and South-West England is not in the Russell Group.

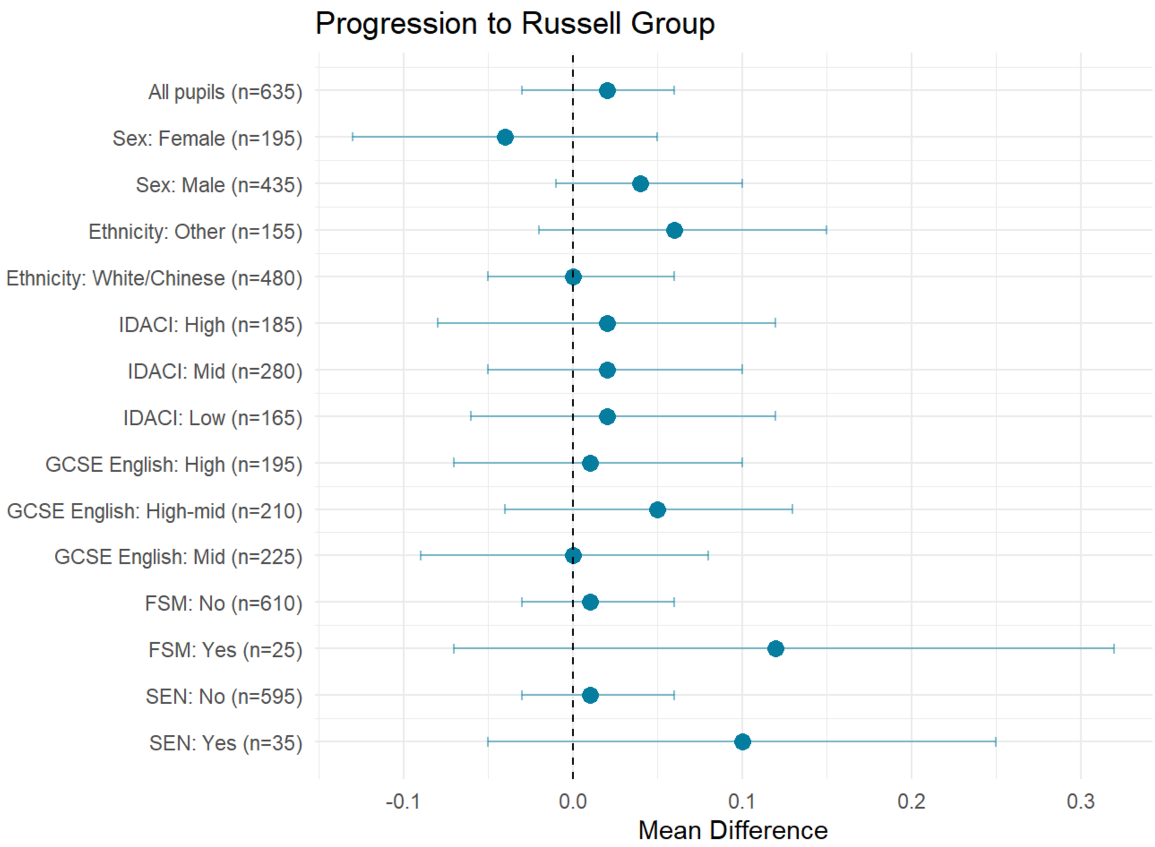

Figure 18 The mean difference between Maths School pupils and their control group counterparts for progression to Russell Group universities (where 1 means they progressed and 0 means they did not).

Top-tariff STEM institutions

Having observed that Maths School pupils benefit from a higher progression rate to Oxbridge, but there is no significant difference for Russell Group admissions, this section considers the progression rate to ‘top-tariff STEM’ universities defined as the institutions where first year students on STEM degrees have, on average, entry grades of A*AA or higher across their best 3 A levels (all subjects). These 10 universities largely correspond to the ‘top half’ of Russell Group institutions. As such, progression rates to these top-tariff STEM providers are between those observed for Oxbridge and Russell Group. Figure 19 shows about 13% of all A level Mathematics pupils progress to these institutions, rising to 36% of A level Further Mathematics pupils. Patterns relating to GCSE English grade and socio-economic status observed in the previous cases are repeated here too.

While Maths School pupils do not experience a higher progression rate to Russell Group universities compared to the control group, Figure 20 shows the progression rate to top-tariff STEM institutions is 11 percentage points higher for Maths School pupils. The uplift is statistically significant for most of the demographic groups considered. The increase is greater for female pupils compared to male pupils, reversing the pattern observed for Oxbridge and Russell group universities. While there is no significant increase, compared to the control group, for Maths School pupils with weaker GCSE English grades in terms of progression to Oxbridge (see earlier), Maths Schools are able to enhance their progression to top-tariff STEM institutions to the same extent as more-able pupils. As with progression to Oxbridge, it is students with lower socio-economic status, particularly those eligible for free school meals, where Maths Schools are not making a statistically significant difference.

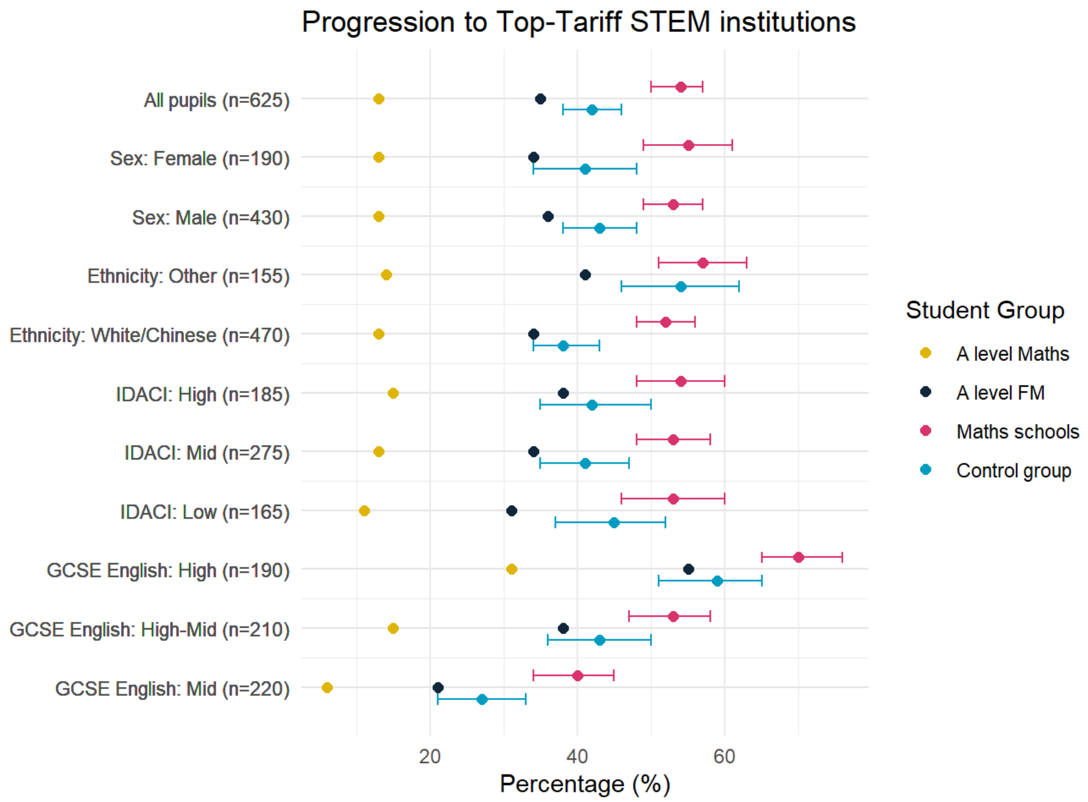

Figure 19 The proportion of students who progress to a top-tariff STEM university for all A level Mathematics pupils in England, those studying A level Further Mathematics in England, Maths School pupils and the control group.

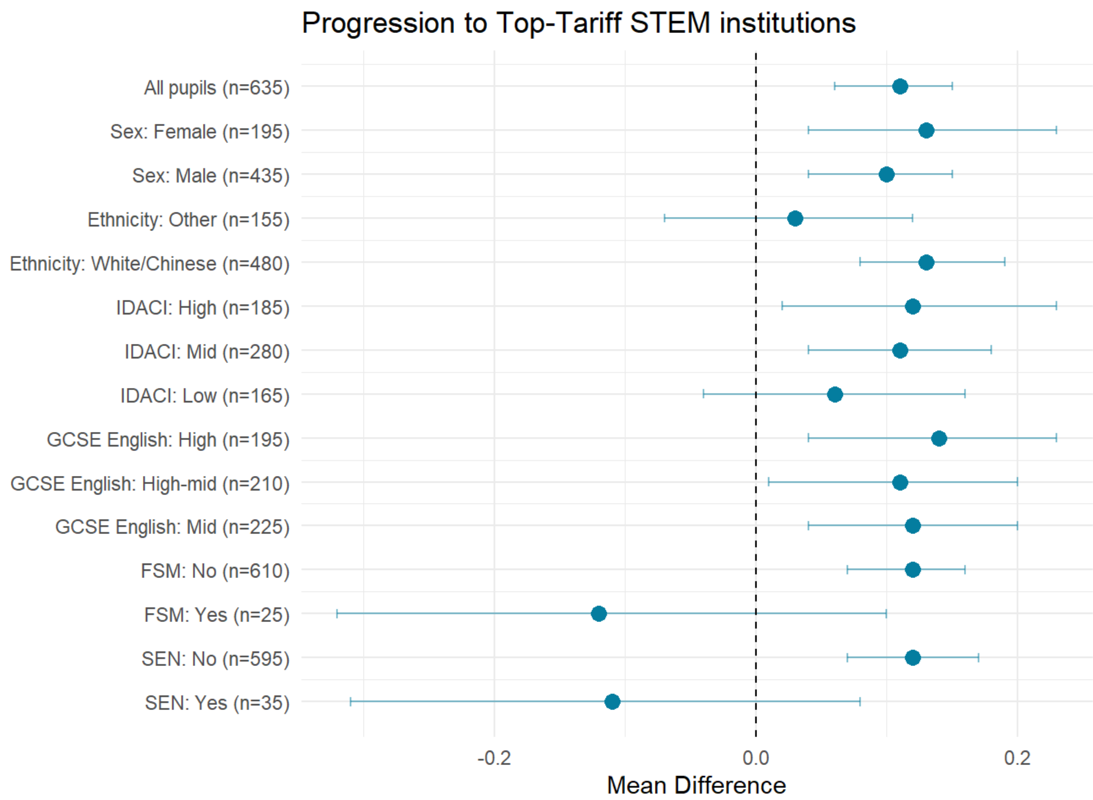

Figure 20 The mean difference between Maths School pupils and their control group counterparts for progression to a top-tariff STEM university (where 1 means they progress and 0 means they did not).

Degree classification

First-class degree classification

Figure 21 shows the proportion of A level Mathematics pupils who go on to obtain a first-class degree (in any subject). At the national level, this proportion is higher for female students (compared to male students), White/Chinese ethnicities (compared to under-represented ethnicities), students with higher socio-economic status (compared to lower socio-economic status) and students with higher GCSE English grades (compared to those with lower grades). In each case, the pattern remains if we only consider those who study A level Further Mathematics, with the likelihood of getting a first-class degree increasing for those with two mathematics A levels.

For this outcome measure there is little difference between Maths School pupils, their control group and the national picture. However, care should be taken with interpreting this finding because the analysis is merging different degree subjects and different awarding institutions. For example, it was shown earlier that students with A level Further Mathematics are more likely to study a mathematical discipline where, traditionally, a higher proportion of first-class degrees are awarded. Similarly, it was shown earlier that Maths School pupils are more likely to attend Oxbridge universities where the standard required for a first-class degree may be different to other universities. A more detailed analysis, controlling for degree subject and university, is required but the sample size for Maths School pupils is not yet sufficient to permit this.

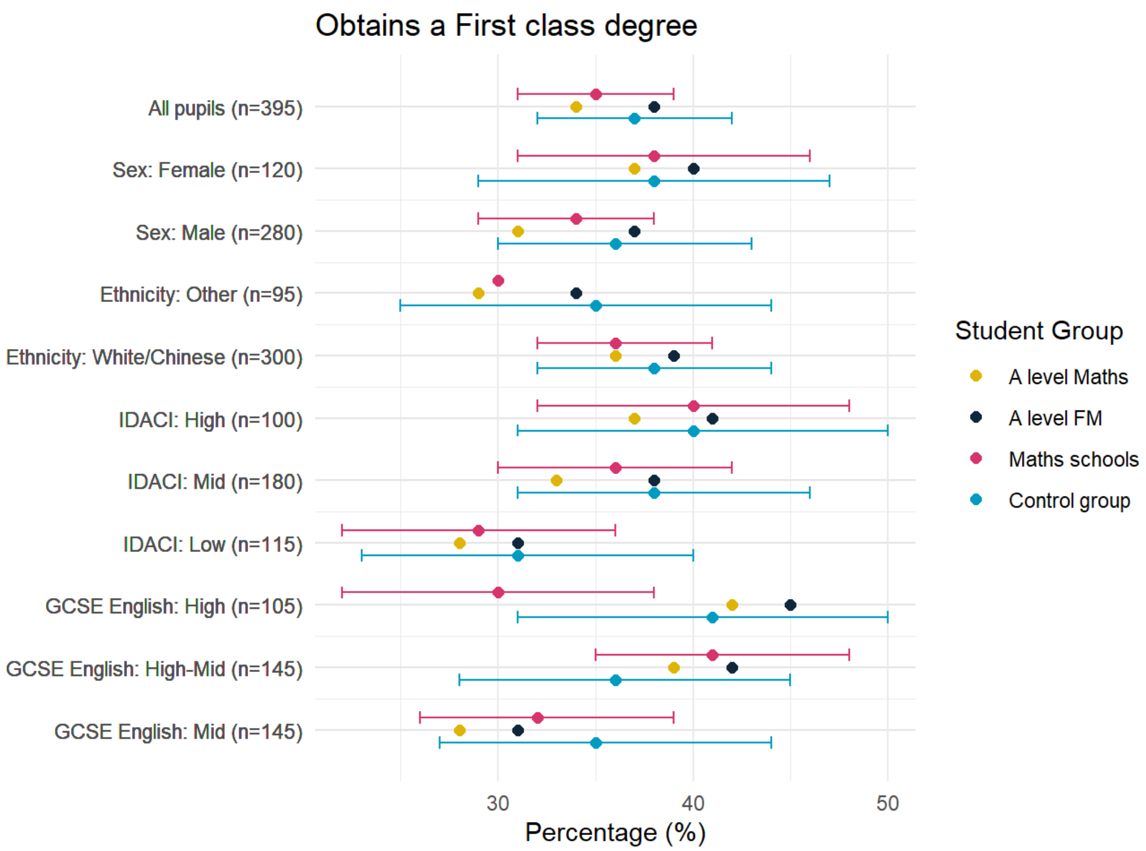

Figure 21 The proportion of students who achieve a first-class degree for all A level Mathematics pupils in England, those studying A level Further Mathematics in England, Maths School pupils and the control group.

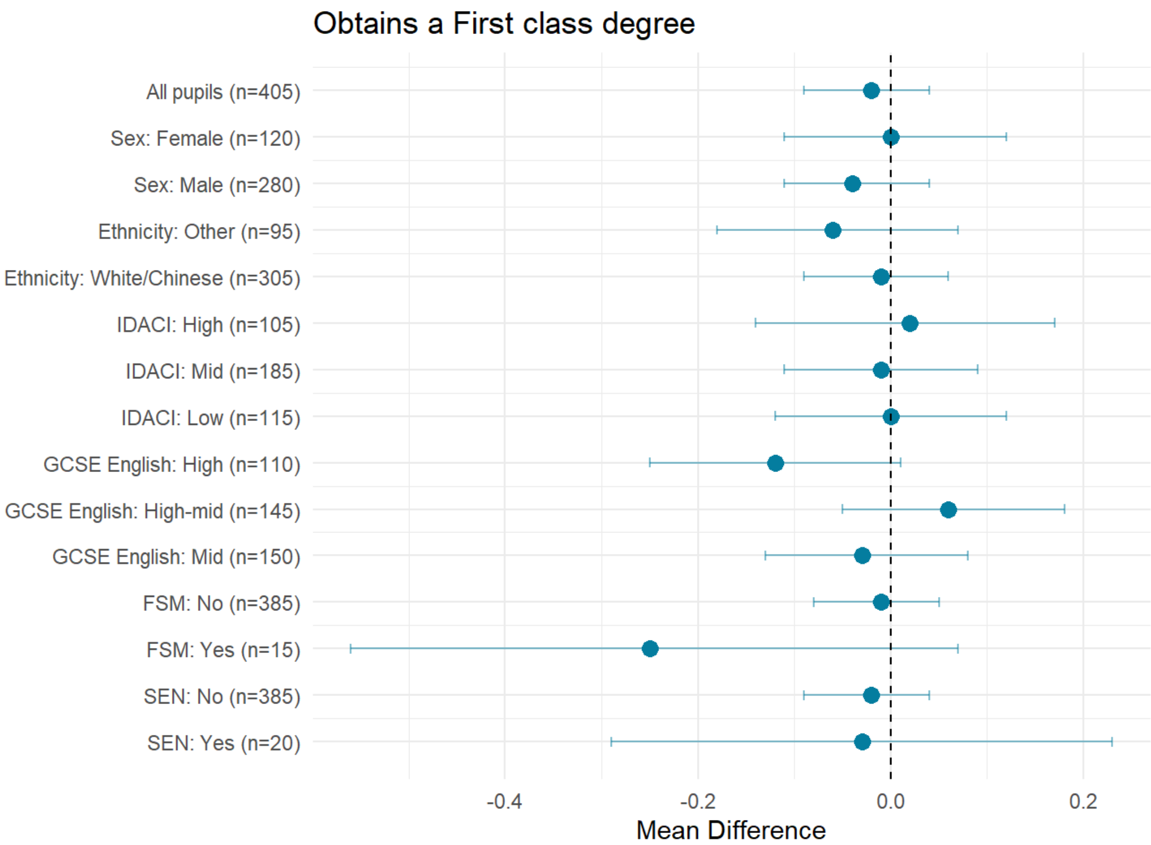

Figure 22 The mean difference between Maths School pupils and their control group counterparts for achieving a first-class degree (where 1 means they progressed and 0 means they did not).

Conclusion

Findings

It is well known that Maths Schools are academically strong, producing high-achieving A level pupils who regularly progress to Oxbridge and other Russell Group universities. King's College London Mathematics School, for example, was awarded Sixth Form College of the Year for Academic Excellence 2025 by *The Sunday Times*. Further, all Maths Schools have positive progress measures, banded 'above average' or 'well above average' by the Department for Education[7], for A level results in 2024 suggesting that Maths Schools add value, with pupils progressing further compared to similar students across England.

The analysis in this report corroborates these previously published findings using a carefully controlled quasi-experimental design to eliminate as many other confounding factors as possible. Furthermore, this report is able to examine medium-term outcome measures that go beyond A level grades and gives a more detailed breakdown by different demographic groups based on factors such as sex, ethnicity and socio-economic status.

Overall, there is strong evidence that pupils at Maths Schools benefit from enhanced A level grades, particularly in A level Further Mathematics. This feeds through into more Maths School pupils progressing to degrees in mathematics, mathematically intensive subjects and, more generally, STEM degrees than would be expected compared to equivalent pupils with similar education performance up to age 16. They can also gain admission to Oxbridge and prestigious Russell Group universities, such as UCL and Warwick, at a higher rate than their counterparts who studied A level Mathematics and Further Mathematics in other settings. In summary, Maths Schools are successful in keeping more of their pupils within the 'excellence' stream of the mathematics pipeline for longer.

Maths Schools also have a remit to provide support for demographic groups which are under-represented within the later stages of the mathematics education. The analysis shows that female students, under-represented ethnicities and pupils with low socio-economic status are among the groups where Maths Schools add most value in terms of A level grades. These three groups also progress to mathematically intensive STEM degrees at a higher rate than equivalent pupils in other settings. However, supporting these groups into prestigious universities remains a challenge for Maths Schools. The progression rate for female students into Oxbridge, for example, is only marginally higher for Maths School pupils compared to the control group (although the difference is significant when considering top-tariff STEM institutions). Pupils with low socio-economic status (those from the 30% of council wards with the greatest deprivation as measured by IDACI) also experience limited benefit from attending Maths Schools in terms of admission to Oxbridge. However, there may be socio-cultural or higher education factors, which are outside the control or influence of Maths Schools, that explain this and limit the ability of Maths Schools to diversify the mathematics 'excellence' stream beyond age 18.

This report is less successful at establishing longer-term impacts of attending Maths Schools. For example, no benefit is measured in terms of the percentage of Maths School alumni who achieve a first-class degree compared to the control group. The most likely explanation is each university, and each course within each university, having a unique curriculum and assessment regime which makes comparison across the sector more difficult. Unfortunately, with only two Maths Schools in existence until 2020, the sample size needed to conduct a more detailed analysis which takes these factors into account is not yet possible.

Currently the intention to open the remaining two proposed Maths Schools in Durham and Nottingham is being reviewed by the Department for Education. This report does not consider the wider impact of Maths Schools, through their outreach, enrichment and professional development programmes, for pupils and teachers in other schools in their respective regions. However, the analysis in this report suggests that pupils in Maths Schools greatly benefit in the short- and medium-term, at least, while the longer-term impacts are not yet fully observable. Potential explanations for these enhanced outcomes include affective (e.g. pupils have greater motivation or sense of identity as mathematicians) or cognitive (e.g. better pedagogical practices and extra-curricular enrichment leads to better understanding) reasons. Further research is needed to understand any underlying causal mechanisms.

Limitations

The full impact of changes in the education system are typically seen on a longer timescale than considered in this report. The first students to attend Maths Schools graduated from A levels less than a decade ago so this report is unable to robustly evaluate long-term impacts on postgraduate study, careers and earnings into adulthood. Furthermore, the existing analysis is largely dominated by pupils who attended the first two Maths Schools, King's and Exeter. There are a number of differences between these two schools in terms of their context, the extra-curricular provision both in mathematics and more generally, as well as the facilities, curriculum and staff. Pupils at Exeter, for example, have the option of boarding and the option of taking a 4th A level outside of maths-related subjects whereas pupils at King's have a more constrained A level curriculum but can take advantage of good transport links to commute from home. Merging the outcomes of pupils from these two schools plus Liverpool was necessary to achieve a reasonable sample size but it is likely there is between-school variation in some of these measures. Whether the conclusions of this report are applicable to the Maths Schools which opened more recently remains to be seen.

It should also be noted that the majority of cohorts considered in this analysis were impacted to some extent by the Covid-19 pandemic. The GCSE, A level and university examinations in 2020 and 2021 were heavily disrupted and controversies surrounding teacher-assessed and centre-assessed grades are well documented. However, the use of matching within cohorts should control for much of the between-year variation in grade distributions. Re-running the analysis for pre-pandemic cohorts only does not notably change the conclusions of this report.

More generally, the matching of Maths School pupils to control group pupils in the quasi-experimental design controls for differences in prior attainment (GCSE Mathematics and GCSE English) and demographics (e.g. sex, ethnicity, socio-economic status). However, there are other variables not recorded in the NPD and HESA records which are likely to influence pupil outcomes, such as pupil motivation or extra-curricular tuition. Recording which control group pupils applied to Maths Schools might offer some control for mathematical motivation but Maths Schools do not have consent to use applicant data in this way. For some measures in the NPD and HESA, the sample size was too small to give a breakdown by different levels. For example, under-represented ethnicities were merged in the analysis when previous studies[5] have shown the mathematical outcomes for, say, Asian and Black ethnicities are significantly different at the national level. As more cohorts progress through Maths Schools the sample size will increase, and more detail can be introduced to the analysis. It is unclear whether unrecorded variables and merged levels of recorded variables have led to an overestimate or underestimate of the effect of Maths Schools and caution should be exercised in attributing a causal relationship without more detailed analysis.

The Observatory for Mathematical Education

The Observatory for Mathematical Education is undertaking an unprecedented ten-year programme of longitudinal research from reception to postgraduate level. This holistic, multi-scale and mixed-method programme aims to better understand our national system of mathematical education and support those trying to improve it. Further details can be found in the Introductory Report on the website.

Acknowledgements:

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Citation details:

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Endnotes:

1. This report uses GCSE cohort as the basis for comparing outcomes. Timelines in post-16 education can vary due to gap years and repeated study years so GCSE cohort provides a more consistent cohort comparison group.
2. NPD and HESA records only cover England and UK institutions, respectively. Enrolment in an overseas degree programme, for example, will not be captured in the data.
3. IDACI measures are recorded at the level of Lower Layer Super Output Areas which contain approximately 400-1200 households and typically align to council wards.
4. Due to the change in grading system, GCSE English grades are shown as High (grades 8, 9 or A*), High-Mid (grades 7 or A) or Mid (grades 4, 5, 6, B or C).
5. See https://www.nottingham.ac.uk/research/groups/crme/documents/maths-pipeline-report.pdf
6. The Office for National Statistics' statistical disclosure control rules do not permit the reporting of statistics based on counts of fewer than 10 individuals. This means percentages close to 0% or 100% may be supressed in the graphs. All counts reported are rounded to the nearest 5.
7. Performance measures published by the Department for Education can be found here: https://www.compare-school-performance.service.gov.uk/

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