

# Canterbury Christ Church University (CCCU) Inspiring Minds Impact Evaluation

Examining the impact on Key Stage 4 (GCSE) exam  
results

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The following report follows a quasi-experimental evaluation design to evaluate the impact of participating in CCCU's Inspiring Minds Year 10 STEM activity. The analysis draws on data supplied as part of the HEAT Track to examine the impact of participation on Key Stage 4 exam attainment.

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## Introduction

The following analysis evaluates the impact of participating in Canterbury Christ Church University's (CCCU) Inspiring Minds STEM activity on Key Stage 4 (GCSE) attainment. The purpose of the analysis is twofold:

1. **To provide robust evidence on the impact of participating in the Inspiring Minds activity on Key Stage 4 exam attainment.** This evaluation will have Sector-wide value as it will contribute to our understanding around the potential for outreach to raise students' attainment. This is important given that Key Stage 4 attainment is critical to future HE progression (Crawford, 2014), and that the Office for Students (OfS) ask Outreach Providers to raise attainment prior to HE entry (OfS, 2020).
2. **To provide an example of how data supplied through the HEAT Track can be used by HEAT's members to generate robust evaluation.** It is possible for all HEAT member organisations to apply the approach taken in this evaluation to their own activities; the data and tool used are available to all HEAT members. This case study example will therefore provide a guide for other HEAT members wishing to follow a similar evaluation design.

## Summary of Findings

### Impact on Overall Key Stage 4 Attainment / English and Maths

1. The analysis found that participants of Inspiring Minds **achieved higher Attainment 8 scores** than a matched comparator group of non-participants. Participants achieved **an average of 6 grades higher across eight core subjects. This result was significant at  $p < .10$ .**
2. The analysis also found that participants of Inspiring Minds were **+13 percentage points more likely to achieve a 9 to 4 pass in English and Maths** (45%) than the non-participant group (32%). However, this result was not statistically significant.
3. Although a higher proportion of participants achieved a 9-4 pass in English and Maths, the same was not found when the pass mark was extended to 9-5, with equal proportions in both group achieving this standard (20%).

### Impact on Attainment in STEM Subjects

4. The analysis found that participants of Inspiring Minds were **+26 percentage points more likely to achieve a 9 to 4 pass in Maths** (64%) than the non-participant group (38%). **This result was significant at  $p < .05$ .**
5. Inspiring Minds participants were no more likely to achieve a 9 to 5 pass in Maths (25%) than the non-participant group (27%). Therefore **improvements in attainment can be traced to raising the Maths grade from a 3 to a 4.**
6. Participants of Inspiring Minds were **+7 percentage points more likely to achieve a 9 to 4 pass in Science** (32%) than the non-participant group (24%). However, this result was not statistically significant.
7. The proportion achieving a grade 4 pass in Science in both groups was relatively low, and mean Science grade for both participants and non-participant groups was less than 4. Although a more positive result for the programme would have been to find a significant impact on Science attainment, the low overall attainment in this subject is perhaps an indication of the **successful targeting of this STEM activity towards schools and pupils with low science capital.**

### Lessons for Evaluation Design

8. The evaluation design followed here provides a useful model for other similar outreach activities, i.e. **activities that are not over-subscribed and so a comparison group is not readily available**.
9. The relatively low participant counts in this evaluation made achieving statistical significance difficult. Therefore, we would caution against assuming that the lack of statistical significance means there was no impact.
10. The design is not perfect and **recommendations for improvements have been made** at the end of this report. Any evaluators reading this should aim to incorporate these recommendations into their own evaluation designs.

### Activity Description and Evaluation Research Questions

Inspiring Minds is a Science, Technology, Engineering & Maths (STEM) activity delivered to Year 10 pupils who attend six Saturday sessions of between four to six hours. This evaluation focuses on the first cohort of Inspiring Minds participants, delivered between January and June 2018.

The activity, designed by leading academics from CCCU's Department of Education, is based in ground-breaking pedagogy and aims to enable students to not only understand their school curriculum but develop a rich and deep understanding of the nature and interactions between science and their other subjects. Owing to the pedagogical research underpinning the design of the activity, there is a clear causal mechanism for the activity to raise attainment in science and maths due to the STEM subject nature, as well as English due to report writing.

Students engage with intellectual puzzles about the nature of reality and human personhood in the lights of science, artificial technology, religion and mathematics. They investigate whether a robot can think for itself, the secrets of optical illusions and the power and limitations of our senses to reveal the true nature of reality, whether mathematics is already present in the universe or whether people invented it and how they represent themselves online and the concept of a self-portrait in the modern digital age. This research informs their own STEM projects, where participants develop then apply their new and multidisciplinary knowledge to finding solutions for real world problems. Projects are presented at a public showcase event attended by parents/carers, teachers and university professors.

The following research questions will be addressed in this evaluation:

1. Do Inspiring Minds participants achieve higher Key Stage exam attainment than a matched comparator group of similar non-participants?
2. Do Inspiring Minds participants achieve higher Key Stage 4 attainment in Maths than a matched comparator group of similar non-participants?
3. Do Inspiring Minds participants achieve higher Key Stage 4 attainment in Science than a matched comparator group of similar non-participants?
4. Do Inspiring Minds participants achieve higher Key Stage 4 attainment in English than a matched comparator group of similar non-participants?

### Evaluation Design

The research questions above will be explored using a quasi-experimental evaluation design whereby participants of Inspiring Minds are matched to non-participants based on confounding variables known to influence the outcome in question - Key Stage 4 attainment.

Evaluation incorporating matching techniques such as this can reach **Type 3 standards of evidence** according to the Office for Students' report (OfS, 2019), with this type considered

capable of establishing a causal impact. However, we aim to provide a critical reflection of our approach as part of this evaluation report, and will be clear about the limitations and any likely differences between the participant and comparator groups.

### **Sourcing a comparison group**

Inspiring Minds is a carefully targeted activity, offered to schools with high proportions of Uni Connect Target students. The activity is not oversubscribed and so a comparator group of students with which to compare outcomes is not readily available. Although this is not ideal it is often the case in outreach activities that are targeted at those students who are less easily engaged in educational interventions. As a result, other options for a comparator group must be explored.

Fortunately, there is a tradition of large-scale data collection in Kent and Medway owing to a well-established local partnership, the [Kent and Medway Progression Federation \(KMPF\)](#), of which CCCU is a part. KMPF collect baseline data for the pupils in their 70 partner schools and colleges. All baselined students who give permission are tracked by HEAT. Thanks to this extensive data collection, we have access to data for a large number of students from the same or similar schools as the participant group from which to draw a comparator group of students.

In this evaluation, non-participants will be drawn from those of the baselined students who are not linked to any activities on HEAT, or who are only linked to a light touch activity such as an HE Talk or Assembly of no more than one hour. These light touch activities were typically one-off events which were far less intensive than the Inspiring Minds activity. Non-participants are therefore not non-participants of any outreach activity, but rather non-participants of Inspiring Minds and any other intensive or sustained activities delivered by the KMPF partnership. All students included in the non-participant group have been recorded on the HEAT database and tracked, alongside the participant group and so their Key Stage 4 exam data are available for analysis.

As is the case with most educational interventions, the Inspiring Minds participant group has already been established. The challenge, therefore, is to find or create a comparison group that is as similar as possible in terms of characteristics. Similarity between the two groups is critical in order to maximize the validity of the comparison, and have confidence in attributing any improvements detected in the participant group to their participation in Inspiring Minds. To do this, we will use matching techniques to ensure similarity in observed variables, as well as making other relevant considerations to ensure similarity in unobserved variables. These are discussed next.

### **Similarities between the Participant and Non-participant Groups**

#### 1) Students' motivation levels

It is often difficult in widening participation evaluations to argue that the unobserved variable of students' motivation and engagement with their education is similar between the participant and non-participant groups. This is because students who attend outreach programmes *may be* naturally more engaged with their education and therefore likely to achieve higher Key Stage 4 exam attainment when compared with students who do not attend. Failing to justify that underlying student motivation is similar between the two groups could lead to students in one group having a great likelihood of achieving higher grades at

Key Stage 4 regardless of activity participation. This issue can sometimes be overcome by drawing a comparator group from a population of students who applied to attend the activity, but were not accepted.

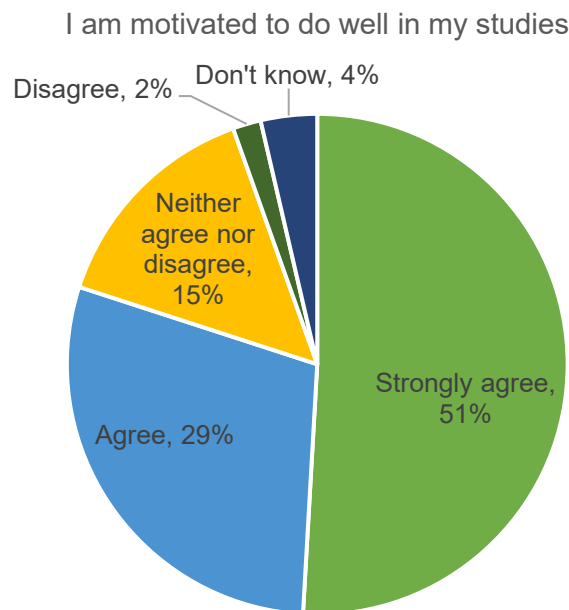
Inspiring Minds was not an activity to which students self-selected or applied, and it was not oversubscribed, and so this approach is not suitable here. Rather, students were targeted based on proxies which are traditionally associated with being disengaged with education, and then encouraged to apply. The CCCU Outreach Team put in place measures to engage these traditionally disengaged students, including the following:

- Students were provided with high street vouchers worth £30 for every Saturday session they attended. These vouchers would have provided an extrinsic incentive for students, rather than relying on students recognising the value attending may have on their education. It can be argued therefore, that using vouchers would have attracted students with lower levels of intrinsic motivation to engage with their education.
- Students were selected based on postcode and other proxies for disadvantage and sent personal invitations to attend.
- The CCCU Outreach Team spent time convincing the cohort to attend through in-class presentations which addressed the “why bother?” questions and any other worries (e.g. Can I sit with my mates? Is food provided? Is this another lesson? How will I get my vouchers?)
- Coaches were provided to take students from their school gates to campus and therefore remove barriers associated with access to transport.
- Reminder emails and text messages were sent to the school and also parents of the students the day before to remind them of the activity details.

These targeting processes suggest that Inspiring Minds participants are not highly engaged and motivated students and therefore their motivation levels should not be significantly different from those of the comparator group students who have not attended any activities or have only attended light touch activities. However, it must be acknowledged that we do not know this for certain, and underlying motivation levels, although likely to be similar between the two groups, could be different.

Furthermore, the self-reported attitudinal data from the CfE baseline survey that is available for the participant group, shows that motivation towards education is generally high, with 80% agreeing that they are motivated to do well in their studies. However, self-reported survey data are likely to over-estimate measures such as motivation due to social desirability bias (where students give what they perceive is the ‘right’ answer).

Figure 1: Motivation levels amongst the participant group



This same survey data is not available for non-participants, and so cannot be included in the matching. In the future we will endeavour to collect attitudinal data reflecting students' motivation to attend activities for both groups.

For this evaluation, we are able to use proxies for motivation in place of a more specific measure. Motivation levels tend to correlate with some of the observed variables on which we do hold data (First in family to attend HE and IMD/IDACI).

### 2) Students' prior attainment at Key Stage 2

Ideally we would like to match participants and non-participants on their prior attainment at Key Stage 2. However, these data are not available to HEAT members at student-level. Data are available to HEAT Analysts, but this analysis follows the process that HEAT offers to members, using the data available to them. HEAT are trying to find a solution to this that would allow prior attainment to be included in the matching variables whilst complying with the DfE's data sharing requirements, but for now this is not possible.

As a proxy for student-level prior attainment, we will instead use school-level average attainment. This measure is predictive of students' exam grades, although a weaker measure than student-level prior attainment.

We will be able to check whether students' prior attainment is balanced between the two groups, but only at the point of accessing the exam results, by which time the groups will have already been constructed.

### 3) Students' level of disadvantage

Levels of disadvantage between students from the participant and non-participant groups may be dissimilar. Students from the participant group have been encouraged to take part in Inspiring Minds because they are classified as belonging to certain disadvantaged groups.

Non-participants or participants of light touch activities may not have been encouraged to take part because they did not meet these markers for disadvantage.

To account for differences in students’ backgrounds we will match participants with non-participant on observed variables that are known to influence Key Stage 4 attainment. Research by Sullivan *et al.* (2014) and Baker *et al.* (2014) shows that parent’s education levels is strongly predictive of their children’s attainment . Sylva *et al.* (2014) shows that neighbourhood variables relating to the child’s home area (e.g. the Index of Multiple Deprivation (IMD)) also correlate highly with pupil attainment. This indicates the importance of the home community in explaining young people’s educational outcomes, and gives weight to the influence of place outside the immediate family home. These variables will be included in the matching.

Figure 2 summarises the similarities and differences between participants and non-participants

Figure 2: Similarities and differences between participants and non-participants

	Participant Group	Non-Participant Group	Matching Required?
<b>Selection / Motivation to participate</b> – Did participants apply for the activity?	✗	✗	No, the participant group did not apply for the activity and so motivation to attend <i>should</i> be similar, although we cannot be certain.
<b>Prior Attainment</b> – Did participants require a minimum level of prior attainment?	?	?	No minimum level required. It is not possible to match student-level prior attainment with data available. A weaker proxy marker of average school attainment will be used instead.
<b>Disadvantage</b> - Did participants meet markers for disadvantage?	✓	✗	Yes, participants and non-participants will be matched to ensure they are from similar backgrounds

### Participant and Non-Participant Populations

A sample of 67 participants of the first cohort of Inspiring Minds were recorded on HEAT with full tracking data. The first activity cohort is the most recent for whom Key Stage 4 exam results are available for analysis. These participants took their Key Stage 4 exams in the Summer of 2019 which pre-dates the COVID pandemic.

A sample of 1,860 students are available for the non-participant group. This group is made up of students who completed a KMPF baseline survey but did not go on to participate in any outreach activities, or who only attended a light touch activity. It is fortunate that we have a much large sample of students in the non-participant group to draw matches for participants. This means that we should be able to find close matches for a large proportion of participants. The matching process is explained next.



## The Matching Process

Participants were matched in SPSS v25 to a pair from the non-participant group without replacing cases. A match tolerance of one decile was allowed for IMD and IDACI. All other variables matched exactly. When conducting this type of matching, the match tolerance can be tightened or loosened; there will always be a trade-off between maximising the comparability of the groups and ensuring that a sufficient number of matches are made. Table 1 below summarises the matching criteria used.

Table 1: Summary of matching variables

Match Variable	Tolerance	Reason for including in matching criteria
Gender	Exact Match	To control for differentials in the KS4 achievement of boys when compared with girls
Ethnicity	Exact Match	To control for differentials in KS4 achievement across ethnic groups
First in family to attend HE	Exact Match	To control for the influence of parental experience on education
IMD Decile	+/- 1 Decile	To control for differentials in Key Stage 4 achievement by socio-economic background
IDACI Decile	+/- 1 Decile	To control for differentials in Key Stage 4 achievement by socio-economic background
Average KS4 Performance of School (Decile)	Exact Match	To control for the influence of the school, this may include the school environment and teaching quality. This will also be used as a weaker replacement for pupil-level prior attainment.

Of the 67 Summer School participants, a pair was found for 47 (70%). Unmatched records were discarded. The sample size is now slightly smaller but this is necessary to ensure the participant and non-participant groups are as similar as possible.

## Participant and Non-Participant Characteristics Pre- and Post-Matching

Table 2 shows the proportion of individuals in the participant and non-participant groups, pre- and post-matching, by a range of characteristics, including those on which the matching was conducted. This comparison allows us to check the groups for balance post-matching.

Table 2 shows that, post-matching, the groups are now very similar in relation to the observed variables to which we have access. The participant and non-participant groups are identical in terms of gender, ethnicity, the proportion who are first in family to attend HE and the average Key Stage 4 performance of the schools the students attended. The participants and non-participants are now more similar in terms of average IMD and IDACI decile, although not identical as a tolerance of one quintile was allowed when matching.

The final participant group (post-matching) is also broadly similar in profile of the original participant group (pre-matching). However, differences can be seen in the average Key Stage 4 performance decile of the schools the post-matching students attend. A larger proportion of students in the post-matching participant group are from lower attaining schools (decile 3 = 96%) when compared with the participant group pre-matching (decile 3 = 73%). The results from the impact analysis will therefore be based on the post-matching populations, which consists predominantly of students from lower attaining schools.

Table 2: Comparison of Participant and Non-Participant groups before and after matching

Matching Variables	Pre-Matching		Post-Matching	
	Participant	Non-Participant	Participant	Non-Participant
<b>Gender</b>				
Female	45%	47%	43%	43%
Male	54%	49%	57%	57%
Other	1%	0%	0%	0%
Unknown	0%	4%	0%	0%
<b>Ethnicity</b>				
White	63%	64%	62%	62%
Asian / Asian British	6%	3%	0%	0%
Black / African / Caribbean / Black British	3%	3%	2%	2%
Mixed / Multiple ethnic background	3%	3%	0%	0%
Other ethnic background	0%	1%	0%	0%
Unknown	25%	26%	36%	36%
<b>First in Family to attend HE</b>				
Yes	45%	64%	55%	55%
No	30%	21%	15%	15%
Unknown	25%	15%	30%	30%
<b>IMD Decile</b>				
Decile 1	28%	8%	23%	32%
Decile 2	37%	11%	40%	28%
Decile 3	12%	9%	15%	15%
Decile 4	6%	10%	7%	13%
Decile 5	1%	13%	0%	2%
Decile 6	3%	11%	4%	6%
Decile 7	7%	11%	6%	2%
Decile 8	0%	8%	0%	2%
Decile 9	3%	7%	2%	0%
Decile 10	0%	7%	0%	0%
Unknown	1%	5%	0%	0%
<b>IDACI Decile</b>				
Decile 1	27%	10%	23%	45%
Decile 2	31%	10%	34%	21%
Decile 3	16%	10%	19%	11%
Decile 4	7%	13%	6%	13%
Decile 5	6%	10%	9%	2%
Decile 6	0%	11%	0%	2%
Decile 7	9%	11%	9%	4%
Decile 8	1%	9%	0%	2%
Decile 9	0%	7%	0%	0%

Decile 10	0%	6%	0%	0%
Unknown	1%	5%	0%	0%
<b>School KS4 performance decile (Source: DfE 2019 Performance Tables)</b>				
Decile 1	0%	0%	0%	0%
Decile 2	0%	2%	0%	0%
Decile 3	73%	31%	96%	96%
Decile 4	0%	24%	0%	0%
Decile 5	0%	24%	0%	0%
Decile 6	0%	0%	0%	0%
Decile 7	0%	10%	0%	0%
Decile 8	0%	0%	0%	0%
Decile 9	0%	0%	0%	0%
Decile 10	27%	8%	4%	4%
Unknown	0%	0%	0%	0%

## Results

In this section we compare Key Stage 4 exam attainment outcomes for the matched participants and non-participants.

### Differences in Key Stage 4 attainment between the two groups

Table 3 provides a summary of this comparison. Numbers are rounded in line with the Department for Education's policy.

Table 3: Comparison of outcomes for the matched participant and non-participant groups

Research Question		Participants	Non-participants	Difference between the groups
	Number in each group	n=50	n=50	
1	Average Attainment 8	40.1	34.2	+6 grades*
1	Achieved a 9-4 pass in English and Maths	45%	32%	+13 p.p.
1	Achieved a 9-5 pass in English and Maths	20%	20%	0 p.p.
2	Achieved a 9-4 pass in Maths	64%	38%	+26 p.p.**
2	Achieved a 9-5 pass in Maths	25%	27%	-2 p.p.
2	Mean grade in Maths	4.0	3.6	+0.4 grade
3	Achieved a 9-4 pass in Science	32%	24%	+8 p.p.
3	Achieved a 9-5 pass in Science	11%	5%	+6 p.p.
3	Mean grade in Science	3.7	3.5	+0.2 grade
4	Achieved a 9-4 pass in English	55%	46%	+9 p.p.
4	Achieved a 9-5 pass in English	34%	27%	+7 p.p.

4	Mean grade in English	4.0	3.9	+0.1 grade
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\*\*Statistically significant at  $p < .05$

\*Statistically significant at  $p < .10$

The difference between the matched participant and non-participant groups was tested for significance at  $p < .05$  using either a T-test or a Chi-Square test and all p-values are given in the Appendix.

## Discussion of Results

We will return to the research questions posed at the beginning of this report and discuss each in turn.

**Research Question 1:** Do Inspiring Minds participants achieve higher Key Stage 4 exam attainment than a matched comparator group of similar non-participants?

The analysis shows that mean Attainment 8 scores for Inspiring Minds participants were six grades higher than those for the matched comparator group of similar non-participants. This finding is positive, suggesting that participating in Inspiring Minds may help contribute towards raising Key Stage 4 attainment. Although the six grade higher average Attainment 8 result for participants was not statistically significant at the 95% significance level ( $p = 0.05$ ), it was significant at the 90% level ( $p = 0.10$ ) and therefore p-values show a strong trend towards significance. This means that the finding has a 90% chance of being true. A lack of statistical significance at the standard 95% level is not surprising in this context as jumps in grades may be insufficiently sensitive to pick up the marginal gains on attainment of participating in outreach activities. These findings resonate with research commissioned by the Office for Students (OfS) which reported that assessing the impact of outreach in terms of raising exam grades may be difficult to demonstrate (Harrison *et al.*, 2018).

Improvements in overall Attainment 8 can be partly accounted for by improvements in the key subject of English and Maths. The proportion of participants who achieved a 9-4 pass in English and Maths was also higher, by +13 percentage points, when compared with non-treatments. However, further improvements were not found when examining the proportion of participants who achieved a strong 9-5 pass.

That participants were not found more likely to achieve a strong 9-5 pass in English and Maths suggests that improvements in the attainment of participants have been achieved by raising the number who reach a grade 4 pass, rather than those who reach a stronger 5+ grade. To help explain this further we next examine the prior attainment at Key Stage 2 of participants when compared with non-participants.

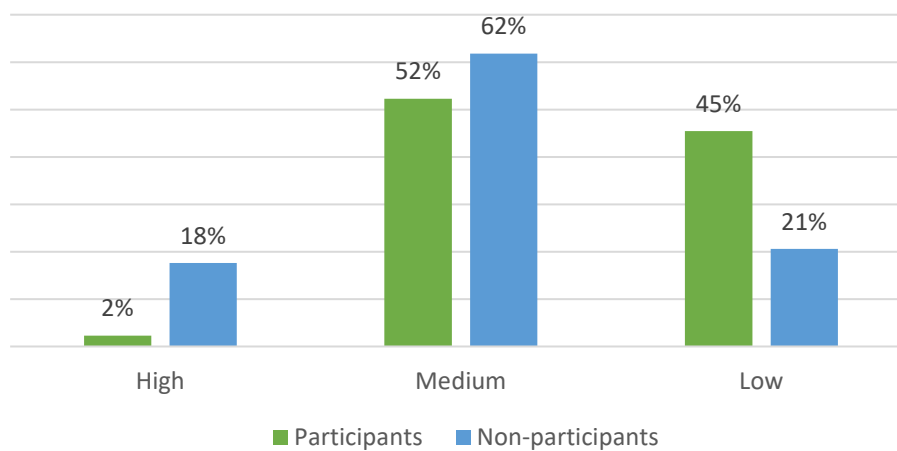
As previously discussed, we were unable to match participants with non-participant on their prior attainment at Key Stage 2, with these exams being the latest available prior to Key Stage 4, as these data were not available at the time of matching. The average school-level attainment for the schools the students attended was used as a proxy for matching on attainment, but as students' individual-level attainment will often differ significantly from the average of their schools, this is a far weaker variable on which to match.

Previous analysis by HEAT into the [relationship between outreach participation and Key Stage 4 attainment](#) (HEAT, 2021), showed that students' prior attainment at Key Stage 2 accounts for 42.7% of the variance in their Attainment 8 scores. Including measures for socio-economic background explain a further 11%. Therefore, Key Stage 2 is the biggest

predictor of future attainment at Key Stage 4 and it is important that this marker of prior attainment is similar between the two groups if we are to have confidence in the results.

As Key Stage 2 attainment was made available for pupils alongside Key Stage 4 attainment, we are now able to compare differences between the participant and non-participant group. Figure 2 shows the Key Stage 2 bands of both groups, bands consist of 'Low' (below Level 4), 'Medium' (at Level 4) and 'High' (above Level 4). Participants had lower prior attainment at Key Stage 2 when compared with non-participants. A larger proportion of students from the participant group belonged to the 'Low' prior attainment band, and smaller proportions to the 'High' and 'Medium' bands.

Figure 2: Key Stage 2 attainment band of participants and non-participants



In light of the above, we can be more confident in our claim that participating in Inspiring Minds raises the Key Stage 4 exam attainment of students. We have already seen that participants achieved, on average, six grades higher across their core eight subjects used to calculate Attainment 8. We also know that a greater proportion of participants achieved a 9-4 pass in English and Maths, by +13 percentage points. We now know that this difference cannot be attributed to a higher baseline level of attainment. Rather, participants had 'further to travel' in terms of their attainment having started from a lower level at Key Stage 2 when compared with non-participants.

Although this result is reassuring, the lack of precise comparability between the two groups does make measuring the effect size of participating in the Inspiring Minds intervention on Key Stage 4 attainment more difficult. In our analysis, participants achieved six grades higher than non-participants but this difference is likely to have been higher still if participants and non-participants had been more closely matched on their prior attainment.

Progress 8 scores for participants and non-participants were compared to help compare Attainment 8 scores that had already been contextualised with prior attainment level by the Department for Education. However, some students in our sample were not included in Progress 8 calculations and as a result we cannot be certain that those in the two groups with scores to compare were comparable (i.e. the participant and non-participant groups may not have been similar in other characteristics when we remove those for whom Progress 8 scores were not available). The very similar Progress 8 scores (participants = 0.05 and non-participants = 0.03) should therefore be interpreted with caution.

**Research Question 2:** Do Inspiring Minds participants achieve higher Key Stage 4 attainment in Maths than a matched comparator group of similar non-participants?

Next we examine whether participating in Inspiring Minds can lead to improved levels of attainment in particular subjects. The activity has a STEM focus and so first we examine the impact on Maths.

Participants of Inspiring Minds were more likely to achieve a 9 to 4 pass in Maths (64%) than the non-participant group (38%), a difference of +26 percentage points. This result was statistically significant at  $p < .05$  using a chi-square test. This finding is even more indicative of an impact in light of the lower prior attainment levels of participants when compared with non-participants that we have already observed.

The pass mark in Maths was then extended to 9-5 to examine whether participants were more likely to achieve this stronger pass level than non-participants. Our analysis found that participants were no more likely to achieve a 9 to 5 pass in Maths (25%) than the non-participant group (27%). This suggests that improvements in Maths attainment were traced to raising the Maths grade from a 3 to a 4. This is supported by mean Maths grades which were 4 for the participants group and 3.6 for the non-participant group. However, the mean difference was not statistically significant and this is likely due to the larger number of students in the participant group who achieved a stronger pass (5 or higher), perhaps due to their higher levels of prior attainment.

**Research Question 3:** Do Inspiring Minds participants achieve higher Key Stage 4 attainment in Science subjects than a matched comparator group of similar non-participants?

Continuing with our investigation into the impact of participating in Inspiring Minds on specific STEM subject, we next examine attainment in Science subjects. Our analysis found that participants were more likely to achieve a 9 to 4 pass in Science (32%) than the non-participant group (24%), a difference of +8 percentage points. However, this result was not statistically significant.

The proportion achieving at least a grade 4 pass in Science in both groups was low. Only 32% of participants achieved at least a grade 4 in Science, compared with 55% in English and 64% in Maths. This is supported by the mean Science grade which is less than 4 for both groups (3.7 for participants and 3.5 for non-participants), compared with a mean grade of 4 in both Maths and English for participants.

Although it would have been a more positive result for the programme evaluation to find a statistically significant improvement in Science attainment, the low levels of attainment are perhaps an indication of the successful targeting of this STEM activity towards schools and pupils with low science capital.

Furthermore, as already discussed, a lack of statistical significance is not surprising in this context where sample sizes are small and jumps in grades may be insufficiently sensitive to pick up the marginal gains on attainment of participating in outreach activities.

**Research Question 4:** Do Inspiring Minds participants achieve higher Key Stage 4 attainment in English subjects than a matched comparator group of similar non-participants?

Finally we examine the impact on English attainment, this is a combined grade for English language and English literature. Although not a STEM subject, participants are required to write up their STEM project in a report and so develop their writing skills as part of the programme.

Our analysis found that participants were more likely to achieve a 9 to 4 pass in English (55%) than the non-participant group (46%), a +9 percentage point difference. Similarly, participants were more likely to achieve a 9 to 5 pass in English (34%) than the non-participant group (27%), a +7 percentage point difference. However, neither of these results were not statistically significant.

### Limitations and Recommendations for Further Analysis

Next we discuss the limitations of this evaluation and give suggestions for improvements which could be incorporated into future analysis.

**Limitation 1:** The lack of certainty around whether the underlying motivation levels were similar between participants and non-participants.

The heavily targeted nature of this activity means that a comparison group is not as readily available as it would be for an over-subscribed activity for example. Although CCCU were in a privileged position with access to a large volume of baseline data, we knew little about their underlying attitudes and motivations.

**Recommendation:** Collect attitudinal data reflecting students' motivation to attend activities for both participants and non-participants.

It may also be useful for future evaluations to assess whether there is any additional impact of participating in Inspiring Minds on exam attainment over a less intensive Mentoring programme. This is more relevant for future cohorts of Inspiring Minds participants who, it is planned, will also benefit from Mentoring in addition to their Inspiring Minds six week Saturday programme.

**Recommendation:** Explore designing an evaluation whereby participants of the new Inspiring Minds plus Mentoring programme are compared with participants who only take part in the Mentoring programme. Critically, participants from both groups should be selected or targeted in the same way to ensure underlying motivation and engagement was similar. This would include engaging similar schools and employing similar student eligibility criteria. Baseline attitudinal data should also be collected for both groups, and used in the matching process.

It should be noted that as this would compare participating in Inspiring Minds plus a Mentoring programme with participating in only a Mentoring programme, any effect size would be lower than when comparing participants with students who had not taken part in any outreach at all.

**Limitation 2:** The lack of similarity in prior attainment between participants and non-participants

For future evaluations we need to find a comparator group that is more closely matched on prior attainment. This is very difficult as Providers do not have access to that data at student-level. An alternative could be collecting from the students when they engage in the activity, or their schools, but this would need to be done for both participants and non-participants and this is not easy to negotiate, especially for non-participants.

A further complexity here is that the most recent prior attainment stage is Key Stage 2, exams taken at the end of Year 6, the results of which are not commonly known by students themselves. Predicted grades are an alternative, although accuracy of predictions is known to vary amongst schools.

**Recommendation:** There is no immediately obvious solution to this issue and we would welcome ideas from the Sector on how to control for prior attainment when examining impact on Key Stage 4 attainment.

## Conclusions

This analysis provides evidence that strongly suggests the Inspiring Minds programme can contribute to increases in the Key Stage 4 attainment of those who participate. Higher levels of Key Stage 4 attainment were observed amongst participants when compared with the matched group of non-participants, in spite of their lower prior attainment at Key Stage 2.

However, the lack of statistical significance means that we cannot be certain that the improved attainment observed of the participants in this analysis did not occur by chance. The difficulties of achieving statistical significant in the context of attainment-raising outreach activities has been discussed. However, including additional data for subsequent cohorts may help increase the statistical power needed for a statistical significant result.

In light of the limitations associated with this evaluation, we conclude this to be a strong Type 2 evaluation according to the OfS's Standards of Evidence (OfS, 2019). Incorporation of the recommendations above would help achieve a Type 3 standard, capable of making causal claims.

## References

Baker, W., Sammons, P., Siraj-Blatchford, I., Sylva, K., Melhuish, E. C., & Taggart, B. (2014). Aspirations, education and inequality in England: Insights from the effective provision of pre-school, primary and secondary education project. *Oxford Review of Education*, 40(5), pp. 525–542.

Crawford, C. (2014) *The link between secondary school characteristics and university participation and outcomes*, London: Department for Education.

Department for Education (DfE) (2020) Performance Tables – Final Key Stage 4. Available at: <https://www.compare-school-performance.service.gov.uk/download-data>

Harrison, N., Vigurs, K., Crockford, J., McCaig, C., Squire, R. and Clark, L. (2018) Understanding the evaluation of access and participation outreach interventions for under 16 year olds. Full research project report. Available at: [https://www.officeforstudents.org.uk/media/a8ad5c94-7a33-4b53-8f09-824d0705f073/ofs2018\\_apevaluation.pdf](https://www.officeforstudents.org.uk/media/a8ad5c94-7a33-4b53-8f09-824d0705f073/ofs2018_apevaluation.pdf) (Accessed 18/06/2019).

Office for Students (OfS) (2019) Access and participation standards of evidence. February 2019. Available at: <https://www.officeforstudents.org.uk/media/6971cf8f-985b-4c67-8ee2-4c99e53c4ea2/access-and-participation-standards-of-evidence.pdf>



Office for Students (OfS) (2020) *Regulatory Notice 1 Access and participation plan guidance*. OfS publication reference OfS 2020.25. Available at: <https://www.officeforstudents.org.uk/media/ee5a189a-2ed1-4345-803e-e02d38384025/regulatory-notice-1-guidance-may-2020.pdf>

Strand, S. (2014) Ethnicity, gender, social class and achievement gaps at age 16: intersectionality and 'getting it' for the white working class, *Research Papers in Education*, 29(2), pp. 131-171

Sullivan, A, Parsons, S., Wiggins, R., Heath, A. and Green, F. (2014) Social origins, school type and higher education destinations, *Oxford Review of Education*, 40(6), pp. 739-63.

Sylva, K., Melhuish, E., Sammons, P., Siraj, I and Taggart, B. (2014) *Students' educational and developmental outcomes at age 16. Effective Pre-school, Primary and Secondary Education (EPPSE 3-16) Project*. Department for Education Report. Available at: <https://www.ucl.ac.uk/ioe/research/pdf/16-educational-Developmental-Outcomes-RR.pdf> (Accessed: 08/10/2018)

## Appendix

### Appendix 1: Summary of statistical significance tests

	Participants	Non-participants	Difference between the groups	Difference Test and p-values
Number in each group	n=50	n=50		
Average Attainment 8	40.1	34.2	+6 grades*	The 1 tail T-Test p-value is .0614807. Not significant at $p < .05$ but significant at $p < .10$
Achieved a 9-4 pass in English and Maths	45%	32%	+13 p.p.	The chi-square statistic is 1.6207. The p-value is .202996. Not significant at $p < .05$ .
Achieved a 9-5 pass in English and Maths	20%	20%	0 p.p.	The chi-square statistic is 0. The p-value is 1. Not significant at $p < .05$ .
Achieved a 9-4 pass in Maths	64%	38%	+26 p.p.**	The chi-square statistic is 6.1304. The p-value is .013287. Significant at $p < .05$ .
Achieved a 9-5 pass in Maths	25%	27%	-2 p.p.	The chi-square statistic is 0.0545. The p-value is .815422. Not significant at $p < .05$ .
Mean grade in Maths	4.0	3.6	+0.4 grade	The 1 tail T-Test p-value is .1763357. Not significant at $p < .05$ or at $p < .10$

Achieved a 9-4 pass in English	55%	46%	+9 p.p.	The chi-square statistic is 0.6812. The p-value is .409188. Not significant at $p < .05$ .
Achieved a 9-5 pass in English	34%	27%	+7 p.p.	The chi-square statistic is 0.4488. The p-value is .502902. Not significant at $p < .05$ .
Mean grade in English	4.0	3.9	+0.1 grade	The 1 tail T-Test p-value is .3446200. Not significant at $p < .05$ or at $p < .10$
Achieved a 9-4 pass in Science	32%	24%	+8 p.p.	The chi-square statistic is 0.8507. The p-value is .35636. Not significant at $p < .05$ .
Achieved a 9-5 pass in Science	11%	5%	+6 p.p.	The chi-square statistic is 0.5465. The p-value is .459747. Not significant at $p < .05$ .
Mean grade in Science	3.7	3.5	+0.2 grade	The 1 tail T-Test p-value is .3273352. Not significant at $p < .05$ or at $p < .10$