

Science Stars

2019/2020 Evaluation



Part 1: Introduction

About the Organisations	03
Executive Summary	04
Evaluation Design	05

Part 2: Academic Outcomes Evaluation

Mock Examination Analysis	06
GCSE Examination Analysis	09
Combined Findings and Analysis	10

Part 3: Non-Cognitive Outcomes Evaluation

Outcome Measures and Design	11
Results summary	12

Part 4: Process Evaluation Analysis

Participant Feedback Summary	13
Student Ambassador Feedback Summary	15

Part 5: Summarised Findings

Conclusion	20
------------	----

Appendix	21
----------	----

About the Organisations

St George's is an independent medical university, affiliated with the University of London. With a strong historical commitment to widening participation activities, St George's is now increasingly working across the whole student lifecycle to support students from under-represented backgrounds. This year, St George's has piloted the first project focused specifically at school-based activities to raise attainment, the Science Stars programme.

ImpactEd is a not-for-profit organisation that exists to improve pupil outcomes by addressing this evaluation deficit in education. ImpactEd works in partnership across the education sector to support high-quality monitoring and evaluation that informs decisions about what will work most effectively to support students. Their work in access and widening participation has included evaluation projects with The Brilliant Club, Nesta and Leeds Beckett University among others.

Programme Overview

Science Stars is a sustained tutoring intervention designed to support Year 11 students to prepare for GCSEs and ultimately increase their attainment in Science. The programme is delivered by Student Ambassadors – current students at St George's, University of London – following a pre-designed curriculum developed by a former Science teacher.

The programme aims to improve educational outcomes in GCSE Science for target students in Year 11. The key aims and objectives of the programme for participating students are as follows:

- Increase student understanding of the expectations of their GCSE Science examinations by in a range of topics
- Provide practice opportunities for students to develop the skills to support them to successfully answer examination questions
- For students to improve their ability to think explicitly about their own learning
- For students to extend their revision repertoire

Executive Summary

This report provides an overview of the evaluation process and findings from the Science Stars tutoring intervention to assess changes in participant science attainment. The programme was evaluated through a baseline and endline analysis of participant attainment in Science on mock and GCSE examinations, and data was compared with a matched control group to gather robust insights. Several non-cognitive outcomes such as metacognition, self-efficacy and test anxiety was also measured through a pre/post survey design.

Findings from the evaluation indicate positive improvements in attainment outcomes for Science Stars participants compared to the control group on both mock examinations and GCSE final results. Science Stars participants demonstrated an overall grade increase of 0.67 at statistically significant levels on their mock examinations compared to the control group. Similar trends are also sustained in their Combined Science GCSE examination results with 0.98 grades additional progress compared to pupils in the control group. In addition, significant progress is also observed in participant attainment between baseline and endline testing.

A similar positive trend is also observed across all non-cognitive outcomes with participants reporting a 10% increase in self-efficacy, 8% increase in metacognition and a 10% decrease in test anxiety which are all closely linked to improvements in academic outcomes as well. However, it must be noted that post-survey data was limited, and analysis is built on a very small sample. Thus, the results must be read with caution.

In addition to quantitative data on academic and non-cognitive outcomes, a process evaluation was conducted to understand the impact of the programme on participants and student ambassadors, and their overall experience. The key insights gathered from the qualitative feedback suggests that almost all participants would not change anything about the programme and over 70% reported the programme improved their attitudes toward science. In addition, feedback from student ambassadors suggest that the programme this year has significantly improved in terms of design, delivery, and training thus improving overall experience of participants and student ambassadors.

The overall positive trends observed are particularly reassuring considering the disruptions brought on by COVID-19

Evaluation Design

The evaluation had a combined focus. As well as looking at impact on science attainment, this evaluation also paid attention to non-cognitive outcomes with predictive validity i.e. which have been shown to be with associated improvements in long-term outcomes such as well-being, academic achievement, and employment destinations. Alongside academic achievement, there is evidence that these skills - such as metacognition and self-efficacy – can be particularly important in closing disadvantage gaps (Gutmann & Schoon, 2013).

In terms of specific outcomes, we have considered the following:

- Science attainment data using school administered mock examinations
- Science attainment data using final GCSE results
- Pre/post assessment using validated questionnaire measures to measure student attitudes and perceptions for meta-cognition, self-efficacy and test anxiety.

The evaluation used a control group design to better isolate the impact of the Science Stars programme beyond simply comparing pre-programme and post-programme data.

As pupil selection was conducted by the school and through a voluntary sign-up process, a randomised control group design was not possible. As such, we used a matched control group consisting of students not participating in the Science Stars programme who were within the same set as participants, to control for prior attainment.

Some important caveats for this evaluation design are worth noting:

- As the control group was not randomised, there may be unobservable characteristics affecting performance beyond prior attainment. For example, Science Stars participants may be more motivated in general or likely to study harder than their peers independent of the programme itself
- Given that the programme is currently being run only in one school, the overall sample size for both participants and the control group is small. As such, results may not be immediately generalisable to other school contexts.
- Due to disruptions brought on by COVID-19, pupils were awarded their centre assessment grades which means that the final data is more positively biased. Therefore, any final comparison data must be read with this consideration in mind.

Notwithstanding these points, the design approach allows us to make relatively robust inferences within these constraints by collecting a range of datapoints to triangulate findings and assess if there was a common pattern across indicators.

Part 2: Academic Outcomes Evaluation

Mock Examination Analysis

The data for the mock examination analysis was provided by Ernest Bevin College. Baseline data was from mock examinations taken in November 2019 – relatively early in the programme – and is compared with interim data from mock examinations taken in March 2020. Two caveats should be noted here:

- As the programme had already commenced at the time at which baseline data was collected, if earlier sessions had an outsized effect the baselines might be slightly distorted. However, any such effect should be relatively minor.
- There is majority, but not complete, overlap between the content tested in the March mock examination and that covered by the Science Stars programme at this point.

The primary outcome considered in the mock examination analysis is relative progress between the two assessment points for Science Stars participants compared to the (matched) control group. Analysis has been split out into two categories: participants that took Foundation papers, and participants that took Higher papers. This is because any change in overall mark for the former group will correspond to a smaller change in overall grade than will be the case for the latter group. The sample size for Triple students was too small to conduct analysis (n=2, 1 participating group and 1 control group), so results for these students have been omitted from the analysis.

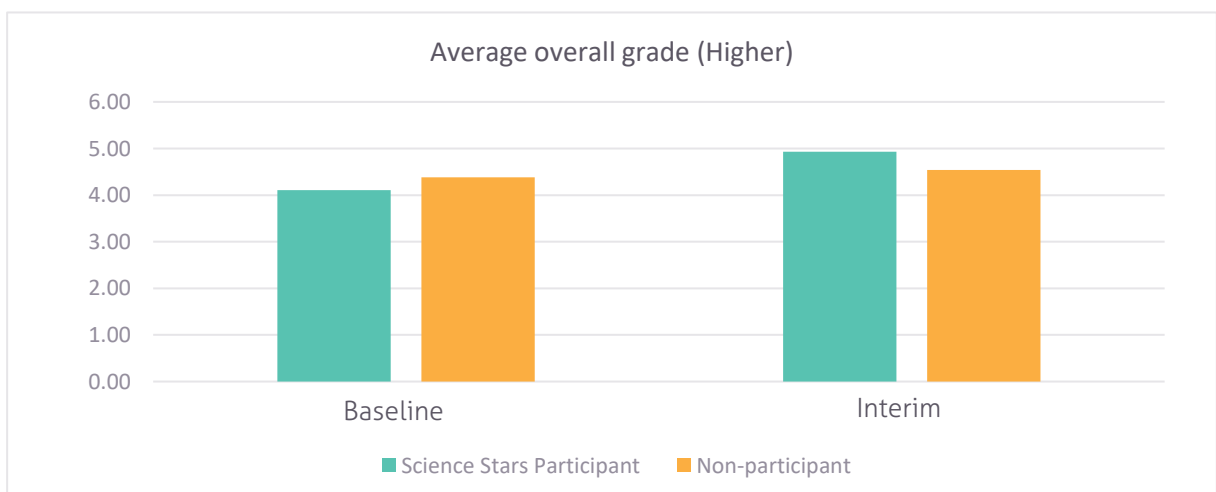
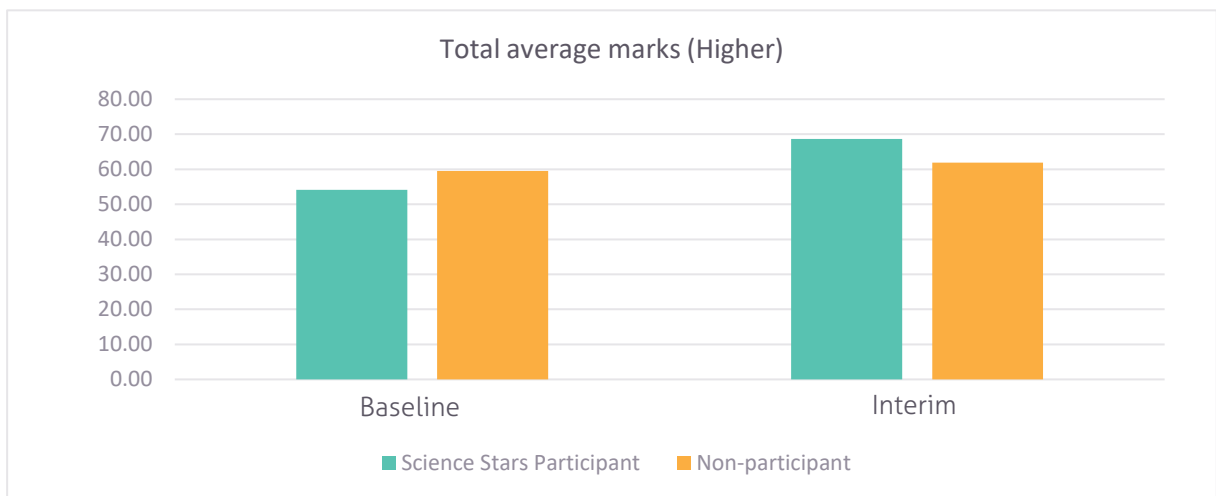
The overall sample size is small and so results should not be taken as generalisable to the overall population or to other students that may participate in the Science Stars programme in the future (n=34, of which 17 are Science Stars participants and 16 are in the non-participating control group). However, the results do reflect the experiences of these specific students and so may be taken as valid in this context.

We used parametric methods (two-sample t-tests) on the data to see if findings were statistically significant – that is, to see if we could rule out the possibility that any observed difference between the participating and control group was down to chance.

Mock Results Summary - Higher papers

When comparing progress made between Science Stars participants and the control group:

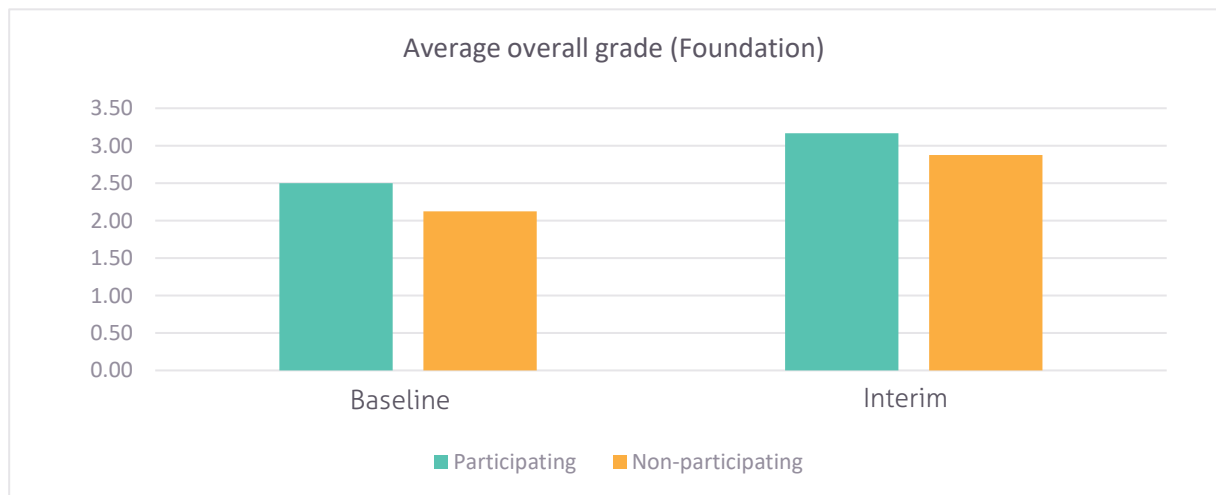
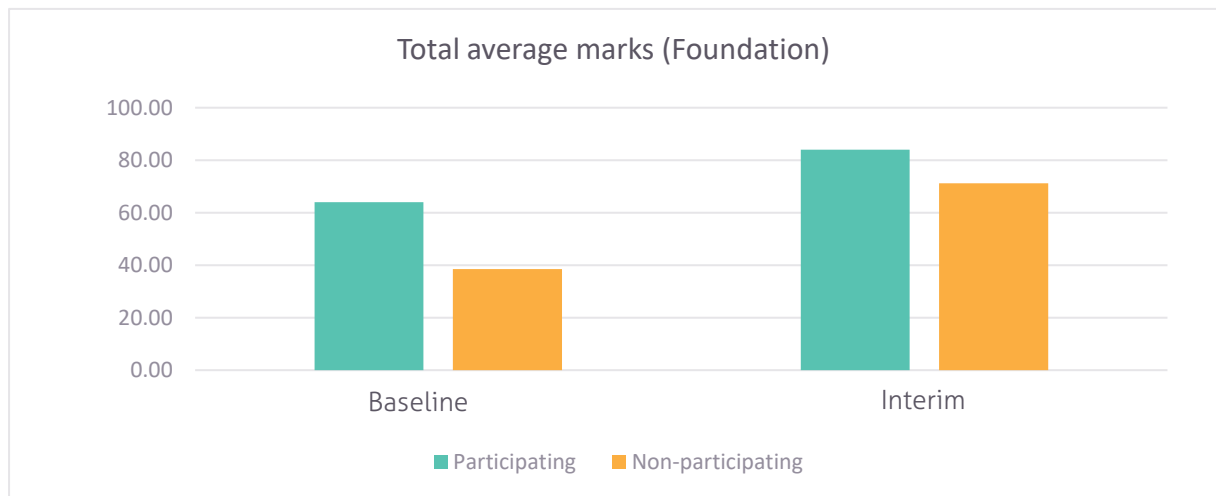
- Science Stars participants taking Higher papers showed **greater levels of progress on average** when compared to control group students taking Higher papers. Participation was associated with **greater progress in terms of total mark across all papers (on average 12.1 additional progress) and overall grade (on average 0.67 grades additional progress)**. Both results were statistically significant (for total marks, $p=0.009$; for overall grade, $p=0.008$).
- **In Physics**, Science Stars participants who took Higher papers showed on **average 4.7 marks and 0.67 grades greater progress** between the November 2019 and February 2020 mock examinations in comparison to the control group. The greater progress in terms of average marks was a statistically significant result ($p=0.04$).
- **In Biology** participation in Science Stars was associated with increased progress in Higher papers compared to the control group. On average, this was equivalent to **3.1 marks or 0.36 grades**. However, as these results were not statistically significant, we cannot rule out the possibility that they occurred due to chance.
- **In Chemistry**, participation in Science Stars was associated with **an additional 4.3 marks or 0.87 grades of progress in Higher papers** compared to the control group. The greater progress in terms of average grade was a statistically significant result ($p=0.03$).



Mock Results Summary - Foundation papers

Science Stars participants taking Foundation papers showed considerably different results to their peers taking Higher papers, showing **smaller amounts of progress** in comparison to the control group in terms of both total mark across all papers (on average 12.75 marks lower progress) and overall grade (on average 0.08 grades lower progress).

However, these results **were not statistically significant**, so may have occurred due to chance. In addition, the sample size for pupils that took Foundation papers was much smaller (n=7, 3 of which were Science Stars participants and 4 of which were in the non-participating control group), so our analysis in this category is less reliable.

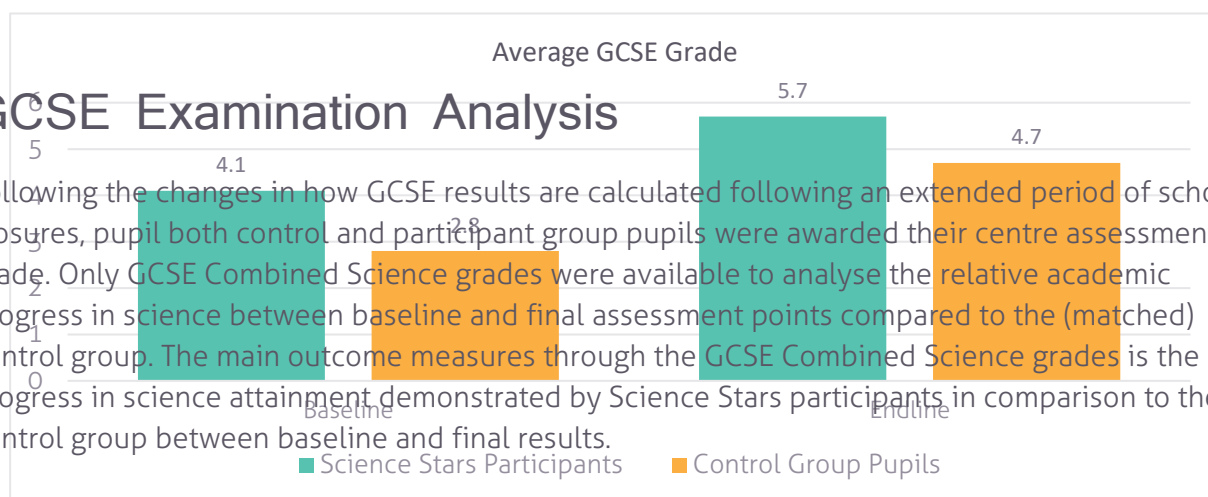


Overall results from mock examination indicate promising evidence of impact, particularly for students taking Higher papers. The positive trends observed for this group indicate that progress to date is in line with the aims and objectives of Science Stars. Interestingly, the statistically significant results for Physics mirror those found in the 2018-19 mock examination analysis, indicating that impact for this subject is consistently substantively positive.

A breakdown of the data by subject can be found in the Appendix.

GCSE Examination Analysis

Following the changes in how GCSE results are calculated following an extended period of school closures, pupil both control and participant group pupils were awarded their centre assessment grade. Only GCSE Combined Science grades were available to analyse the relative academic progress in science between baseline and final assessment points compared to the (matched) control group. The main outcome measures through the GCSE Combined Science grades is the progress in science attainment demonstrated by Science Stars participants in comparison to the control group between baseline and final results.



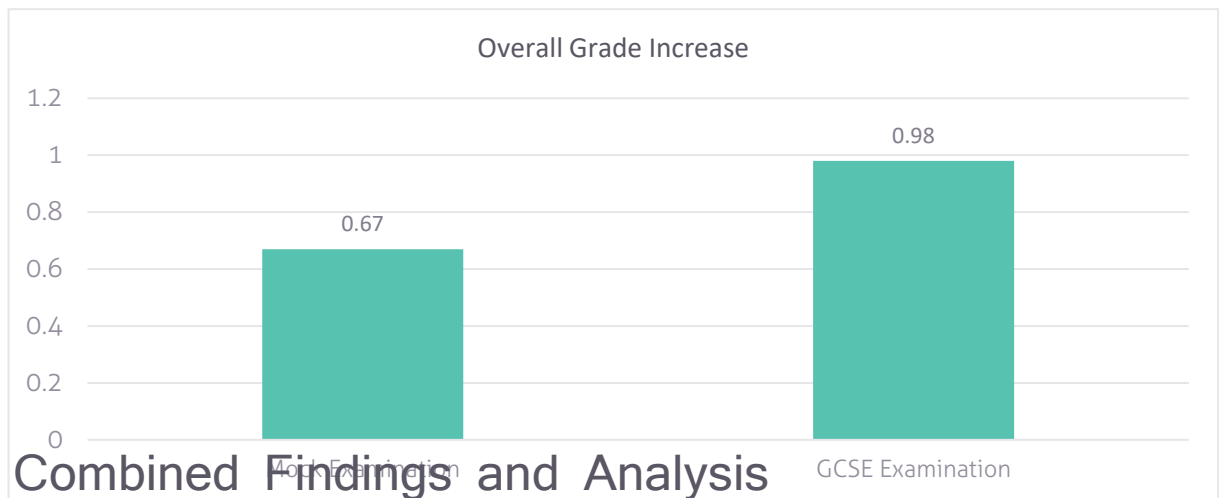
We also used parametric methods (two-sample t-tests) on the data to see if findings were statistically significant – that is, to see if we could rule out the possibility that any observed difference between the participating and control group was down to chance.

The overall sample size is small and so results should not be taken as generalisable to the overall population or to other students that may participate in the Science Stars programme in the future (n=56, of which 17 are Science Stars participants and 39 are in the non-participating control group). However, the results do reflect the experiences of these specific students and so may be taken as valid in this context.

Results Summary

When comparing progress made between Science Stars participants and the control group:

- Science Stars participants showed significantly **increased levels of improvement** in their combined science grades on average from baseline. Participation was associated with increased final grade (on average 1.5 grades additional progress) and participants saw a **37% increase in their grades** from baseline. However, the results were **not statistically significant** (for overall average grade, $p=0.07$).
- On average, Science Stars participants demonstrated **0.98 grades additional progress compared to pupils in the control group**. However, the distance travelled between baseline and endline for pupils in the control group was 1.9 grades additional progress compared to additional progress of 1.5 grades for Science Stars participants. This is associated with the fact that pupils in the control group started with a lower baseline grade compared to Science Stars participants, hence statistically the change observed is greater for pupils in the control group. Please refer to the graph below summarising the average overall grade change between baseline and endline for Science Stars participants and control group participants
- When comparing set targets for each Science Stars participant, **67% pupils reached their target grades, 33% exceeded their target and 94% of pupils got a grade of 5 or higher**. In comparison. Only 21% of pupils in the control group met their target results, and 3% exceeded it with 76% of pupils who did not meet their target grade by 1 grade or more.



The findings from the GCSE examination results are consistent with Science Stars participant performance on the mock examinations with all pupils showing increased grades between baseline and final collection in comparison to the control group. The participants showed **an overall 0.98 grade increase in their GCSE results compared to a 0.67 grade increase across all mock papers** as demonstrated in the previous analysis.

However, it is important to note that due to the changes in GCSE grading this summer with centre assessed grades being awarded to students, the results have to be read with caution including the overall positive bias in final results. In addition, the changes observed between baseline and endline scores for Science Stars participants on the GCSE is not statistically significant indicating that there is not enough evidence to conclude if the changes observed occurred due to the intervention or by chance.

As the interim report highlighted, Science Stars participants demonstrated a marked improvement in both their foundation and higher papers in comparison to the control group. Similar trends are also sustained in their Combined Science GCSE examination results with a higher overall grade offering a promising picture of the Science Stars programme in improving science attainment.

Part 3: Non-Cognitive Outcomes Analysis

Outcome Measures and Design

As well as looking at impact on science attainment, this evaluation also paid attention to non-cognitive outcomes with predictive validity i.e. which have been shown to be with associated improvements in long-term outcomes such as well-being, academic achievement, and employment destinations. Alongside academic achievement, there is evidence that these skills - such as metacognition and self-efficacy – can be particularly important in closing disadvantage gaps (Gutmann & Schoon, 2013).

These non-cognitive outcomes were measured using psychometrically validated questionnaires, administered to pupils pre and post Science Stars. The evaluation followed a pre-post-test design. Pupils were assessed at the beginning (baseline collection) and end (final collection) of the programme. Collecting data at these two time points allows us to analyse the level of change over the course of the programme for each specific outcome.

Our core outcome measures for this evaluation were:

Outcome	Measurement details
Metacognition	Metacognition means 'thinking about thinking': pupils' ability to think explicitly about their own learning. It is strongly associated with academic progress and improves other skills required for learning, such as critical thinking (Flavell, 1979; Higgins et al., 2016). We measured metacognition using the Cognitive Strategies Use and Self-Regulation subscales of the Motivated Strategies for Learning Questionnaire.
Self-efficacy	Self-efficacy is a measure of pupils' belief in their ability to achieve a specific task in the future. Self-efficacy is correlated with higher academic achievement and persistence, and also contributes to pupil wellbeing (Gutman & Schoon 2013, DeWitz et. al. 2009). We measured self-efficacy using the Self-efficacy subscale of the Motivated Strategies for Learning Questionnaire.
Test Anxiety	Test anxiety is concerned with pupils' emotional responses to tests (Pintrich and De Groot, 1990). Greater levels of test anxiety can result in worse performance in exams but in some situations may be linked to increased motivation.

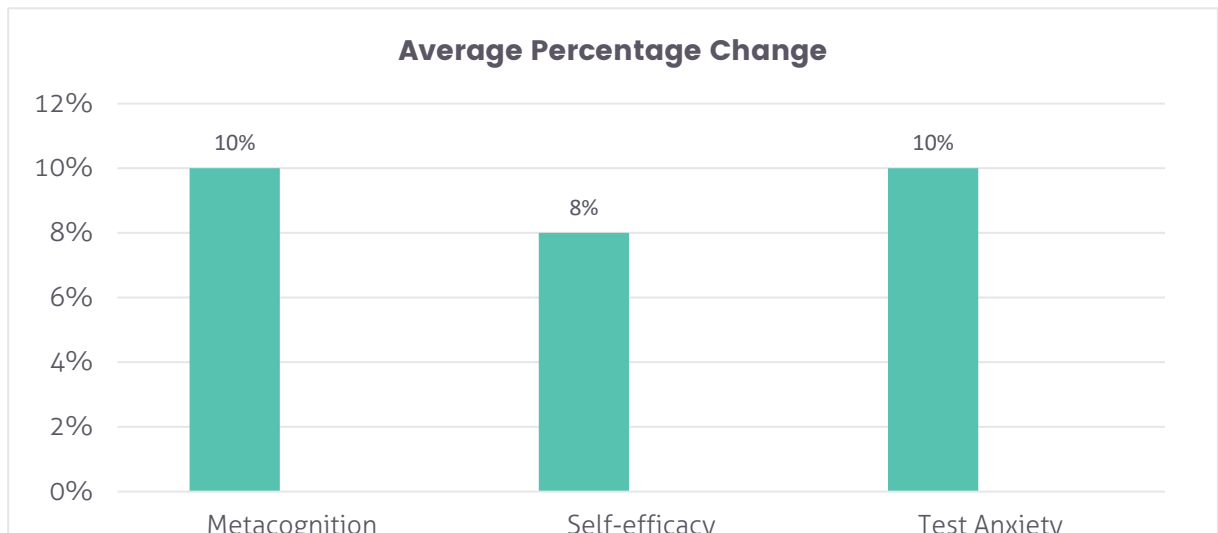
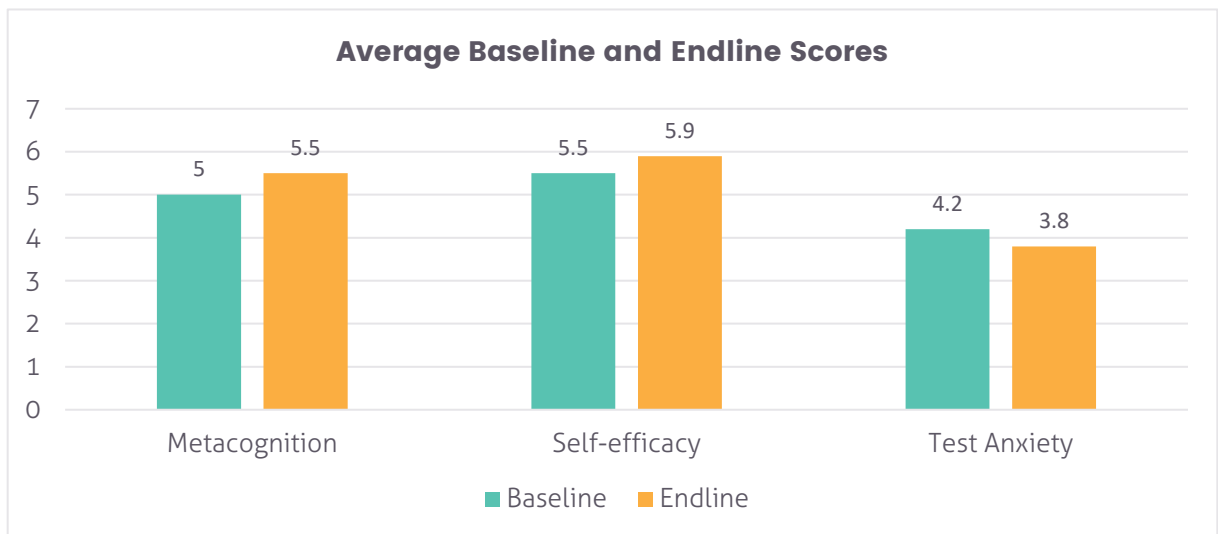
It is important to note that due to disruptions brought on by the pandemic, we received limited data on final collection with pre and post survey data available for only n=5 participants from the participating cohort of 18. Thus, the results in this section must be reviewed with caution given the small sample size of participants on which this analysis is based. As schools return to more regular collection of data, this evaluation should be supplemented by longer-term datasets.

Results Summary

- Positive changes were observed across all non-cognitive outcomes. This is particularly encouraging given that the evaluation conducted in the 2018-19 school year saw similar but slightly smaller increases. Of the three non-cognitive outcomes measured this year, most **notable improvements were seen across metacognition which increased by 10% and test**

anxiety which decreased by 10%. Self-efficacy also saw an 8% increase between baseline and final collection.

- In comparison to available national data on metacognition collected through a national survey during lockdown, Science Stars **participant metacognition levels are significantly higher than the national average of 3.48**. However, it must be noted that the baseline scores for Science Stars participants were higher than the national average and the sample size analysed in this study is too small to draw any concrete comparisons. Overall, the trends show a positive indication for the pupils who completed a pre and post surveys with implication for the entire cohort.



Part 4: Process Evaluation Analysis

Participant Feedback Summary

The mid-programme feedback session was held at Ernest Bevin College on the 18th December 2019. 11 of the 18 Science Stars participants attended and completed several feedback activities, as well as questionnaire (the summarised results of which can be found at the end of this

document). Findings from the feedback session are summarised here and detailed questionnaire responses can be found in Appendix B.

Pre-programme support

Feedback on the support provided to participants prior to the start of the programme was very positive. When responding to the questionnaire most participants (91%) reported that they understood what the Science Stars programme involved before signing up. The same proportion reported that they found the launch event useful.

Logistics

Participants gave positive feedback regarding the logistics of the programme. All participants agreed that the current timing of the sessions – after school on Wednesdays – works well. 91% of participants felt that the groups are the right size – the remaining 9% represents a single participant, who expressed that the groups be smaller, but added that this wasn't essential and that the current size generally works well.

Session content

Feedback on different elements of the session content was broadly positive, but more mixed than other areas of evaluation. When asked whether they enjoyed the weekly sessions, 73% of participants responded 'Yes', whereas 27% responded 'Sometimes'. No student reported that they did not enjoy the sessions.

The feedback activities allowed participants to expand on this. Two key themes were identified amongst the reasons participants gave for enjoying the sessions: the tutors' style of teaching, which was described as 'lively', 'energetic', and 'interactive'; and the opportunity to participate in 'competitive' scenarios, particularly for practicing exam technique.

Several students suggested increasing the frequency of these competitive activities to improve the programme even further. It was noted that the repetition of topics that participants have already covered in their school lessons can feel tedious and weaken enjoyment – however, it was acknowledged in other parts of the session that this is necessary to reinforce participants' understanding of science subjects.

We also asked participants whether they found the sessions useful. Verbal feedback in the session was positive, and centred around five main themes: a more engaging style of teaching and learning; the pre-tests ensuring areas of weakness were targeted; a general feeling that participants were improving their ability and understanding; the opportunity to learn more about university and listen to tutors' experiences; and improving study skills/exam technique.

This feedback was also reflected in participants' answers to questions about whether the programme made them feel more confident in their science lessons at school, to which 73% responded 'Yes'. Crucially, the one area of criticism expressed by participants in the session was that some elements of the programme are too easy. This was reflected in responses to the question of whether each session focused on areas the participants had previously found difficult – only 27% responded 'Yes', whereas the remaining 73% responded 'Sometimes'. It may be worth



The tutors' style of teaching... was described as 'lively', 'energetic', and 'interactive'.

reflecting on the pre-test method, to see if areas in need of support could be targeted more effectively.

When asked if anything could be done to improve the sessions, one participant expressed that more activities focusing on study skills and exam technique would be helpful.

Impact outside of the programme

A particularly positive finding is that 73% of participants find science more interesting as a result of Science Stars. This was reflected in participants reported future intentions. When asked in the session, most participants planned to continue to study science/a science-based subject after their GCSEs.

Most of those asked expressed ambitions to pursue scientific careers in future – although it should be noted that some participants already held these ambitions prior to the programme. The careers that participants hoped to pursue included: psychology, orthodontics, business, medicine, engineering, and becoming an aircraft pilot.

Most participants (73%) reported an intention to attend university. When asked in the session, 7 of the 11 participants expressed that they were more likely to go to university having met their Science Stars tutors. They reported feeling reassured by the fact that tutors seemed happy, enthusiastic, and had access to lots of opportunities at university. They found it helpful being able to ask questions about the university experience and receiving honest answers. Other participants were considering apprenticeships or alternative forms of employment or training following their GCSEs.

All participants reported discussing the sessions with their parents or carers 'Sometimes' (as opposed to every week).

Hopes and fears

At the end of the session, participants were asked to write one 'hope' and one 'fear' for the rest of the programme on a post-it note. The data from the activity revealed that participants are largely focused on improving their grades, with one specifying that this was in order to pursue science-related subjects after their GCSEs. Some participants were more specific than others regarding the grades they wanted to achieve/which subjects they hoped to do well in. Similarly, a universal fear among the group was failing to achieve the grades they are hoping for at GCSE. Please find the detailed findings from the activity in Appendix A.

Overall summary

Participants' responses on whether they would have liked more visits to the St George's campus were mixed. Just over half (55%) expressed that they would have liked this, whereas 35% were unsure and 9% responded 'No'. It may be that offering additional campus visits as an optional part of the programme would work well, offering the opportunity to those who would like to take it.



73% of participants find science more interesting as a result of Science Stars.

An encouraging takeaway from the questionnaire is the fact that, when asked what could be improved about Science Stars, almost every participant responded 'Nothing' or left the space blank. One participant requested more exam-style question practice. By contrast, when asked what the best thing about Science Stars was, most participants contributed their thoughts. The full range can be found in the questionnaire results at the end of this document, but included: 'the tutors'; 'that it is a different style of learning than what we do in class', and 'how you can ask anything, anytime'.

Student Ambassador Feedback

The Student Ambassador feedback session was held online on the 23rd April 2020. All six Student Ambassadors attended the session to offer reflections on their experience. They also filled in a questionnaire (the summarised results of which can be found at the end of this document). Findings from the feedback session and questionnaire are summarised here and detailed questionnaire responses can be found in Appendix C.

The Science Stars programme ran for most of the 2019/20 academic year but was cut short (with the final session being delivered in March 2020) due to the Covid-19 pandemic and associated school closures.

Before Science Stars

All Student Ambassadors reported having previous experience of teaching or tutoring young people before delivering this year's Science Stars programme. Most of those who reported previous experience had taught/tutored the GCSE Science curriculum previously. For some participants, this experience was gained when working as a tutor or volunteering at similar outreach initiatives. It is worth noting that several of the Student Ambassadors who delivered this year's Science Stars programme had also done so last year, so may have been referring to their previous experience delivering Science Stars when answering these questions.

Several Student Ambassadors cited their previous experiences of teaching and working with young people as a significant motivating factor behind their decision to participate. They wanted to gain more experience, improve their existing skills/confidence, and try out a wider variety of teaching methods. Additional motivating factors for the Student Ambassadors are elaborated on below.

Motivations for participating

As noted above, many Student Ambassadors reported a desire to expand their teaching experience as a key motivating factor behind their decision to deliver Science Stars. Several of the Student Ambassadors had delivered Science Stars last year and cited a positive experience as a primary reason for wanting to be involved again this year.



**Student Ambassadors
felt motivated to support
pupils from
disadvantaged
backgrounds**

There was also a significant focus on the background of the pupils participating in the programme. Student Ambassadors felt motivated to support pupils from disadvantaged backgrounds, and offer them access to the sort of high-quality tutoring experience that is often only afforded by students from more privileged backgrounds whose families can afford to pay for this type of provision. It was also acknowledged that Science Stars provides pupils with the opportunity to meet university students and hear about their university experiences, which might not otherwise be available for pupils whose parents/carers/families have not attended higher education. One Student Ambassador wanted to 'empower young people to take charge of their learning', whilst another wanted to 'build their confidence and ensure they reach their full potential'.

Finally, several Student Ambassadors spoke about the impact of seeing the results of the evaluation of last year's Science Stars programme. The statistically-significant finding that Science Stars participants achieved better GCSE Science grades than their non-participating peers, as well as positive results for non-cognitive outcomes (namely metacognition, self-efficacy and test anxiety), encouraged Science Ambassadors to continue to support delivery as they could do so with increased confidence that the programme was impactful.

Expectations of the programme

When asked if they felt well-prepared and knew what to expect from delivering Science Stars, Student Ambassadors offered overwhelmingly positive responses. They expressed that the training day offered at the beginning of the year was comprehensive and prepared them well. The resources provided to Student Ambassadors were also described as 'fantastic' and 'perfect', ensuring there were 'no surprises' when it came to delivering the programme.

Student Ambassadors were also asked if they had any concerns prior to delivering this year's programme. When completing the questionnaire, four of the six Student Ambassadors reported concerns regarding pupil engagement and behaviour. Two Student Ambassadors reported concerns about learning and delivering material that they were less familiar with – for example, the Physics curriculum. However, one of these Student Ambassadors reported that concerns around understanding and delivering the material were significantly reduced on receipt of the supportive resources, and that their worries did not materialise when it actually came to delivering the programme.

Experience of programme delivery

Student Ambassadors reported that the programme was generally much more organised than last year, which significantly improved their experience of tutoring. One element of this was the introduction of pre-tests which were completed by pupils before the Science Stars sessions. Student Ambassadors reported that this made their preparation much easier.

In addition, Student Ambassadors reported that the school was much more prepared for them than last year. During the previous year, Student Ambassadors had often arrived to find that teachers had not been expecting them, so classrooms needed for Science Stars were being used for detentions. Last year, Student Ambassadors had found that additional pupils had unexpectedly turned up for Science Stars sessions because they had been sent there for detention. Whilst some Student Ambassadors still experienced such misunderstandings with the school on occasion, these were generally reported to be much less frequent than last year.

Student Ambassadors also expressed that parental engagement was considerably increased this year, and that this had a powerful impact. A pre-programme day with pupils and parents/carers was added to Science Stars this year, as well as a code of conduct that was shared with parents/carers and pupils, a phone call to parents/carers, and a letter explaining why it was important for pupils to attend. This was felt to have improved pupil attendance. In addition, Student Ambassadors felt that pupils and parents/carers were much more engaged with and enthusiastic about Science Stars this year having read last year's evaluation results in the impact report.



Parental engagement was considerably increased this year... this had a powerful impact

In terms of potential improvements to the programme, one issue that came up was the mid-programme training day for Student Ambassadors which had focused primarily on teaching exam technique. Student Ambassadors felt that training on teaching exam technique would have been helpful much earlier in the programme, given that pupils were keen to improve these skills from the outset and a lot of Student Ambassadors had found themselves teaching on this already.

Some Student Ambassadors had noticed small issues with the resources – for example, some of the PowerPoint slides with questions for pupils to answer also had the answers on them. Student Ambassadors had worked together to identify errors in the resources and fix them but encouraged more effective proofreading in future.

Finally, it was reported that the pre-test marking process had been challenging given that the spreadsheet wasn't formatted in the most useful way and was generating some errors. Student Ambassadors suggested simplifying this to just have pupils' answers alongside correct answers, making the marking process easier.

Student progress

Student Ambassadors expressed that they felt pupils had made noticeable progress over the course of Science Stars, particularly regarding confidence, perseverance, and exam technique.

Some Student Ambassadors reported that towards the end of the programme they felt they were teaching pupils content for the first time – possibly because their teachers did not have sufficient time to cover some topics in class. Given that the purpose of Science Stars is to complement, rather than replace, normal class teaching, this was a challenge.

In addition, Student Ambassadors felt that pupils could benefit from more structured input on revision and learning strategies. Many Student Ambassadors had found themselves giving general advice on this, but to ensure consistency it might be helpful to include this as part of Student Ambassador training. It was also reported that, whilst pupil engagement during the sessions was good, it was difficult to encourage sustained revision habits. Some pupils seemed to perceive Science Stars attendance as a replacement for revision at home.

Finally, one of the Student Ambassadors reported adjusting the structure of their sessions to include a short test at the beginning. This covered content from previous sessions, and the Student

Ambassador who implemented this felt it had a positive impact on consolidation of learning. Other Student Ambassadors were highly positive about this idea, and suggested that a potential alteration to the programme in future could be to include regular consolidation and testing sessions – for example, extending every fourth session to include this, or running optional drop in sessions, each run by different Student Ambassadors.

Overall summary

All Student Ambassadors reported that delivering Science Stars had increased their confidence in teaching and tutoring young people. In terms of fulfilment of other motivations, all felt that they had obtained or achieved what they had hoped from being involved with Science Stars. Several Student Ambassadors expressed disappointment at the programme being cut short, as they felt they still had useful content to deliver and were looking forward to seeing the impact on pupils' exam performance.

Generally, feedback from Science Ambassadors on programme delivery was positive. There was general agreement that the programme was better organised this year, and that the additional elements of parent/carer engagement had had a particularly positive impact. The training days, resources and general support offered to Student Ambassadors was reported to be extremely helpful. Schools also seemed more prepared for Science Stars this year.

Areas for improvement focused on some small issues with the supportive resources – in particular, errors or incomplete slides that Student Ambassadors had to work together to fix. Some changes to the system for marking pre-tests were also recommended. Student Ambassadors felt that the mid-programme session content on exam technique would be better placed earlier on in the programme, and that there could be more of a general emphasis on testing and consolidation of learning to ensure sustained impact. Student Ambassadors also suggested that the addition of training on teaching learning and revision strategies would be beneficial to pupils.

Part 5: Summarised Findings

Conclusions

The results from this year's evaluation of the Science Stars program is encouraging. Overall positive trends were observed in science attainment in comparison to the control group in both mock and GCSE examination results. In addition to positive trends seen across science attainment, participants also demonstrated significant increases across all non-cognitive outcomes. The positive trends observed are particularly reassuring considering the disruptions brought on by COVID-19. It is also worth noting that overall qualitative feedback from student ambassadors and participants indicate improvements in programme delivery and outcomes this academic year compared to 2018-19.

In mock exams, Science Stars participants demonstrated a marked improvement in both their foundation and higher papers in comparison to the control group with an overall grade increase of 0.67 at statistically significant levels. Similar trends are also sustained in their Combined Science GCSE examination results with 0.98 grades additional progress compared to pupils in the control group. A potentially impressive aspect of the results is the progress demonstrated by Science Stars participants in their final GCSE results of an overall grade of 1.5 higher than their baseline scores with 67% students meeting their set result targets. However, this finding should be interpreted with some caution given that the results were not statistically significant and were determined by centre assessment grades. Another limitation was that individual subject grades were not available to conduct more intricate analysis to understand variation in subject outcomes.

The non-cognitive survey data available strengthens the case for the programme improving science attainment and related learning strategies. Science Stars participants demonstrated significant increases in their metacognition and self-efficacy skills and showed a marked reduction in test anxiety. The positive trends observed for this group indicate that progress to date is in line with the aims and objectives of Science Stars. However, the data would have been more indicative if the sample size were larger including pre and post surveys from more participants in the programme.

Finally, the qualitative data gathered from in-depth participant and student ambassador feedback also highlights the merits of the programme in offering stimulating and engaging science content to participants. 73% of students reported that they now feel more confident in their science lessons at school and the same percentage of students found science more interesting as a result of the programme. Almost all participants responded that they would not change anything about the programme. The feedback from student ambassadors on the programme also follow similar trends, with the key takeaway that significant improvement was reported in programme planning, delivery and design compared to the last academic year. Student Ambassadors agreed that the programme was better organised this year, with adequate training and that the additional elements of parent/carer engagement had a particularly positive impact.

Appendix

Appendix A: Hopes and Fears Activity Results

Hopes	Fears
<ul style="list-style-type: none"> • For Science Stars to improve my grade especially as I want to do science-based topics as a form of Further Education • To pass with a good grade • That Science Stars will help me get good grades • To do well in my GCSEs • I will discover more on certain subjects and will remember it throughout the year • To increase my grade by the end of the session • To achieve highly in Biology and Chemistry • To achieve a good grade of 5-9 in GCSEs • To achieve a 6 in science at the end of my GCSEs 	<ul style="list-style-type: none"> • Forgetting what I've learned • To fail, as it would ruin everything • To fail, even though I attended • Getting my GCSE results in future • I won't get good enough grades at the end of my GCSEs even though I went to Science Stars • I will fail and not get the grades I want • I won't achieve my grades • Despite my efforts, I still fail my GCSEs • That I will forget what I've learned

Appendix B: Participant Questionnaire Results

Question	Answers	Summary
1. Do you feel like you understood what the Science Stars programme involved before signing up?	Yes 91% Not sure 9% No 0%	
2. Was the launch event (when you came to St George's University and met your tutors for the first time) useful?	Yes 91% Not sure 9% No 0%	
3. Is after school on Wednesday a good time to hold the weekly sessions?	Yes 100% Not sure 0% No 0%	
4. Do you think the groups are the right size?	Yes 91% Not sure 9% No 0%	
4a. If not, do you think they should be bigger or smaller?	One pupil requested that the groups be smaller, but added that the current size generally works.	

5. Does each session focus on areas that you previously found difficult?	Yes Sometimes No	27% 73% 0%
6. Do you enjoy the weekly sessions?	Yes Sometimes No	73% 27% 0%
7. What is one thing we could improve about the sessions?	Most pupils responded 'nothing'! One pupil requested more opportunities to practice exam-style questions.	
8. Has Science Stars made you more interested in science?	Yes Not sure No	73% 9% 18%
9. Do you feel more confident in your science lessons in school since taking part in Science Stars?	Yes Not sure No	73% 27% 0%
10. Do you discuss the weekly sessions with your parents?	Yes Sometimes No	0% 100% 0%
11. What is the best thing about Science Stars?	Pupil responses: 'Improves understanding'; 'the tutors'; 'learning new things'; 'that it is a different style to learning than what we do in class'; 'it helps me to go over areas I have forgotten'; 'going over things I haven't learned'; 'the pre-tests and topic exams'; 'how you can ask anything, anytime'.	
12. Would you have liked to have more visits to St George's University throughout the programme?	Yes Not sure No	55% 35% 9%
13. Do you plan to attend university?	Yes Not sure No	73% 18% 9%

Appendix C: Student Ambassador Questionnaire Results

Question	Answers	
Before starting Science Stars, did you have any experience teaching or tutoring young people?	No experience	1 0%
		2 0%
	Some experience	3 17%
		4 33%
	A lot of experience	5 50%
Before starting Science Stars, did you have any experience teaching the GCSE Science curriculum?	No experience	1 0%
		2 17%
	Some experience	3 33%
		4 33%
	A lot of experience	5 17%
What were your main motivations for joining the Science Stars programme?	<p>I wanted to help disadvantaged young people and improve my teaching and communication skills. To engage young people in science. To build their confidence and ensure they reached their full potential. Enjoyment of teaching especially at such an important time for the pupils, also it helps financially whilst at university.</p> <p>Growing my experience, helping my tutees achieve more, developing my teaching skills</p> <p>Empowering young people to take charge of their learning and taking part in the programme again, as I enjoyed teaching the students last year</p> <p>Encouraging younger students.</p>	
Before starting Science Stars, did you have any concerns about delivering the programme?	<p>Yes, what the young people would be like, what kind of material I'd present, if I could commit to the time.</p> <p>Not really, as I was a tutor on it last year and so knew what to expect</p> <p>Concerns over relearning and understanding the concepts that are in the teaching especially for physics but we received the books and also the concepts were quite easy to teach as it was more about teaching the pupils exam techniques</p> <p>Whether my students would actually care about the lessons I was delivering</p> <p>Whether the students of this age group would be engaged in the programme</p> <p>Behaviour management and control</p>	

Science Stars increased my confidence in teaching and tutoring young people	Not at all true of me	1	0%
		2	0%
	Somewhat true of me	3	0%
		4	17%
	Very true of me	5	83%
I was able to deliver the GCSE Science curriculum confidently throughout the programme	Yes	27%	
	Sometimes	73%	
	No	0%	
Thinking back to your motivations for joining the programme, did these change or did they stay the same while you were involved?	Yes	73%	
	Sometimes	27%	
	No	0%	
Did you get what you hoped to out of being involved in the programme?	Yes		
	Yes. Although sadly it was cut short and therefore felt that more could have been done.		
	Yes, was very enjoyable. Would have been better if the scheme was able to carry on and the pupils say their GCSE's and we found out they're grades. Unfortunately due to the pandemic this wasn't possible.		
	Definitely. I'm much more confident in my teaching skills and it was really rewarding growing my students knowledge and confidence		
	Yes Yes, wish I could finish it		
If you had any concerns about delivering the programme, did they continue or were they resolved?	Any concerns I had were resolved		
	No concerns.		
	Resolved		
	No concerns - the students were very eager to be there so were very interested in the lessons		
	Yes Resolved		
The students I was working with appeared to improve their performance across the GCSE science curriculum	Strongly disagree	1	0%
		2	0%
	Somewhat agree	3	0%
		4	66%
	Strongly agree	5	33%
The students I was working with appeared to improve their ability to respond to the demands of written examinations	Strongly disagree	1	0
		2	0
	Somewhat agree	3	0
		4	50%
	Strongly agree	5	50%
The students I was working with appeared to improve their confidence in their ability to achieve in science	Strongly disagree	1	0%
		2	0%
	Somewhat agree	3	0%
		4	66%
	Strongly agree	5	33%

The students I was working with appeared to improve their ability to think explicitly about scientific concepts and communicate their thought processes	Strongly disagree Somewhat agree Strongly agree	1 2 3 4 5	0% 0% 17% 33% 50%
The students I was working with appeared to reduce their levels of anxiety about preparation for GCSE science examinations	Strongly disagree Somewhat agree Strongly agree	1 2 3 4 5	0% 0% 17% 50% 33%
Would any additional information/support have been useful when delivering the programme?	<p>More support with regards to the resources and editing them to fit the session.</p> <p>No all the resources provided were incredibly helpful.</p> <p>No, lots of support and resources were given. Some errors in the resources which were addressed. I felt well supported throughout the program, and having somebody I could contact with any issues was really beneficial</p> <p>Additional support in terms of the slides - as there were a lot of activities but perhaps not enough explanations for the students</p> <p>Resources were enough, well thought out.</p>		
Are there any elements of the programme that you feel could be improved? Please give details	<p>Sometimes the PowerPoints were not correct or fully completed e.g. animations, information, etc.</p> <p>Only the excel spreadsheet where we typed in their results from the weekly tests. Other than that nothing.</p> <p>N/A</p> <p>No</p> <p>The slides had a lot of mistakes in them and this caused some issues with teaching (as it did last year)</p> <p>Organisation on the schools part, school trips and room equipment</p>		
Was the training day useful/sufficient (in terms of length, content, timing etc)?	<p>Yes</p> <p>Yes- although I knew most of it before as I was a tutor on it last year, it was all essential information.</p> <p>Was very useful, could've been a little shorter.</p> <p>Definitely, and the follow up session focussing on exams was very good too but in the future I think the exam question training day would have been useful earlier in the program</p> <p>Was useful but it took a bit long - I think it could have been a bit more concise, especially since I had taught</p>		

last year too and knew nearly everything that was said
Yes, maybe a bit long but maybe because I done it last year so it felt like repetition

It would have been useful to have more contact with the Widening Participation team throughout the programme	Strongly disagree	1	33%
		2	33%
	Somewhat agree	3	33%
		4	0%
	Strongly agree	5	0%

Appendix D: Mock Examination Results Breakdown

	Biology mark		Chemistry mark		Physics mark		Total marks		Overall grade	
	Baseline	Interim	Baseline	Interim	Baseline	Interim	Baseline	Interim	Baseline	Interim
Science Stars Participant	22.00	24.36	17.07	24.14	16.23	20.14	54.14	68.64	4.11	4.93
Non-participant	21.92	21.15	19.69	22.46	17.92	18.31	59.54	61.92	4.38	4.54
Statistically significant difference in progress?	No (p=0.134)		No (p=0.053)		Yes (p=0.039)		Yes (p=0.009)		Yes (p=0.008)	

	Biology grade		Chemistry grade		Physics grade	
	Baseline	Interim	Baseline	Interim	Baseline	Interim
Science Stars Participant	4.57	4.93	3.57	5.14	3.71	4.46
Non-participant	4.38	4.38	4.38	5.08	4.31	4.38
Statistically significant difference in progress?	No (p=0.399)		Yes (p=0.029)		No (p=0.069)	

The data for students taking Foundation papers was as follows:

	Biology mark		Chemistry mark		Physics mark		Total marks		Overall grade	
	Baseline	Interim	Baseline	Interim	Baseline	Interim	Baseline	Interim	Baseline	Interim
Science Stars Participant	26.33	31.33	19.33	27.00	18.33	25.67	64.00	84.00	2.50	3.17
Non-participant	17.00	25.25	9.75	26.00	11.75	20.00	38.50	71.25	2.13	2.88

Statistically significant difference in progress?	No (p=0.681)	No (p=0.431)	No (p=0.931)	No (p=0.632)	No (p=0.892)
---	--------------	--------------	--------------	--------------	--------------

	Biology grade		Chemistry grade		Physics grade	
	Baseline	Interim	Baseline	Interim	Baseline	Interim
Science Stars Participant	2.67	3.33	2	3	2	2.67
Non-participant	2.75	2.75	1.25	2.75	1.75	2
Statistically significant difference in progress?	No (p=0.721)		No (p=0.678)		No (p=0.622)	