Intensive STEM Summer Camps
Final Impact Report

December 2022

Supported by

Goldman Sachs Gives

Delivered by

STEM LEARNING

Evaluation completed by The Charity Spark

Contents

Executive summary

Intensive STEM (science, technology, engineering and maths) summer camps were delivered at 18 schools across England during the summer of 2021 through a partnership of STEM Learning and *Goldman Sachs Gives*. The camps were designed to support students in improving their curriculum knowledge and to re-engage them with formal learning environments after the disruption of COVID-19. The camps also provided teachers with the opportunity to learn new techniques and gain CPD (continuing professional development) from experienced specialist teachers.

This report reflects on the impact of the camps after a full academic year. The camps set out to achieve the following outcomes and initially made good or very good progress towards all of them. This report now considers how sustained that progress has been and what the impact is of achieving these outcomes for young people and their schools.

For young people:

Students gain a deeper and stronger core of scientific knowledge essential to future exam success

Very good progress - **sustained**

Students re-engage with their learning in a formal classroom setting following the disruption caused by the pandemic

Very good progress - **sustained**

Students gain mental health benefits from face-to-face interaction with peers and teachers post-lockdown

Good progress - **immediate benefit at the time of camps, specific impact of camp is short term**

Very good progress in improving student confidence - **sustained**

For teachers/schools:

Teachers at schools in areas of need benefit from exposure to subject expert teachers

Good progress - **sustained**

Teachers embed this learning in their own practice, improving outcomes for all in the school

Good progress - **sustained**

The clear objectives of the intensive STEM summer camp programme combined with tailored support from the STEM Learning team created a productive and effective experience for both students and teachers.

The impact has been more evident where students who were not taking triple science or already achieving at a high level were invited to participate. This is particularly the case when looking at the impact of the camp on attainment: students on the combined sciences GCSE stream achieved a greater increase in grades compared to those taking triple science subjects.

In the initial post-camp survey:

87%
of students agreed or strongly agreed that the camp had helped improve their understanding of science

76%
of students agreed or strongly agreed that the summer camp helped them to catch up on learning they had missed because of the pandemic

82%
of students agreed or strongly agreed that the summer camp had helped them build the knowledge they need to be successful in their GCSEs or A levels

In our follow up survey of teachers at the end of the academic year 2021/22:

100%
of teachers observed that students who attended camps had significantly improved confidence when compared to their peers

100%
of teachers observed that students who attended camps had significantly improved their ability to approach exam questions when compared to their peers

75%
of teachers observed that students who attended camps had improved their practical science skills

> *You look at students who attended camp and their approach to their GCSE exams, and they are just so much more confident and secure than their peers who didn't do camp. And it's a case of, I think, a part of them realising that they did have a bit more control over their outcomes and going on the camp was a way to regain a bit of control.*
>
> **Science Teacher**

> *For the students that were within that grade five to seven boundary, who were in between grades, that's where the summer camp had the most impact in terms of their attitude to science and what they can achieve. I think what it did was show them that they could DO science.*
>
> **Head of Science**


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Introduction

About STEM Learning:

STEM Learning is a national organisation with a commitment to providing world-leading STEM education for all young people across the UK. They do this through a variety of programmes and partnerships, from delivering teacher CPD and introducing young people to role models through the STEM Ambassador programme, to providing tailored support to schools through their ENTHUSE and Enrichment partnerships.

STEM Learning collaborates with the UK government, employers of all sizes, charitable organisations, academic bodies and educational establishments to improve access to good quality STEM education for young people and their teachers.

About *Goldman Sachs Gives*:

Goldman Sachs Gives is committed to fostering innovative ideas, solving economic and social issues, and enabling progress in underserved communities globally. Through a donor-advised fund, Goldman Sachs' current and retired senior employees work together to recommend grants to qualifying nonprofit organizations to help them achieve their goals. Since 2010, *Goldman Sachs Gives* has granted more than $2 billion to 9,000 nonprofits in 100 countries around the world.

Goldman Sachs Gives has partnered with STEM Learning over a number of projects to support the mission of Goldman Sachs to provide more young people with access to excellent STEM education. A number of Goldman Sachs partners in their engineering division are STEM Ambassadors, and through their prior funding of STEM Learning's ENTHUSE Partnership programme, Goldman Sachs invests in the professional and technical development of teachers as well as supporting the Ambassador programme.

In Spring 2021, STEM Learning and *Goldman Sachs Gives* joined to develop a set of intensive STEM summer camps for selected schools across the UK. Up to 20 students at each school from either year 10 or year 12 attended the camps, which were designed to re-engage students in formal classroom-based learning after significant disruption to their time in school due to the COVID-19 pandemic in 2020 and 2021.

Charlotte Keenan, Head of the Office of Corporate Engagement International at Goldman Sachs, said: *"Goldman Sachs Gives is proud to support the work of STEM Learning. COVID-19 has caused unprecedented disruption to the teaching of children and young people across the UK, and the support these young people have received through STEM Learning's Summer Camps has been crucial in mitigating the potential long-term impacts of the pandemic. Education is essential to achieving a diverse and inclusive STEM workforce, something Goldman Sachs Gives is incredibly committed to."*

Author of this report:

Rebecca Denny is an independent evaluator and impact measurement expert. She is the founder of The Charity Spark, a consultancy to the charity and not-for-profit sector that specialises in helping organisations measure and evidence their impact. Rebecca and her team have worked on programme development and evaluation for a number of STEM education programmes in the UK. Rebecca is a full member of the UK Evaluation Society and the Chartered Institute of Fundraising, has trained with the NCVO and Charities Evaluation Service, and engages in reflective professional development practice.

thecharityspark.co.uk

The impact of COVID-19 on STEM education in the UK

The report 'Intensive STEM Summer Camps – Interim Impact Report' published by STEM Learning in December 2021 outlined the impact of COVID-19 on STEM education in the UK. Whilst there is value in continuing to consider the context within which the intensive STEM summer camps were developed and implemented, this report summarises only new and additional insights received since the interim report.

> *I think for us, success is probably linked to the fact that it was the first time myself and [NQT] had been involved in a programme like this. It elevated our expectations a little bit, and we felt if we're providing this quality product [the camp] to the kids, then our subsequent teaching also has to match that. I think that that's probably been a spur on for us teaching them this year, because they've seen quality teaching, and we're trying to use that as a benchmark for ourselves.*
>
> **Assistant Head of Science**

The impact of COVID-19 disruption for students

The effects of school closures and interrupted learning on students are far-reaching and form one of the key investigation points of the public UK COVID-19 inquiry that is underway at the time of writing this report.

A 2022 report by McKinsey & Company[1] found that even in countries with effective school systems and near-universal connectivity and device access, learning delays were significant, especially for historically vulnerable populations. This reflects the results of our qualitative research involving teachers and students at both the interim and final evaluation stages of our evaluation of the intensive summer camps programme.

Similar findings were reported by the UK government in their report '16-19 learners' experiences of the COVID-19 pandemic'[2], which also highlighted the opinions of students on recovery sessions offered to them. Small group study sessions were popular and they appreciated being back in a classroom setting.

Students were unambiguous when interviewed during STEM Learning's intensive STEM summer camps, and when surveyed afterwards, it was clear that the opportunity to be back in a classroom doing practical science and being able to directly ask questions was a positive, and enjoyable, experience.

The impact of COVID-19 disruption for teachers and schools

Recent research by King's College London[3] sought to understand the impact of the pandemic on trainee and newly qualified teachers at secondary level. They identified that continuing professional development opportunities were motivating factors for teachers remaining in the profession. Such opportunities were particularly important for teachers who trained during the pandemic and therefore had limited opportunities to shadow experienced teachers in person.

These findings reiterate the importance to teachers, and schools, of STEM Learning's intensive STEM summer camps in providing vital, relevant CPD which improves the confidence and wellbeing of the teachers, as well as ensuring outcomes are achieved for students beyond the summer camp group.

Response from STEM Learning and *Goldman Sachs Gives*

STEM Learning and *Goldman Sachs Gives* responded to the need created by education disruption due to COVID-19. They created a programme which provided STEM support to schools affected by the pandemic.

The intensive STEM summer camps were developed to provide positive outcomes for both students and teachers (explored more on page 12) through the content delivered by external specialist teachers. Each school was chosen through careful consideration of the demographic and regional data available to STEM Learning, working closely with Goldman Sachs' partners to select priority regions.

Schools were invited to participate through STEM Learning's national network. Programme coordinators then worked closely with them to tailor the summer camp to the needs of the students at each school.

> *We haven't been in a lab for nearly two years! This is brilliant*
>
> **Year 10 Student**

> *We are grateful for this generous support from the Goldman Sachs Gives programme. It is enabling the STEM Learning team to deploy its evidence-led, quality assured approach in developing these tailored summer camp interventions for schools around England.*
>
> *Young people need every support in raising their aspirations and attainment, and we are deeply committed to our vision of a world-leading STEM education for all young people, to inspire lifelong engagement with STEM subjects and build a strong and diverse STEM sector.*
>
> **Yvonne Baker OBE, Chief Executive of STEM Learning**

The intensive STEM summer camp model

Map pins point to approximate locations of the camps, with numbered pins indicating locations where more than one camp ran in the region.

The selection of schools

STEM Learning worked closely with *Goldman Sachs Gives* to identify key locations which would be the focus for the summer camp programme. Within these locations, schools were selected where there was a significant need. This was determined through analysis of socioeconomic data, including student demographic and nationally published deprivation data as well as average GCSE attainment for the 2019 examination period, and by drawing on the expertise of regional staff members who hold specialist local knowledge.

In total, 18 schools were selected nationally.

What data was gathered?

For each school, an initial dataset* was formed.
This included:

- percentage of students eligible for free school meals ** at the school
- percentage of students eligible for free school meals on average in that region
- analysis of ethnic diversity***
- percentage of students achieving a pass grade in combined science**** at GCSE in 2019
- percentage of students achieving a pass grade in triple science at GCSE in 2019 at schools where triple science was offered

*Data presented was for the 2020/21 academic year
**FSM is often used as an indicator for socioeconomic disadvantage
***Ethnic diversity was determined through use of the government's accepted aggregated groupings
****Every GCSE student in England should take at least two GCSEs in science - usually by taking either combined science (sometimes known as 'double award') or the separate sciences (often referred to as 'triple science')

The design of the camps

The camps were designed to provide support to a specific, targeted cohort of up to 20 year 10 or year 12 pupils. Over a three-day period, expert experienced teachers delivered intensive practical science lessons in physics, chemistry and biology. The facilitating teachers worked closely with the school's own science teachers to determine the course content, allowing the school to flex the delivery of the lessons to best meet the needs of their students. This enabled content to be focused on areas of missed study, core practicals required for exams and exam question technique.

Each camp was designed to run for three full days (following typical school day timings), although some schools did adapt this to suit their own needs and fit into existing summer holiday provision (this is discussed later in this report on page 27. It was suggested that each day was dedicated to a different subject, eg biology on day one, chemistry on day two and physics on day three.

The camps were designed to maximise time spent on practical science. This provided a much-needed opportunity for students to practise experimental techniques that were particularly hard to deliver during the pandemic.

A teacher from the school was encouraged to shadow the camp each day, providing an opportunity to engage in their own professional development as well as continuity for the students in attendance.

In addition to the three days of science learning, schools were also invited to plan a STEM careers session into the summer camp timetable. For some schools this was a video call with STEM Ambassadors to talk about their careers and enable the students to ask questions. For other schools this took a different form, including having visitors attend the school to spend time with the students.

Outcomes of the camps

STEM Learning identified a specific set of outcomes that the camps intended to achieve for students, teachers and schools.

For young people

Outcome 1 - Students gain a deeper and stronger core of scientific knowledge essential to future exam success

Outcome 2 - Students re-engage with their learning in a formal classroom setting following the disruption caused by the pandemic

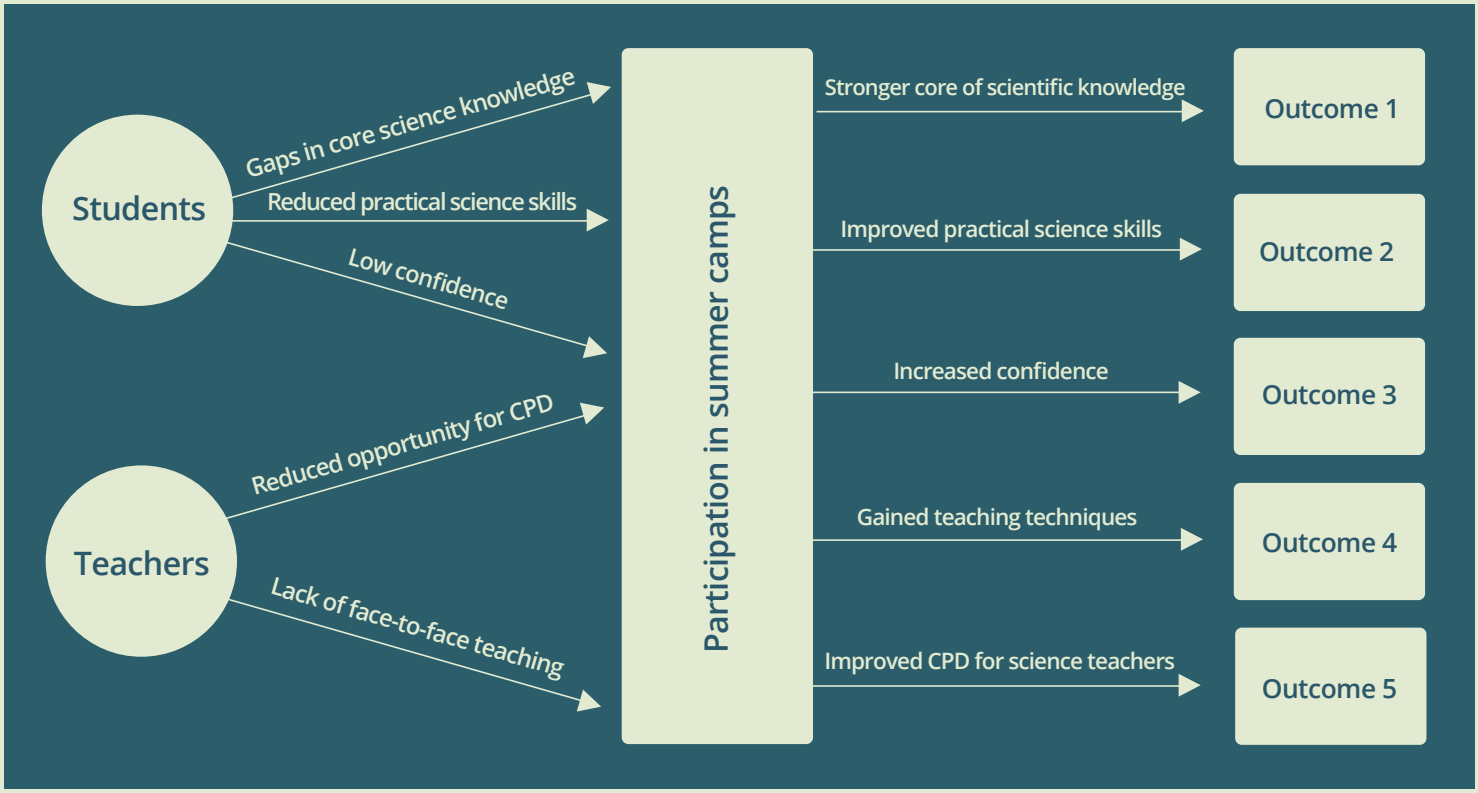
Outcome 3 - Students gain mental health benefits from face-to-face interaction with peers and teachers post-lockdown

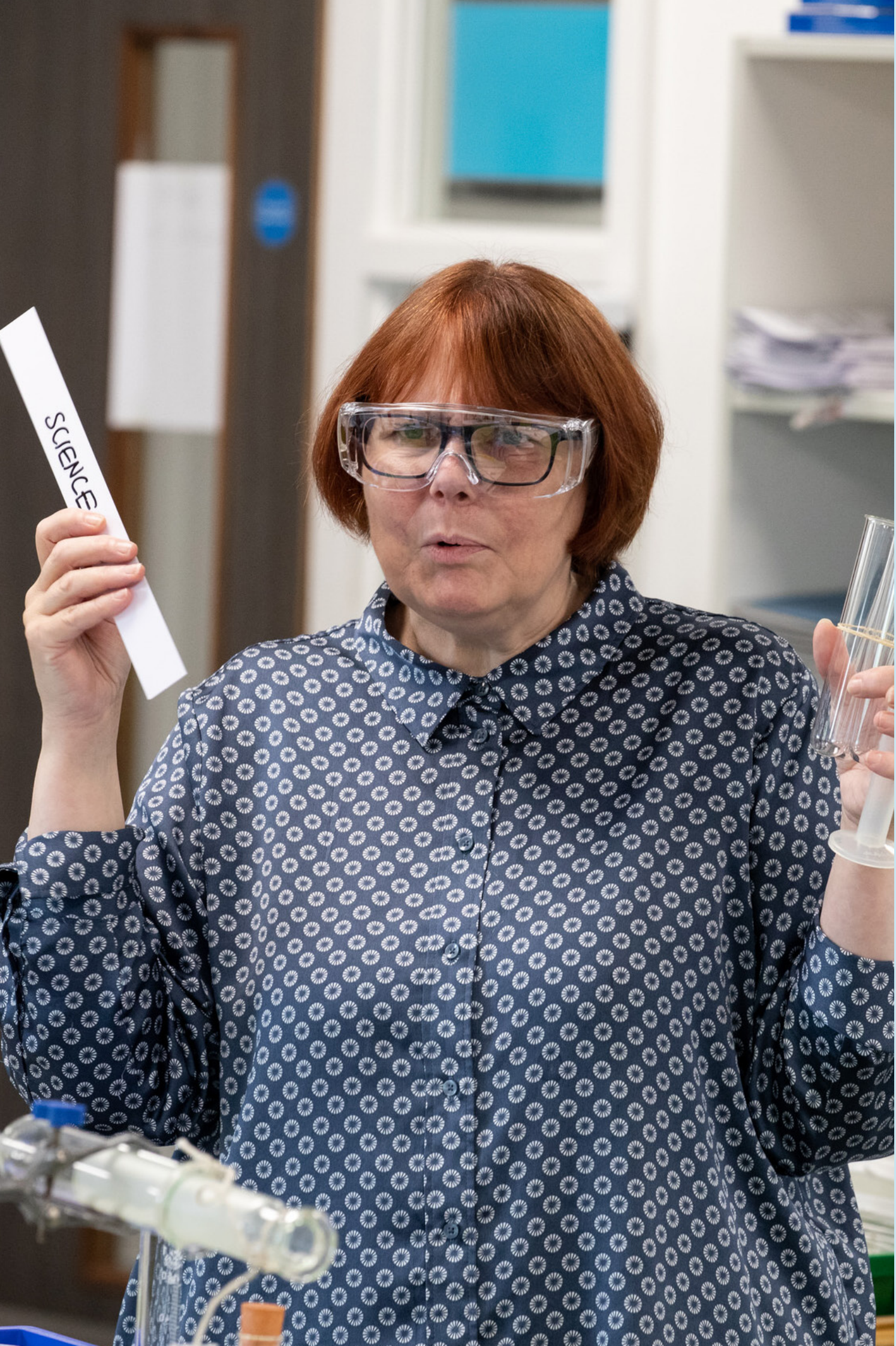
For teachers and schools

Outcome 4 - School teachers at schools in areas of need benefit from exposure to subject expert teachers

Outcome 5 - Teachers embed this learning in their own practice, improving outcomes for all in the school

These outcomes were developed by taking into consideration the observed impact of COVID-19 disruption on both students and teachers (for a summary of publicly available research see the published interim report). The camps were designed to reintroduce students to a formal learning environment and cover specific curriculum learning points relevant to their next phase of learning (either GCSE or A level exams). Additionally, the close involvement of the school science teachers was intended to build their own subject knowledge and therefore have an impact beyond the 20 students invited to participate in the intensive summer camp.




SCIENCE

Evaluating the intensive STEM summer camps

The evaluation of the STEM summer camps was designed to be part of the programme delivery.

Nine of the 18 schools were selected to be case study schools. An independent evaluator visited each of the schools during the summer camp to observe how the camp was run, to speak with students and teachers, and to build a portfolio of evidence to demonstrate how effectively the programme was making progress towards the intended outcomes.

An interim report was published which included qualitative and quantitative data gathered through teacher and student surveys, teacher interviews and school case studies.

This final summary report has benefitted from additional research material collected between April and October 2022.

Case study schools were contacted and invited to participate in a short video interview at the end of the academic year (June/July 2022) to reflect upon the outcomes that students who attended the summer camps have achieved when compared to students at the same school who did not attend the camps. Five of the case study schools attended follow-up interviews.

Teachers at all the schools which participated in the camps but were not active case studies were invited to complete an end-of-year survey which provided both qualitative and quantitative data (four submitted responses).

Finally, all schools were invited to submit exam data (mock assessment grades from autumn 2021 and actual exam results from summer 2022) which included results for all students in the year group that was supported by the summer schools (five of the schools provided data). In completing our analysis we wish to highlight the small sample size for students sitting triple science subjects, which is to be taken into consideration when reporting any of our findings beyond this report.*

There have been difficulties in engaging schools with the research for this final report, which does mean that the evidence presented here is limited in its reach. Teachers' engagement with the research for the final report has been significantly less than the engagement we received in the interim report research period. This could be due to the time elapsed since the summer school, some role changes by teachers, summer term time pressures or wider role requirements meaning teachers lack capacity to take part in this kind of research.

To mitigate against this, we implemented multiple strategies to encourage participation: flexible interview slots of no longer than 30 minutes available during the day and evening, an online survey which could be completed in less than ten minutes, and no requirement for exam data to be formatted before submission. Additionally, a small incentive was offered to teachers who were able to submit the survey and exam data.

Whilst the data received has been limited, we are confident that the findings confirm those of the interim report and are indicative of a model which has had real impact in the schools where summer camps were held.

Evaluation methodology

Quantitative

Demographic data
Average attainment data for schools pre-camp
Mock exam data for students
Actual summer 2022 exam data for students
Pre- and post-camp surveys completed by students and teachers
Summer 2022 survey with teachers

Qualitative

Case study visits
Pre- and post-camp surveys with students and teachers
Summer 2022 survey with teachers

*For further information on sample size please refer to page 34.

Outcome 1:
Students gain a deeper and stronger core of scientific knowledge essential to future exam success

75%
of teachers reported that students who attended a camp have demonstrated improved or significantly improved performance in practical skills when compared to their peers who did not attend the camp

100%
of teachers reported that students who attended a camp have demonstrated improved and significantly improved knowledge of core syllabus concepts when compared to their peers who did not attend the camp

100%
of teachers reported that students who attended a camp have demonstrated significantly improved ability to approach exam questions when compared to their peers who did not attend the camp

The intensive STEM summer camps provided an opportunity for students to cover key curriculum components that had been missed due to COVID-19 or not taught in a practical setting previously.

All the schools we spoke to reported that their students gained confidence in practical skills and approaching exam questions. This was clearly a priority for the case study schools as observed from evaluation visits, with the camp days structured to allow for maximum practical experiment time alongside taking students through exam question techniques.

"For the majority of the students in the triple [science] cohort who came to the summer camp, you can see trends where, from their mocks in the summer to their mocks in November, you saw quite a jump. Then it shows a steady improvement to their next set of mocks in March. I think the biggest difference though, is their attitudes to science."* Head of Science

"The students who attended the summer school are achieving half a grade higher in science than other students." Deputy Headteacher

"Some of our students have gone up slightly [in grades], which is really positive considering that in second year, they learn more material for them to keep that grade or even increase slightly, it's a difficult task. I think that's had a positive impact. The summer camp really made them realise and kickstarted the idea that 'Oh, I do need to revise, I do need to take this quite seriously now'. I think they felt the importance of it. Some of them took that on board, and started addressing their areas that they needed to work on; even approaching their teachers and saying, 'Look, when we did this, there was a bit I'm not quite there yet. Can you go over this bit of the topic with me please?'. That has made a difference to them." Science Teacher

For many of the students who provided insight to this evaluation, the intensive practical focus was important to them and helped to consolidate topics originally introduced via remote learning.

"This has been so helpful to do practicals that we didn't get a chance to do in year 12 biology as well as go over content that we did during lockdown to get a better understanding." Year 12 Student

"We've only seen this online so it is harder to understand. Camp has really helped me." Year 10 Student

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* Every GCSE student in England should take at least two GCSEs in science, usually by taking either combined science (sometimes known as 'double award') or the separate sciences (often referred to as 'triple science'). In 2019, 96% of GCSE students from state-funded schools in England entered at least two science GCSEs. Around one in four GCSE students entered separate science GCSEs, and approximately 69% of students entered combined science.

"The camp has been really good. The best thing has been covering the topics in more depth so we get a wider understanding of the subject areas and the teachers have been really interesting." Year 10 Student

GCSEs are graded from 1 to 9. Exam results for GCSE combined science or triple science were provided by five schools for each of the students who attended the summer camps and for those in the control group. The control group is made up of students at the same academic stage across the schools who did not attend a camp. The schools also provided the June 2021 and November 2021 mock exam data for both groups of students. An average actual exam grade and an average mock exam grade was calculated for each pupil from the two grades for combined science or the three grades for triple science. Analysis of the provided exam data shows that the average exam result for the group of students attending the camps was 0.93 grade points higher than that of the control group for those students sitting combined science.

In the November 2021 mocks, the first term after the summer camp, the difference between the two groups was 0.73 grade points for combined science students. For those sitting triple science GCSE, the difference in attainment was less but summer camp students still achieved an average 0.38 grade points higher than their peers who did not attend camp.

When considering this as a percentage increase between mock exams and actual results, students sitting combined science who attended the camps achieved a slightly higher percentage increase in grades from their year 11 mock to their actual exam result of 13%, compared to 10% for students who did not attend the camps.

For triple science students, the percentage difference in average grades between year 11 mocks and the actual exams was negligible when comparing the summer school participants with the control group students. The percentage increase in grades between year 10 mocks and actual exam results was higher for the summer camp group than their peers who did not attend. This suggests the summer camps provided a 'catch-up' opportunity for triple science students rather than resulting in a significantly higher grade overall.

In the final interviews held with teachers for this evaluation, all indicated a belief that the increased knowledge shown by students who took part in the summer camp was as a result of increased confidence in specific techniques as well as an overall increase in their personal motivation towards studying.

The greatest impact on grades was observed when schools offered the camp to students who had the potential to achieve in science but were not doing so already. This is likely down to the specialist support, small cohort teaching, increased motivation and improved confidence gained from the camp.

In schools where the students attending camp were all higher ability, teachers reported less of a difference in attainment. This is expected because the higher ability students were already working at higher grades regardless of their attendance at summer camp. Additionally, their peers who did not attend camp were also already motivated to learn and capable of achieving high grades in science subjects.

As part of the data analysis, an unpaired t-test was used to compare the actual grades achieved for each group (camp students sitting combined sciences vs non-camp students sitting combined sciences, and camp students sitting triple sciences vs non-camp students sitting triple sciences). The tests found there was no statistically significant difference in the average grade achieved by individual students sitting the triple science GCSE after completing the camp, when compared to those who did not attend the camp who also sat the triple science exams. However, there was a statistically significant difference in the overall grades achieved by students sitting the combined science GCSE who had attended the camp compared to those who had not.

Again, this further confirms the anecdotal and qualitative evidence that the camps had a greater impact on students who were sitting combined science and had the potential to significantly improve their grades.

Conclusion: Students have gained scientific knowledge through their participation in the intensive summer camps, which is reflected in the exam data provided to the evaluators.

Outcome 2:
Students re-engage with their learning in a formal classroom setting following the disruption caused by the pandemic

100%
of teachers observed that students who attended a camp were significantly more confident in the classroom than their peers

100%
of teachers observed that students who attended a camp were more motivated to learn than their peers throughout the academic year

82%
of students agreed or strongly agreed that the camp had prepared them well for the next academic year

Throughout our evaluation it was clear from both students and teachers that being back in the classroom environment was exciting and helpful in building confidence for the students. In turn, this had the effect of preparing students for a full academic year back in the formal learning environment. The case study schools reported that most of the students attending the camps had faced significant disruption or disadvantage during the pandemic, over and above that experienced by every student because of COVID-19.

The teachers we interviewed and surveyed highlighted the difference between summer camp participants and their peers in terms of their readiness to learn and attitudes towards science since attending the camp.

"Enjoyment is part of it. I think kids ultimately want to succeed, don't they? And if you can show a child that they can succeed at something, even if they don't necessarily enjoy it, it is more satisfying, because they feel 'I'm doing well at it'. They have got tangible evidence, 'can do it'. A lot of the practical work at camp, particularly, was a very immediate way for them [to] realise 'Oh, I can do this practical'. It's been good to see them start their natural journey through year 11. Things start clicking into place." Head of Science

"It's been really good doing the required practicals for real and it has helped me to understand better." Year 12 Student

> *Sometimes practical work is seen more as an add-on but if skills associated with practical work aren't broken down or explained it makes exam questions more difficult to approach. That's a way that you can enrich the practical offer within the curriculum we're giving them. For that cohort [students attending the summer camp] at that time, it was not just catch up, it was a way for them to gain a lot of security with the actual practical skills that they hadn't been able to experience in year 7 to 9.*
>
> **Head of Science**

Conclusion: Students who participated in the summer camp have re-engaged with their learning in a formal classroom environment and exhibit increased confidence at practical activities when compared to their peers. This has had a positive effect on their attainment throughout the academic year.

Outcome 3:
Students gain mental health benefits from face-to-face interaction with peers and teachers post-lockdown

80%
of students agreed or strongly agreed that they feel capable of doing well in their GCSEs or A levels

79%
of students agreed or strongly agreed that camp has helped them feel motivated to succeed in their exams

73%
of students agreed or strongly agreed that camp has helped them improve their confidence in science lessons

100%
of teachers observed that students who attended a camp had significantly improved confidence when compared to their peers

100%
of teachers observed that students who attended a camp had higher motivation to learn during the following academic year than their peers

The participating schools were responsible for the selection of the students to attend the summer camps. The majority of the schools extended the invitation to students who had experienced significant disruption above and beyond that which their peers had experienced during the pandemic. This may have been because of extended periods of time self-isolating, additional illness to manage or significant family events. For many, this was manifesting as underachieving at school despite their academic potential.

As discussed in the interim report, it was difficult to directly evaluate the camps' impact in terms of the mental health benefits of face-to-face interaction with the students in attendance, as no baseline data is available for this group of students. However, it has been repeatedly reported, both in the first term after the summer camps and at the completion of the academic year, that students who attended the camp had gained confidence and perspective which has supported their learning this year.

"[Student] just wrote me a lovely little card and mentioned that summer school helped her attitude, and she didn't think she could do science. Then over the last year she's now thinking that she might not like it, but she could definitely do it." Science Teacher

Increased confidence has been a significant outcome of the intensive STEM summer camps. Several elements of the camps have been identified as contributing towards this outcome:

- smaller cohort than normal class size
- multiple teachers available to support the students
- positive and relaxed environment
- selecting students to attend camp based on attitude and potential to improve their grades, rather than existing attainment.
- supporting students in gaining confidence through fun, novel practical experiments
- providing opportunities to work through exam questions

Conclusion: The increase in confidence observed at the end of the summer camps has persisted throughout the academic year and is one of the standout features of the summer camp experience for the schools.

Outcome 4: Teachers at schools in areas of need benefit from exposure to subject expert teachers

Outcome 5: Teachers embed this learning in their own practice, improving outcomes for all in the school

Case study: The East Manchester Academy

The summer camps were the beginning of a really helpful journey for us as a school. When I and our Head of Science joined the school it had just been placed into special measures. A major focus of our development plan has been the science curriculum. The partnership with STEM Learning, which started with these summer camps, has been integral to our development. It's been such a brilliant process, it's that sharing of expertise and sharing of knowledge which has been so valuable, where sometimes in a school things can get lost.

We are a young department, and this kind of transfer of knowledge is really important to improve our skill sets. As a department we have had two workshops since the camp with one of the specialist teachers. We are now able to use a lot of the practical work that he showed us, and the pedagogy that he talked through, to redesign our schemes of work. So that's now having a direct impact in our school wider than that cohort of students who attended the summer camps.

Dr Matthew Dewhurst

For this final report, we are considering outcomes 4 and 5 together, as they are intrinsically linked, with the impact of these outcomes being achieved having a far-reaching effect within schools' communities.

Many of the teachers interviewed as part of this evaluation commented that the content from the summer camps had now been incorporated into their science curriculum. The innovative teaching methods demonstrated have been inspiring and helpful for teaching staff to see, particularly for those who have had less exposure to experienced teachers.

Case Study: Regional Network Lead – South East, STEM Learning

During the run up to the camps, we created a network between the six schools in our area. I know at least two of the teachers communicate with each other even now, to share some of the things they've learned this year and help each other out. In my region we had three days [one day of each] of biology, chemistry, physics. On day four we ran video calls live to role models from industry and to STEM Ambassadors. That's an important part of contextualising all of this science for the students. They got to speak to somebody who is a chemist, or in biosciences, an engineer or a technologist – all people that could talk to the students about what it means from a career perspective. [This was] helpful to give them the 'so what?' of all this learning.

We've also seen that the schools are having their own internal conversations since the camps, which are centred on why those intensive STEM camps have been very important to the school. The schools are asking questions such as 'Where are we lacking in practicality?' and 'What physical resources do we still need to help our departments not just in this school, but in other schools within the academy group?'. This is something we can then help them with from within the STEM Learning network.

For one of our schools that is part of an academy trust, we've helped them to create an ENTHUSE partnership. The secondary school will be the lead with their cluster of primary schools connected in. And that means over two years, we can create an even more sustainable environment in which the teachers get more support, they get enrichment, they get more contextualisation support using Ambassadors, and it builds a really rich STEM environment for the students.*

Dr Ajay Sharman

*ENTHUSE partnerships are a funded collaboration between 6–10 schools or colleges. The partnerships develop a tailored two-year action plan, including: teacher CPD combining residential, local and online courses; teacher placements in a STEM-related industry or university department; engaging with STEM Ambassadors to inspire young people; and STEM Clubs to engage young people and develop practical skills.

Several of the schools have worked with STEM Learning and their Regional Network Leads to arrange follow-on workshops for the teachers. This has enabled further new methods to be practised and allowed teachers to take time together to develop new curriculum ideas.

Some of the schools have not pursued any teacher CPD since the camps, and there was limited benefit to the teachers in those schools. One of the challenges of the camps was that they required teaching staff to give up some of their non-teaching time to support the students. In some schools that posed a greater challenge than others. It was noted in the interim report that budget availability and colleague capacity also had an impact on how effective the camps were at providing teacher CPD opportunities.

This has been further compounded by the movement of some teachers to new jobs away from the schools which hosted camps, or new roles within the same school.

"It was also confidence building for teachers who had the same issues in the pandemic that all of us have had, particularly newly qualified teachers, some of which had not done any practical science during their training. We had at least two teachers I'm aware of that had gone through their teacher training and never done any real practical training. The camp provided them with that exposure to experienced teachers in the lab." Ajay Sharman, STEM Learning's Regional Network Lead for the South East

"It has impacted our teaching and learning within the department from the teachers who came in and supported with some of the sessions. We've taken some of the techniques on as a department, particularly in terms of how to engage with the students. I think that definitely has a positive impact. I've even used some of the techniques with the year 12s, so the camp has impacted wider year groups." Science Teacher

"If we can embed STEM into a school's DNA then it reaches far more than 20 students in the classroom. These camps are part of doing just that." Yvonne Baker, CEO STEM Learning

This remains the area of greatest variance across the participant schools. It is an area of importance when considering how this model could be utilised in the future to create positive outcomes for schools beyond the relatively small number of students who are able to attend the camp in person. The benefit of engaging science teachers effectively is that there is a trickle-down effect of inspiration and knowledge through the school's science provision. This is clearly going to happen in some of the participant schools, but certainly not in all.

"[Follow up training for teachers] was really useful because we got to interact with other teachers in the local area. And it's about sharing good practice and techniques where we might have gaps, it builds up confidence in terms of how to do alternative practicals that might not always work." Science Teacher

Conclusion: Outcome 4: Where teachers were able to be in attendance at the camp, it was frequently reported to be inspiring and has had an impact on the way they teach throughout the following year. This was particularly the case for early career teachers.

Conclusion: Outcome 5: A small number of the schools have continued to develop their own CPD opportunities in partnership with STEM Learning and other networks. Where schools have been proactive in engaging with CPD opportunities and sharing knowledge amongst the department, the benefit to the wider student population has been noticeable.


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Contributory factors

Any programme operating in an open environment such as this one will be subject to contributory factors. These may be factors which contribute to the positive outcomes observed and factors that may impact the project detrimentally.

In all the follow-up interviews with teachers, the evaluators have been keen to explore the wider school environment to better understand how the summer camps were placed, and what wider STEM engagement and exam preparation the students were exposed to.

Three key contributory factors were identified:

• Other catch-up sessions
All of the schools interviewed during both the interim and final evaluation provided other interventions to support students with knowledge gaps and exam preparation. Whilst these were less intense and immersive than the intensive STEM summer camps, they are likely to also have contributed to the positive outcomes observed.

• Motivated students
In some schools, the camp was only offered to those students who had opted to study triple sciences. In other schools it was offered as a 'reward' to those already achieving highly. For other schools, the camp was offered to those seen as achieving below their potential but who had the support and motivation to attend in summer holidays. This does somewhat polarise the student group and may have skewed the results we observed.

• Further STEM enrichment
Many of the schools have engaged with STEM Learning before or have a relationship with their Regional Network Lead, which has been a great way of enhancing the STEM curriculum at school. Schools have been motivated by the intensive STEM summer camp and for some it has been a catalyst to arrange further activities. It is expected that any further activities that students are invited to participate in will support their confidence, motivation, and attainment in STEM subjects.

• Teacher engagement
Some schools struggled to get teachers to engage in the summer camps during the summer holidays. This may mean that students were taught key concepts in a different way than they have been in term time, which could cause later confusion. Or the school has missed out on the opportunity to enhance teacher training through exposure to the experienced external teachers coming in to the camps.

It is important to consider the impact of such factors when planning future iterations of the intensive STEM summer camps, as they may detrimentally affect the efficacy of the model but could also enhance the outcomes for those taking part.

Areas of success and opportunity

Overall, it is clear that the intensive STEM summer camps were a positive, engaging and empowering experience for both the students and teachers who participated. This impact has been sustained throughout the last academic year. Some outcomes have been more impactful than others and there are areas of the programme that could be enhanced to provide further opportunity to benefit the students.

Successes

1. Overall, the project has achieved good or very good progress in all outcome areas for both students and teachers

2. The outcome of hugely increased student confidence was by far the most notable effect of the camp, which then impacted their ability and motivation to learn, and improved engagement in the classroom upon return to school. This was sustained throughout the following academic year

3. Teachers also commented on the students' increased motivation to learn upon starting the new academic year, which is another positive unexpected outcome of the summer camps. This motivation was also recognisable throughout the academic year

4. The combination of increased confidence and improved motivation has also had a positive impact on the academic attainment of students who attended the camps in their subsequent exams

5. In some regions, informal networks between participating schools have developed, providing a further opportunity for knowledge transfer and peer-to-peer support

6. Teachers made it clear that the personalisation of the summer camps was a huge benefit and attraction to participating. It ensured content was relevant to their students both in terms of context and depth of knowledge. This evaluation recognises that scaling the summer schools programme may require a more rigid package in order to manage coordination across additional sites, but would urge that the flexibility to pick the content remains with the school teachers

7. The flexibility from the programme coordinators and expert teachers to allow several schools to flex the summer camp into their own existing summer provision should be commended, as this undoubtedly provided additional benefit to the students participating

8. Bringing external teachers into the schools gave both the students and incumbent teachers a boost. For students it was a different voice and teaching style than they may have been used to, and for teachers it was an opportunity to learn something new and reinvigorate their own teaching style

9. Analysis of survey data showed that after the camps, students had a generally increased awareness of the importance and relevance of STEM in their everyday lives and in the future options for their own education, training and career choices

10. It was noted in the evaluation that the small class sizes for the summer camps, together with having two or three adults proactively engaging with the students, were enormously beneficial to the learning outcomes for the students. This was a very different experience for them compared to their regular classes during term time

Areas of opportunity

1. The summer camp was found to have the greatest impact for students in the mid-range of academic achievement pre-camp: those who may be triple science students who are not yet achieving their full potential, or combined sciences students who have the opportunity to improve their grades. We observed, through all elements of the research, that students who are not typically 'rewarded' for excellence and who are also not failing, responded positively to the attention and opportunity of the camp

2. Hard-to-reach students may benefit enormously from an opportunity such as the camps which provides unusual, exciting approaches to science that they may not normally be exposed to. However, this group of students are less likely to engage outside of the school day and school term, so thought could be given as to how to reach students who could benefit but are less motivated to take part independently

3. A more structured approach to the teacher CPD element of the summer camp would support consistent progress towards this outcome for all participant schools. For some schools there was no significant progress in this outcome area due to the structure of the camp or availability of their science staff. This evaluation recognises that this is partially a result of being so flexible in the approach the school took to the camp. This flexibility has been identified as a success; however, with some structure to the post-camp teacher engagement teacher development opportunities could be achieved for all schools

4. Several schools commented that repeating the experience with the same cohort of students would be helpful to consolidate attitudinal change and keep motivation high. Different formats were discussed with teachers during the autumn term interviews, including running a camp follow-on one day per term or providing additional engagement in the Easter holidays as well as the summer holidays

5. Some schools found the length of the summer school days quite long for their students, especially when faced with the intense learning requirement of the lessons. Two schools suggested that shorter days over a five-day period could be beneficial

6. The STEM careers engagement portion seemed to be an add-on which was not fully utilised at all schools. This could be accentuated; however, it may detract from the core outcomes of the programme. Whilst there is a risk of careers engagement distracting from the intended outcomes of the programme, there was an increase in students reporting that they had a better understanding of the importance of STEM in everyday life, and that they were more aware of STEM training opportunities available to them

7. Two STEM Ambassador video conferences were observed during case study visits. The Ambassadors profiled were not very diverse in terms of gender (all male) or diversity (one Ambassador from a non-white background). Considering the diversity of the students at the schools involved, it may be pertinent to endeavour to increase the diversity of role models in line with the People Like Me campaign


STUDENT

Closing summary

Through the final stage of this evaluation, it is apparent that the camps were still looked upon as a positive step in the return to school post-COVID-19. The students who took part have achieved well in their exams and remain motivated to learn, as well as demonstrating increased confidence in science.

Where schools have consolidated their learning around curriculum and practical methodology, there has been wider benefit for the school community. In some regions, informal networks have developed which have allowed for more knowledge sharing and peer-to-peer support to take place.

The camp programme was a success and offers much opportunity to bring about further impact for students and their schools if funding was in place to allow this type of model to continue.

Whilst there are many contributory factors to consider, the feedback from schools is that the intensive STEM summer camps were a catalyst for pursuing other STEM engagement and enrichment opportunities as well as a timely point of reflection on their own science curriculum.

> *I feel there has been more confidence, more of a 'can do' approach. We've been able to build the confidence into progress. Even if they haven't remembered a lot from the sessions, what they do remember is how good they felt.*
>
> **Science Teacher**

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Footnotes

1. Jacob Bryant, Felipe Child, Jose Espinosa, Emma Dorn, Stephen Hall, Dirk Schmautzer, Topsy Kola-Oyeneyin, Cheryl Lim, Frédéric Panier, Jimmy Sarakatsannis, Seckin Ungur and Bart Woord, *How Covid-19 caused a global learning crisis*, (McKinsey & Company, April 2022), Accessed September 2022, https://www.mckinsey.com/industries/education/our-insights/how-covid-19-caused-a-global-learning-crisis

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3. Elizabeth Rushton, Simon Gibbons and Rachel Hesketh, *Understanding and mitigating the impact of Covid-19 disruption on trainee and early career teachers in secondary schools: Recommendations to ensure teacher quality and enable retention*, Accessed October 2022, https://kclpure.kcl.ac.uk/portal/files/156255576/PolicyBriefing_July21_Rushtonetal.pdf

Sample size

Actual GCSE exam results and mock exam results were provided by five schools.
Data was provided for 96 students who participated in the camps and sat combined sciences, and for 337 in the corresponding control group.
Data was provided for 8 students who participated in the camps and sat triple science subjects, and for 23 students in the corresponding control group.

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