Intensive STEM Summer Camps
Interim Impact Report

December 2021

Supported by

Goldman Sachs Gives

Delivered by

STEM LEARNING

Evaluation completed by The Charity Spark

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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 re-engaging 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.

The camps set out to achieve the following outcomes. This evaluation has considered the evidence for progress towards each of the outcomes.

For young people:

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

Very good progress

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

Very good progress

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

Very good progress, particularly in improving student confidence

For teachers/schools:

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

Good progress

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

Good progress

The programme provided a flexible framework and specialist support to develop a tailored summer camp that suited the needs of the students. This approach has resulted in much better outcomes for students and teachers than an off-the-shelf approach may have done.

There is evidence that a summer camp of this nature would have a significant impact for students in future years as well as for those who have recently experienced the disruption of COVID-19. There is a clear opportunity to expand the reach of these intensive STEM summer camps beyond the 18 schools that engaged with the programme in 2021, as well as building on the experience for the existing cohorts.

87%

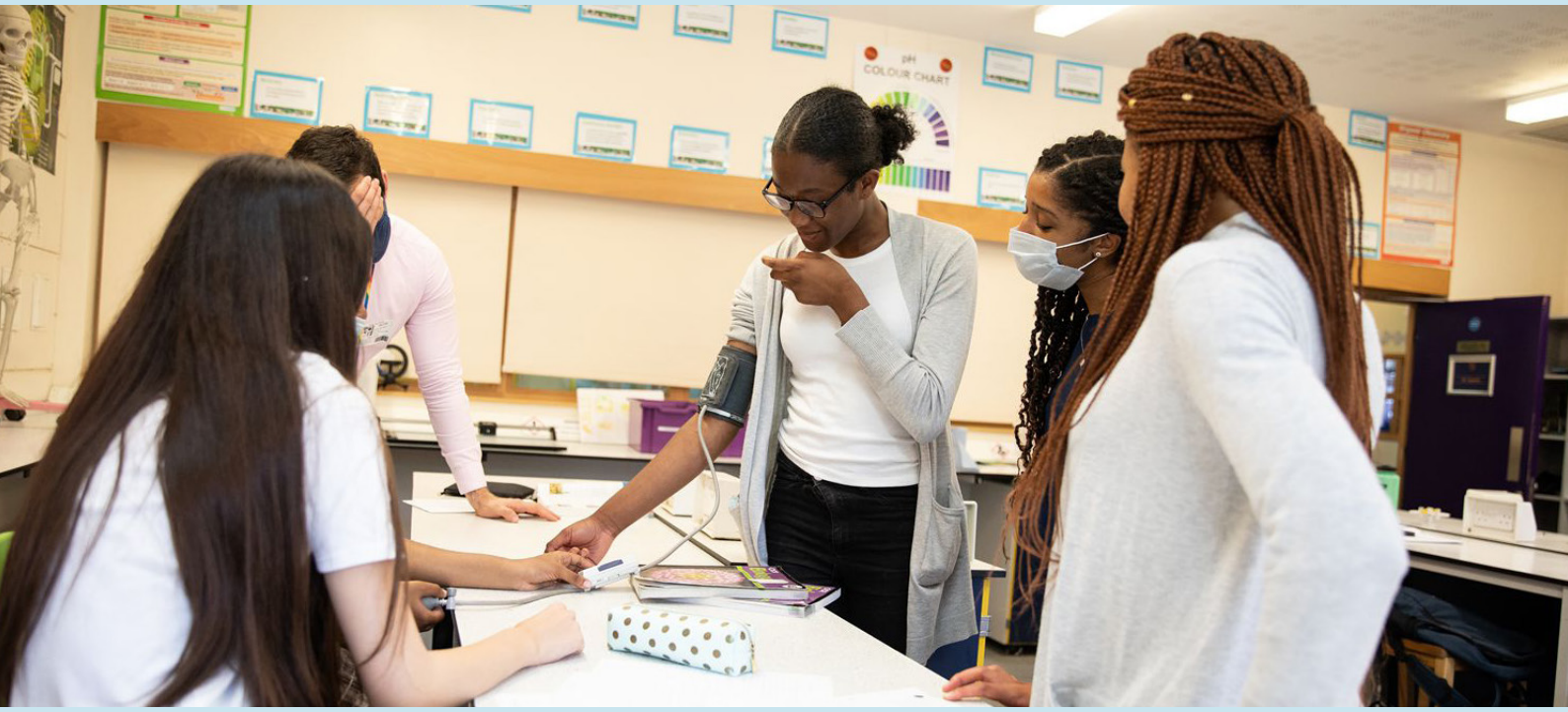
of students agreed or strongly agreed that the camp had helped improve their understanding of science

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



> *Thank you so much for the three days of biology, chemistry and physics. They were outstanding sessions in their content and delivery! Speaking to the students they felt really stimulated and enriched by the experience. Furthermore, it's given them a real opportunity of a confidence boost going into year 11. I thoroughly enjoyed them also!*
>
> **Science Teacher**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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 the ENTHUSE 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 the philanthropic arm of Goldman Sachs and is committed to enabling innovative ideas, solving economic and social issues and enabling progress in disadvantaged communities globally. They have donated nearly $2 billion in grants and partnered with 8,000 non-profits 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

COVID-19 first disrupted schools in early 2020 when they closed until further notice from Friday 20 March, forcing the majority of students to undertake their work from home.

"What followed was easily the most disruptive period in children's education since at least the start of the Second World War. Schools closed only to be opened, closed and then reopened again. Exams were cancelled, not once but twice, with knock-on effects to university admissions that will be felt for years to come. Parents, heads and teachers struggled – with access to laptops for home schooling, with the home schooling itself, and with coronavirus testing regimes for pupils and staff." Nicholas Timmins, Institute for Government report 'Schools and coronavirus. The government's handling of education during the pandemic'[1].

> *Practical science has been really hard to deliver during home-school throughout COVID.*
>
> **Physics Teacher**

The impact of COVID-19 disruption for students

The issues associated with interrupted learning have been identified as being disproportionate for underprivileged students, as they tend to have fewer educational opportunities beyond school[2]. In addition to this, many parents were unprepared for distance and home schooling and unable to put into place resources such as computer and internet access, as well as triggering disengagement in their formal learning[2].

Other effects of the disruption to education caused by COVID-19 are significant, such as lack of access to free school meals, but are not being explored as part of this evaluation report.

Students fell behind in all subjects as a result of the pandemic. In September 2020, 98% of teachers reported that their pupils were behind where they expected them to be at the end of the academic year[3]. Over half of teachers (61%) felt that the learning gap between disadvantaged pupils and their peers had widened since the previous year, with 32% reporting it had stayed the same[3]. In September 2020, teachers estimated that 44% of their pupils were in need of intensive support to catch up to expected levels of learning[3]. These percentages were higher in the most deprived schools, and significantly higher in schools serving the highest proportion of pupils from ethnic minority backgrounds.

It has been recognised that schools and colleges play an important role in supporting young people with their mental health. They provide stability, routine and consistency to young people as well as connection with trusted adults who provide pastoral support and targeted help, such as counselling, when required. The Education Select Committee ran an inquiry into how the outbreak of COVID-19 affected the education sector and children's social care system. YoungMinds told the committee they had found that the impact of school closure on young people's mental health was more prominent in groups that are already disadvantaged and that the pandemic was widening existing inequalities[4]. In the research conducted by YoungMinds, 83% of the surveyed young people who already had a history of mental health needs before the pandemic stated that the pandemic had made their mental health worse and that being away from school was a part of that[4].

> *We had lots of videos to learn at home which I found difficult to understand.*
>
> **Year 10 Student**

The impact of COVID-19 disruption for teachers and schools

The impact of COVID-19 on teachers and schools was also significant. Teachers had to adapt to deliver content online and were also under pressure from high rates of staffing absence due to shielding, self-isolation, illness and compassionate leave. When teachers did return to the classroom, 74% reported that they did not feel able to teach to their usual standard – impacted by distancing requirements – and 39% cited lack of access to their usual resources such as equipment and learning materials. Teachers also highlighted the difficulty of pupils not being able to share resources or work in small groups as they had done previously, or having limited access to specialist learning environments such as labs[3].

Trainee and early career teachers (ECTs) have also been impacted by the disruption, as placements were cancelled, and there has been a lack of opportunity to shadow experienced teachers. This has impacted upon teacher confidence as well as their exposure to creative teaching techniques, chances to observe good classroom management, and opportunities to build a portfolio of teaching resources such as STEM practical examples.

A lack of access to resources or to specialist teaching facilities, such as science labs, had a particular impact on the delivery of science subjects during COVID-19. When combined with the overall effect on student learning, there was a significant risk that STEM education would be particularly affected by COVID-19 disruption.

STEM Learning and Goldman Sachs Gives response

STEM Learning partnered with Goldman Sachs Gives to respond to the need created by education disruption because of 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 specialist teachers, who were usually external to the school. Each school was chosen in partnership with Goldman Sachs as well as through careful consideration of the demographic and regional data available to STEM Learning.

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

> *"We are grateful for this generous sponsorship 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, 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.

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.

A small number of schools were requested by some of the Goldman Sachs partners who sponsored the camps.

In total, 18 schools were selected nationally.

What data was gathered?

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

- % of students eligible for free school meals (FSM)** at the school
- % of students eligible for FSM on average in that region
- Analysis of ethnic diversity***
- % of students achieving a passing grade in combined science at GCSE in 2019
- % of students achieving a pass grade in individual sciences 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

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 would deliver 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 particular 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). It was suggested that each day was dedicated to a different subject, e.g. 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 had been particularly hard to deliver during the pandemic.

A teacher from the school was encouraged to shadow the camp each day, providing an opportunity for their own CPD 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.


STUDENT
STUDENT
STUDENT
STUDENT

Outcomes of the camps

STEM Learning identified a specific set of outcomes that the camps intended to achieve. These were differentiated for students and teachers.

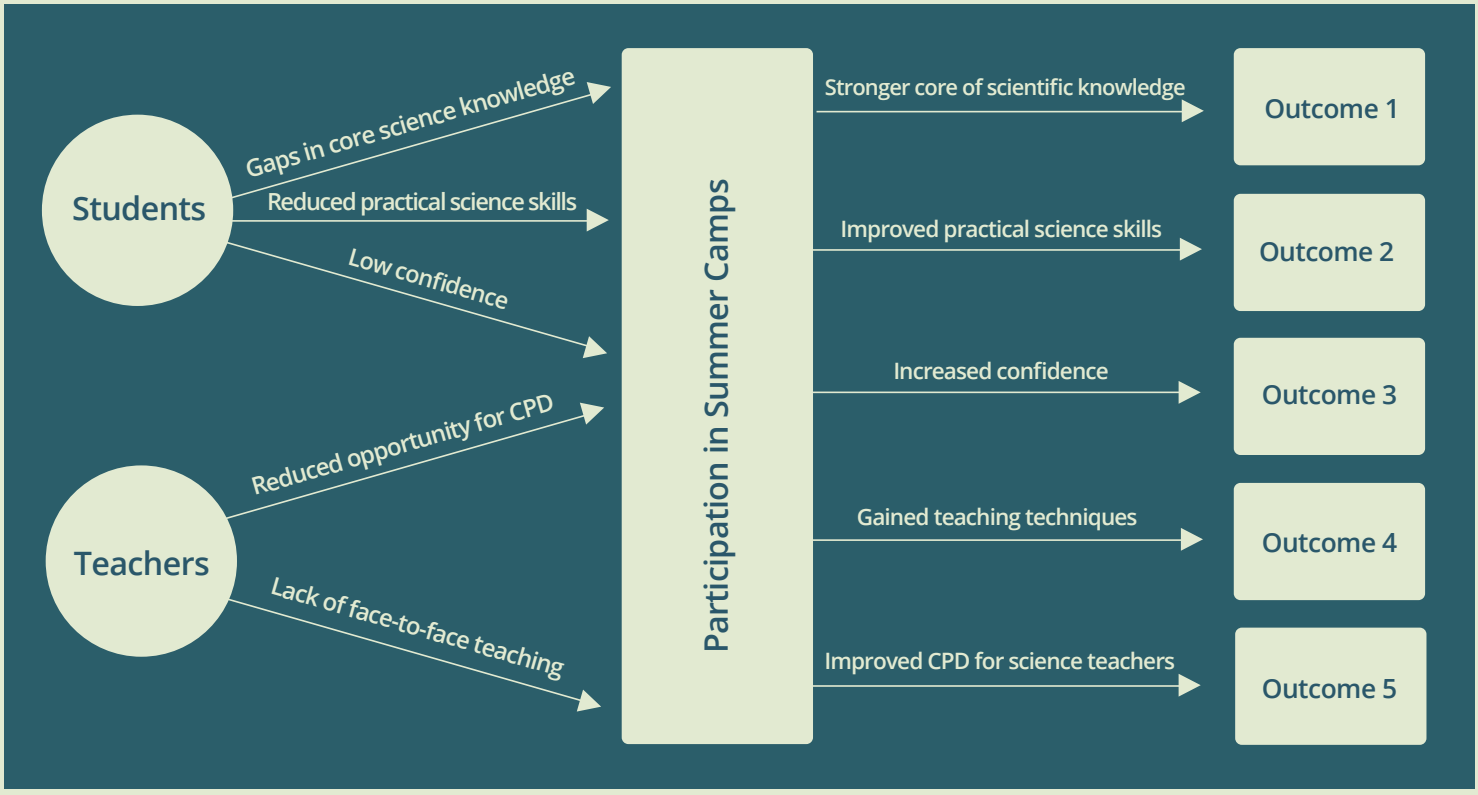
For young people

- 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 taking into consideration the observed impact of COVID-19 disruption on both students and teachers (for a summary of publicly available research see page 7-8). 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.

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The evidence for intensive learning interventions

Research supports the use of intensive learning interventions such as summer camp models as a tool to improve attainment, learning attitudes and motivation to learn in young people. The Wallace Foundation's 2011 paper 'Making Summer Count; how summer programmes can boost children's learning' concluded that summer camps can help to achieve tangible gains for students. Research indicates that several factors may be related to improved programme effectiveness, including personalising instructions, small class sizes and supportive parents/carers. In addition, it is evidenced that high-quality instruction, aligning academic content with school-year curriculum, maximising student participation, providing an engaging learning experience and regularly evaluating outcomes all contribute to high-quality provision[6].

The Department for Education found that the timing of summer schools should be considered, as benefits of an intensive summer programme can vary according to the point in the school holidays at which the students attend[7]. It identified factors that can affect attendance, including the need to engage specifically with students and their families, offering incentives and ensuring the programme retains an element of fun.

Additional research by the Education Endowment Foundation[8] highlighted the non-academic benefits of pupils attending summer camps or off-timetable study programmes, including increased confidence and improved engagement in learning.

STEM Learning specifically developed the intensive summer camp programme to focus on delivering curriculum content rather than being STEM enrichment. This provided learning that had been missing from students' experiences at school since March 2020.


nalgene
A Level

Wider STEM and education interventions

COVID-19 recovery

The UK government announced funding dedicated to supporting schools to provide catch-up and learning enhancements for their students. However, this has proven difficult to access for many organisations. This funding has predominantly been allocated to the National Tutoring Programme, with additional money designed to enable schools to locally employ tutors to support students[9].

Schools were encouraged to signpost students to resources such as the online home learning resources published by STEM Learning. £200 million was also made available to eligible mainstream schools to run their own summer schools with a mix of catch-up lessons and fun activities. Schools were encouraged to focus these camps on students making the transition into year 7[10].

STEM education

STEM Learning coordinates a national network of Science Learning Partnerships to support science education in schools across England. This includes the provision of impactful and quality-assured CPD for teachers, helping to improve outcomes for schools, teachers and young people. Several of the schools that took part in this intensive STEM summer camp programme had already worked with STEM Learning.

Other organisations that support STEM education have programmes focused on improving uptake of STEM subjects at GCSE, A level and beyond, but there is no evidence of a similar tailored, intensive STEM summer camp being delivered in a targeted way.

Contributory factors

Throughout the course of this summer camp programme, there were many factors that could have also impacted on the students and teachers to support their progress towards the intended outcomes. In addition to programmes designed to support academic catch-up, such as the government funded schemes mentioned above, it is also recognised that many students' motivation levels change as they progress into a new school year. Increased motivation and improved attitude to learning can be brought about by intrinsic or extrinsic pressures to do well in exams, a renewed focus once they are in their exam year, and other school interventions.

It was also noted by many of the schools taking part in the case studies that the students attending the camps were generally the more motivated members of their year group, evidenced in part by their willingness to attend a camp during the school holidays. This may mean that any differences in attitude or attainment data between the camp cohort and their school peers who did not attend camp cannot be solely linked to their participation in the summer camp; instead it can be considered part of the wider journey that the student is undertaking.

To reduce the impact of contributory factors on this evaluation's conclusion, peer cohort data was analysed alongside that of the participants'. Peer cohorts did not attend the summer camps but are part of the same schools as those students who did attend the camp, and therefore have exposure to the same learning environment.

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.

All the schools were provided with a survey for students to take at the beginning and end of the summer camp (a copy of this survey is included in the appendix to this report). A total of 209 (58%) students responded to the survey at the beginning of their summer camp, with 197 (55%) students submitting a response to the survey at the end of the programme. At the time of writing this report, 18 summer camps had taken place with approximately 380 students attending.

The lead teachers at each school were sent a survey to complete before and immediately after their camp. Out of 18 camps, 12 teachers (66%) completed the pre-camp survey and 8 (44%) returned the post-camp survey.

A case study was produced for each of the nine schools visited. This included qualitative and quantitative evidence, which provided a snapshot of the student and teacher experience of the camps.

Further contact with each of the nine case study schools provided an opportunity to interview key teachers to determine what the medium-term impact of the summer camps had been. The interviews discussed student attitudes towards and attainment, benefits to the teachers, and the practicalities of the camp's structure and timing. Seven interviews were held in October and November 2021.

A survey was sent to the remaining participating schools, providing them with an opportunity to feedback on the areas of interest.

This report intended to include data that analysed the attainment of participating students, comparing mock exam data from the summer term before the camp (summer 2021) with the most recent autumn term mock exam (autumn 2021). This data will be provided to the STEM Learning team by the end of the 2021 autumn term; however, it was not available to the evaluator at the time of writing. Therefore, all comments on the effect of attending the camp on student attainment is from anecdotal qualitative evidence provided by teaching staff. The final report into this programme will include quantitative exam results to allow further analysis into this area of interest.

This interim report (December 2021) will inform the remaining evaluation period, which culminates in a final report scheduled for summer 2022.

Evaluation methodology

Quantitative

Demographic data
Average attainment data for the school pre-camp
Pre- and post-camp surveys with students and teachers

Qualitative

Case study visits
Pre- and post-camp surveys with students and teachers
Semi-structured interviews with teachers in the autumn term
Feedback from parents and additional school stakeholders

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

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

The intensive STEM summer camps were designed to increase the core curriculum knowledge that students had going into their exam year (either year 11 or year 13, depending on the school). In order to deliver these outcomes, the external specialist teachers worked closely with the school teachers to develop a course programme that was tailored to the needs and knowledge gaps of the students due to attend the camps.

"The camp has given a unique opportunity to meet students where they are and learn the base level of their knowledge after year 10." Head of Science

"We specified with the facilitator what areas we wanted to focus on. For biology day one it was very practical, then day two they worked through lots of exam questions." Biology Teacher

"I chose to focus on electricity because it's a subject students struggle with and it needs going over multiple times." Physics Teacher

The highly tailored nature of the camps is something that all the teachers interviewed commented upon. It clearly made the experience much more useful for students and teachers, as it enabled a focus on specific knowledge gaps rather than being off-the-shelf GCSE or A level content.

The camps were structured in a way that provided significant opportunities to conduct practical science experiments, which had been identified as an area that had been particularly impacted during the disruption of COVID-19.

Many of the students interviewed over the course of this evaluation said that they found some scientific concepts difficult to understand without the hands-on element. They were lacking in the knowledge of how to conduct experiments safely and effectively, which is a particularly important component of both GCSE and A level sciences.

"It's much easier to learn when we get to do science again." Year 10 Student

"These lessons filled the gaps that lockdown created as well as learning new things." Year 10 Student

"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

"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

During the autumn interviews with teachers, anecdotal evidence was shared by three of the schools interviewed that they expected to see a difference in attainment between the students who did attend camp and those who didn't. This was linked in all three cases to an increase in motivation to revise, and an increase in confident self-directed study outside of school time.

"I've progressed a lot in electricity and forces – the experiments are helpful." Year 10 Student

"It's helped me to start my revision – the notes and booklets are really useful." Year 10 Student

Conclusion: Students have gained scientific knowledge through their participation in the intensive summer camps.

> *Thank you so much for the three days of biology, chemistry and physics. They were outstanding sessions in their content and delivery! Speaking to the students they felt really stimulated and enriched by the experience. Furthermore, it's given them a real opportunity of a confidence boost going into year 11. I thoroughly enjoyed them also!*
>
> **Science Teacher**

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

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

100%
of teachers agreed or strongly agreed that the camp had helped the students prepare their return to academic studies

100%
of teachers agreed or strongly agreed that what the students had learned as part of the summer camp would help improve their attainment in future exams

The summer camp programme recognised that for many students, being physically present in school had been an irregular occurrence since the COVID-19 pandemic began, due to mandatory school closures, periods of self-isolation, bubble closures and, in some cases, shielding.

The return to the classroom was identified by YoungMinds[4] as having the potential to both improve and challenge the mental health of students (this is considered further in pages 23-24). It also posed a problem for those who had not spent much time in specialist learning environments such as science labs.

When considering the impact, it is important to consider the experience of the year groups participating in the summer camp programme.

Current year group (academic year 21/22)	Year when COVID-19 shut schools (academic year 19/20)
11	9
12	10
13	11

For many of the camp participants who were progressing into year 11, the last time they had conducted practical science experiments in a science lab they were in year 9. For the students going into year 12 or year 13, they had been studying for their GCSEs when the pandemic began.

The feedback from the summer camps was that being back in the classroom, and the lab, was a huge benefit of attending the programme.

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

"This is my first time in a lab doing a practical since COVID lockdown. We watched the teacher do practicals online but that is hard to listen to." Year 10 Student

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

Teachers interviewed in the autumn term all commented on the confidence of the students who had attended summer camp compared to their peers who did not attend. This was particularly apparent when conducting practical experiments in the science classrooms.

"The students who attended the summer camp are clearly more confident and capable in the lab than their peers who did not get the experience over the summer. Those that did attend are more confident in lab skills from basics like setting up equipment safely." Head of Science

Case study: Kyran*

Before attending summer camp Kyran was a very nervous science student due to a negative experience he had during a science practical earlier on at secondary school. The summer camp gave him the opportunity to build his confidence with practical skills in a safe environment within a smaller group size than usual. He has returned to school for year 11 feeling positive about science practicals and feeling much more confident in the classroom.

**Names have been changed to protect the privacy of the student*

Conclusion: Students who participated in the summer camp have re-engaged with their learning in a formal classroom environment and exhibit increased confidence in the lab.

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

The participating schools were responsible for the selection of the students to participate in 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 as a result 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.

Teachers provided feedback that simply being chosen to attend summer camp gave many of their students a boost of confidence and made them feel valued.

It was difficult to directly evaluate the camp's impact on 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, but many of the survey respondents said that their confidence had increased over the duration of the camp.

"Camp has shown me to never give up on your dreams and there is always support." Year 12 Student

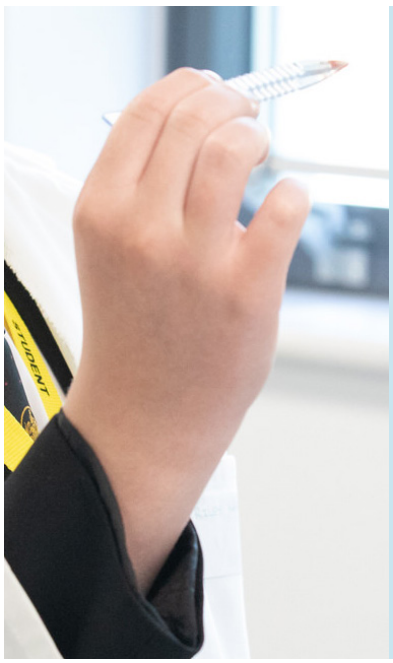
"Camp has helped with my confidence in lessons and in the future, for my career." Year 10 Student

During the autumn term teacher interviews, all of those interviewed said that their students had increased in confidence and motivation. Many of the teachers had seen this drop during the extended periods of home learning, as many students were disengaged by online lessons.

The intensive summer camps have given students an opportunity to bond with their classroom teacher and their peers, and that has had a positive impact on their motivation.

"It made me happy to know I had been picked to take part in the STEM science summer camp which made me want to keep engaged in the lessons." Year 11 Student

"I have found the change of environment really helpful and the teachers were really nice and supportive." Year 11 Student



Case study: Daniel*

Daniel has autistic spectrum disorder and had little interest in science before attending the summer camp. The head of science invited him to attend but was unsure how he would interact with the other students and the camp teachers. She reports, "The camp was a really healthy environment for Daniel. You can be more casual and build a bond out of school time, I was able to praise his attitude. He was interacting with students he doesn't usually interact with and it was really nice to see him rise to the challenge." Daniel has returned to year 11 and now wants to do A level physics – his mindset has changed due to his participation in the camp, as well as some other targeted support at school inspired by the success of the summer camp.

**Names have been changed to protect the privacy of the student*

Increased confidence has been a huge mental health benefit of the camps. It has been apparent in every conversation held by the evaluation team with teaching staff since the camps, and it is an outcome that has persisted through the autumn term.

The result of students having increased confidence is that they are more engaged and ready to learn, which in turn improves their science knowledge, impacting on their overall attainment.

"Our kids do not have many opportunities outside school, we are constantly looking to reinforce that they are valued, particularly with the year that they had in 2020/21. The summer camps gave a really important message to the students 'we value you, we are investing in you, we see the year you have had and here is an opportunity for you', which has boosted the students self-esteem." Head of Science

Conclusion: Whilst holistic mental health benefits are difficult to measure for this programme, it is very clear that most students have seen an increase in confidence through their participation in the camps.

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

The structure of the camps was designed to enable a member of the school's science teaching team to remain in the classroom and observe the external expert teachers as well as support the students during the camp.

It was intended that this would be a less experienced member of the science teaching staff in order to provide an opportunity for them to watch a specialist subject teacher conducting lessons.

This worked for some schools where they were able to place an ECT in the camp for the duration, but for many schools the teacher supervising during the camp was a senior science teacher or the head of science, as they had been the organiser and were able to give time during school holidays.

Where an ECT was present, it was clear they gained a lot from observing the experienced teachers at work. Not only did they get ideas for illustrations of tricky concepts and new practical examples, but they also gained confidence in classroom management techniques.

"I really found it so useful and learned a lot from the teachers who came in to deliver. It was really engaging and helped me to plan my physics teaching for the year." ECT

"For physics particularly, we found it very beneficial to see the different practicals and demos. Really helpful to see that in person from an experienced teacher. It also gave off-timetable time to think about ways of engaging the students. The teacher that observed has gained confidence that he can do more. Really positive experience for our department." Head of Science

"This is a really good idea, it is one of the things for those of us who haven't been teaching for long – what practicals can we do? These are great ideas!" Physics Teacher (ECT, second year of teaching at the school)

For the schools that did not have new, or less experienced, teachers attending the camps, there was less progress made towards this outcome. It is difficult to mandate that a new teacher is in attendance, especially for the camps that were held during the school holidays, as it meant teachers giving up their own time to attend.

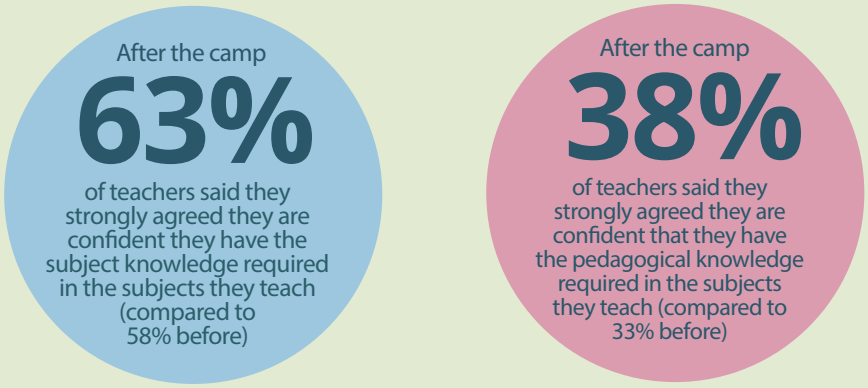
One of the schools observed did not have an external specialist teacher coming in to deliver content, but lessons were taught by one of the experienced teachers from their own department. In this example, there was no benefit from having external teachers coming in to support learning.

Conclusion: Where the camps worked as designed with ECTs or less experienced teachers supporting the lessons, there was significant progress in this outcome area – the teachers were left inspired and motivated.

> *The most useful part was seeing the different practical activities and the different ways the practical work was organised. It was interesting learning how to lift a basic practical activity to another level, which added wonder to the students taking part.*
>
> **Science Teacher**


Jed Marshall
Science

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



"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

The teachers who did attend the summer camps have been quick to take many of the practicals and demonstrations into the lesson plans for science teaching within their schools. All of the teachers interviewed in the autumn term could name at least one element of the summer camp teaching that has been reviewed and adopted into the science teaching at their school.

Similarly to the progress made towards outcome 4, the efficacy of this process does seem to be individual to the school. It appeared to depend upon the budget available to them for new equipment (there was budget allocated to each school to support expenses incurred in hosting the summer camps, although this was spent differently at each school, e.g. on staff overtime, new equipment, printing resources for the students) and the motivation of the lab technicians.

The summer camp was run in a more unusual way for one school that participated. It ran over a two-week period to align with additional summer provision provided at the school, which was in a particularly disadvantaged area. In the mornings, science lessons were taught by specialist teachers, then in the afternoons STEM Ambassadors led enrichment and careers activities. Unfortunately, the science department at the school was not willing to host the intensive STEM summer camp and the organisation was taken up by the deputy headteacher of the school who is a maths teacher. Therefore, the staff supporting each day of the summer camp were maths department teachers, although the content was still focused on the GCSE science curriculum. Due to this, there has been very little benefit to the wider science teaching staff, as they were unwilling to participate.

This is a unique situation and not one repeated at other schools, but it is included here to show the breadth of teacher experience across the participant schools.

A different school in a highly disadvantaged area also ran the STEM summer camp during another school summer provision. The school ran the camp for three days but it was attended by both the deputy head of science and a newly qualified physics teacher. It was also supported very proactively by one of the lab technicians at the school. This was enormously beneficial to the students, as they had three additional engaged adults in the classroom as well as the external teacher. In addition, the lab technician was very motivated to provide new equipment and develop ideas to use existing equipment differently. This school

is now running a post-camp programme of CPD for the whole science department, using video calls with the specialist teachers who taught on the camp, expanding on areas of interest from the topics covered in the summer.

It is clear that this is the area of greatest variance across the participant schools. It is also an area of importance if the summer camps are going to have a reach far greater than the original cohort of students who attended in the summer. The benefit of engaging the 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.

"If we could do it again, we would put less experienced staff in to observe the camp, so they could observe the experienced teacher – get them to learn the practical side of it and be enthused by how someone else manages the classroom'.' Head of Science

"We took a few ideas particularly from chemistry and some biology – simple models to explain certain complex areas for example. The specialist teacher was very good at linking theory to applied – our chemistry teacher mentioned it was positive too. We need to share more of these learnings with our team." Science Teacher

Conclusion: Whilst some schools have made good use of the opportunity to embed learning from the camps into their science teaching, for many it has been overlooked or missed entirely. This is something that is easily intercepted and achieved before the end of the academic year. STEM Learning are already planning opportunities for further teacher CPD with the participating schools, which will support further progress towards this outcome.

"

The highlights for me were hearing what the students had understood, seeing those lightbulb moments and watching their confidence develop. Plus the enthusiasm of the staff for the practicals shown – it might be good to have a post-session staff planning too – to discuss how they might use what they'd seen. We did touch on the fact that they could do future revision/exam prep sessions but not in detail of how to develop them.

Specialist Teacher

"

Planning and execution of the summer camps

The summer camp programme was delivered through STEM Learning's regional networks and led by their network leads who have existing relationships with schools, STEM Ambassadors and STEM organisations locally.

All of the teachers interviewed commented on how helpful the planning team were in the initial phase of developing the summer camps despite this falling in the busy summer term.

The most valuable part of the planning process was when the schools were connected with the specialist teachers to discuss, in detail, the summer camp content, and for the teachers to brief the facilitators on the students that would be attending.

Some schools ran the summer camp within the last few weeks of summer term. This had a number of benefits:

- Easier to get good attendance from students, as they were obliged to be in school anyway.
- It was easier to engage less-motivated students, as they weren't required to come in during the school holidays.
- It was the end of the summer term so other subject teachers were happy for students to be off timetable.
- Science staff were also readily available and so more staff were exposed to the summer camp teaching.

However, running the camp at this point in the school year also had some detrimental effects:

- It was perceived to be a long time from camp to the start of the new academic year, and one teacher commented that he felt the benefit had been reduced because of this drop in motivation, that students had 'forgotten' the camp.
- It required students to regain focus when many of their peers were not in formal lessons in the last few weeks of term.

For those schools that ran their camps during the school holidays, there were also pros and cons.

Positively:

- Students attending were highly motivated, as they had made the effort to attend during their holiday.
- Likewise, the teacher who was supervising was firmly invested in the camp and its outcomes.
- It reduced the skills fade that can be observed due to the long summer holiday and broke up the length of time students were away from the classroom.
- It increased motivation for self-guided study in the school holidays.

Negatively:

- It was harder to reach some of the student body that were less motivated and/or lacking parental support.
- It required teachers to attend in the school holidays – this was incentivised by most schools from the budget provided by STEM Learning.
- It often meant just one science teacher supervising learning, typically a more senior teacher who had been involved in the camp planning and who may not have been the target audience for CPD benefits.

Ideas for development

During the autumn term interviews, several teachers shared their thoughts on how the programme could be developed to provide additional benefit to their students.

"The camp could be longer, not just in that week but another camp (part 2!) maybe later in the summer. Reinforcement of learning and motivation would have been really good. Or even, three days towards the end of the summer holidays – beginning is helpful as still in the zone of studying but at the end of summer holidays provides a really good run into the new term." Science Teacher

"Need to reharness the motivation! If we could do more than one of the camps then that could keep them boosted and remind them. Perhaps taking the same cohort and giving them one 'camp day' per term?" Science Teacher

"It might be worth running an incentive scheme to engage the less motivated students who could really benefit enormously from this type of intervention. Could give them vouchers depending on the number of days completed." Deputy Headteacher

"We ran ours during term time because most of the children come from a particular estate which is two bus rides when they are not in school – term time there is a school bus. It also ensured we had good lab tech support. The headteacher gave us permission to take the kids off timetable." Science Teacher

Whilst broadly it was agreed that the time and structure of the camps worked well this year, consideration could be given to expanding the cohort support to see if that had a greater impact on exam results and maintaining motivation.

> *(In regards to camp timings) "In the summer it was very easy to organise the camps but momentum was disrupted by the summer holidays. Summer term is good as core subject content is completed and it is easier to take them out of timetable – logistically it is the best time to do it. However, there could be benefit of doing it closer to exams too, maybe around Easter?*
>
> **Head of Science**

Areas of success and areas of opportunity

80%

of students say that they believe they are capable of doing well in their GCSEs or A levels since attending camp

The number of students who agree or strongly agree that what they learn in science is important to everyday life increased from **62%** to **72%** after attending the camp

The number of students who agree or strongly agree that they learn about different STEM training options in their science lessons increased from **49%** to **64%** after attending the camp

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.

Successes:

- 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.

- The flexibility from the programme coordinators 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.

- 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.

- 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 training and career choices.

- The additional outcome of hugely increased confidence was by far the most notable effect of the camp, which then impacted ability to learn, motivation to learn and improved engagement in the classroom upon return to school.

- 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.

- 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.

- Overall progress towards the intended outcomes is good.

> *Summer camp has inspired me to consider taking STEM subjects in my A levels or in university and become more passionate about areas regarding chemistry and physics.*
>
> **Year 10 Student**

Areas of opportunity

- 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 in that particular school. This evaluation recognises that this is partially a result from being so flexible in the approach the school took to the camp. This has been identified as a success; however, with some structure to the post-camp teacher engagement this could be mitigated.

- 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.

- 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.

- 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. 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 aware of STEM training opportunities available to them.

- 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 schools involved, it may be pertinent to endeavour to increase the diversity of role models in line with the People Like Me campaign.

> **Excerpt from one participant's personal statement for college entry:**
>
> *Moreover, I participated in a variety of activities and experiences that aided my STEM education. In particular, I undertook a four-day summer school, funded by Goldman Sachs Gives, that provided me with high-quality information and a taste of the world of science and mathematics.*


Daheem

Closing summary

Through the short and medium-term observations and evaluation of the intensive STEM summer camps, it is clear that the programme has had a positive impact on the students and teachers taking part.

As well as making good progress towards the intended outcomes, students feel invested in and valued and have hugely increased in confidence, which has had a tangible impact on their learning since the start of the new academic year.

Teachers who engaged with the CPD element of the summer camps have also seen improvements in their own motivation and learning.

For all of the camps, it was an intense learning environment. However, for those students who have not been able to retain all of the content covered at the summer camps, the motivation to learn has led to better classroom engagement since they returned to school, which in turn has contributed to an increase in their scientific knowledge.

The camps were well organised and the teachers felt supported by the programme coordinators. The most important thing to the schools was that the camp was completely tailored to their needs, something that is not often the case with external engagement like this.

The 2011 Wallace Foundation report into effective summer learning experiences found that high-quality instruction, aligning academic content with school-year curriculum, maximising student participation, providing an engaging learning experience and regularly evaluating outcomes all contribute to high-quality provision[6]. It is clear that these elements have also been the reason that the intensive STEM summer camps have been successful: by bringing expert teachers in to provide high-quality instruction, basing the content on core curriculum learning points, supporting students to attend (adjusting the time of the camp if the school knew that would improve engagement) and providing a particularly engaging learning experience in the form of a practical-led camp.

Whilst there is room to construct a more robust process to support the teacher CPD element of the summer camps, some schools have been very proactive in ensuring this benefit was also maximised for their staff.

For the remaining evaluation period, it will be important to consider contributory factors alongside the data received from the schools to understand more broadly the impact that such intensive summer camps can have on student attainment.

> *"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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