Generation STEM Work Experience

Evaluation Report

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The Education Endowment Foundation (EEF) is an independent grant-making charity dedicated to breaking the link between family income and educational achievement, ensuring that children from all backgrounds can fulfil their potential and make the most of their talents.

The EEF aims to raise the attainment of children facing disadvantage by:

- identifying promising educational innovations that address the needs of disadvantaged children in primary and secondary schools in England;
- evaluating these innovations to extend and secure the evidence on what works and can be made to work at scale; and
- encouraging schools, government, charities, and others to apply evidence and adopt innovations found to be effective.

The EEF was established in 2011 by the Sutton Trust as lead charity in partnership with Impetus Trust (now part of Impetus - Private Equity Foundation) and received a founding £125m grant from the Department for Education.

Together, the EEF and Sutton Trust are the government-designated What Works Centre for improving education outcomes for school-aged children.

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About the evaluator

The project was independently evaluated by a team from the National Foundation for Educational Research (NFER). The principal investigator for this trial was Dr Ben Styles, Head of NFER's Education Trials Unit. Susie Bamford led the evaluation during the set-up phase. Palak Roy, Senior Trials Manager, led the evaluation team for the rest of the trial.

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Disclaimer

This work was produced using statistical data from the Office for National Statistics (ONS). The use of ONS statistical data in this work does not imply the endorsement of ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce national statistics.

Executive summary

The project

Generation STEM (Gen STEM) is a work experience placement intervention for Year 10 students (age 14–15) aiming to develop students' life skills and interest in STEM subjects (science, technology, engineering, and mathematics). By increasing students' ability to see the relevance of schoolwork to their future careers and motivation to engage in school, the programme also aims to raise students' attainment in mathematics and science.

The Gen STEM programme begins with a work experience preparation day delivered by CSW Group or one of their delivery partners to the whole of Year 10, where possible. Fifteen nominated students with an interest in undertaking STEM work experience are then offered a 20-minute interview with a panel of local employers, followed by feedback in a post-interview debrief. Five students from each intervention school are selected to undertake one-week work experience placements, where students are matched based on their interests and aspirations with STEM-related placements provided by local employers. After the work experience, students are provided with feedback through a work experience debrief.

This efficacy trial included 1,665 students from 113 schools and was a two-armed cluster randomised controlled trial (RCT), randomised at the school level. Before randomisation, schools nominated 15 Year 10 students to participate in the trial. The 15 nominated students in the intervention group all took part in the work experience preparation day, employer interviews, and post-interview debrief sessions. Five of the students also undertook the Gen STEM work experience placement. The primary outcome of the trial was GCSE mathematics and science attainment. The secondary outcomes were post-16 subject choices, Year 11 school attendance, and attitudes to STEM, life, and school. An implementation and process evaluation was also conducted, including observations of the intervention and stakeholder interviews. The programme was delivered by CSW Group in partnership with Graphic Science, STEM NOW and participating local employers. It was co-funded by the Education Endowment Foundation, The Careers & Enterprise Company, and the Bank of America Merrill Lynch. The trial started in May 2017 and finished in April 2020.

Figure 1: Key conclusions

Key conclusions	
1.	Children in Generation STEM schools made the equivalent of 0 months' additional progress in mathematics and science, on average, compared with children in other schools. This result has a high security rating.
2.	Children eligible for free school meals in Gen STEM schools made the equivalent of one month's additional progress in mathematics and science, on average, compared with children in other schools. This finding should be interpreted with caution, as it is based on a small sub-group of pupils and there is considerable uncertainty around the result.
3.	There was no evidence in the secondary outcome data that Gen STEM had an impact on students' attendance in Year 11, uptake of STEM-related subjects at A-level, ability to make future decisions, or attitudes to STEM, life, and school.
4.	The intervention was not consistently delivered as intended in the design of the programme and there were considerable disparities in how different providers, employers and schools delivered the intervention.
5.	The intervention was complex with a considerable number of component parts and was implemented very variably across different programme providers and schools. Due to the providers being unable to recruit enough schools to the programme in the target region, the timescale and the geographical regions for the programme were also extended, introducing more inconsistencies into the programme.

EEF security rating

These findings have a high security rating. This was an efficacy trial, which tested whether the intervention worked under developer-led conditions in a number of schools. The trial was a well-designed two-arm randomised controlled trial and was well-powered. Relatively few pupils who started the trial were not included in the final analysis. The pupils in Gen STEM schools were similar to those in the comparison schools in terms of prior attainment. Low implementation fidelity makes it harder to accurately estimate the size of the impact on pupils in the trial.

Additional findings

Pupils in Gen STEM schools made, on average, zero months' progress compared with those in the control group equivalent. This is our best estimate of impact, which has a high security rating. As with any study, there is some uncertainty around the result: the possible impact of this programme ranges from negative effects of one month's less progress to positive effects of two months of additional progress.

The trial design meant that 15 students per school participated in the initial stages of the programme but only five per school progressed to the work experience placement. The fact that not all students included in the analysis had completed the full programme makes it harder to evaluate the effect of the intervention. However, there was no evidence that completing more components of the programme was associated with a more positive effect on students' attainment. There were also considerable disparities between schools and providers in how various aspects of the programme were delivered, including how students were selected, the content of the work preparation day, employers' involvement in the interviews, and the format of post-work experience feedback. This raises the question of whether the lack of impact found was due to issues with the programme design or issues with its implementation.

All young people who undertook the work experience believed it had confirmed or expanded their interest in STEM and increased their confidence. Additionally, most of the young people felt that the overall experience confirmed their career interests or intentions. Similarly, most employers viewed the quality of the Gen STEM work experience programme as good and believed it had increased young people's confidence, provided insights into working life, and progressed their career decision-making. Two-thirds of school staff members felt pupils had benefitted from the programme, noting their pupils had gained valuable interview skills and experience, improved in confidence, and gained awareness of STEM and careers. However, approximately one third of school staff were frustrated by the programme due to delays in the organisation of work experience placements, issues securing appropriate and timely placements, poor communication from the providers, the programme requiring considerable school staff time, and a lack of consistency with the original explanation of the programme.

Other studies of participation in world-of-work experiences report perceived improvements in young people's communication, confidence, and maturity, as well as development of career aspirations. The perceptions of students, staff, and employers who took part in this trial are in line with these findings. However, the trial found no quantitative evidence that this programme had impacted pupils' attitudes to STEM, life, and school, or pupils' mathematics and science GCSE outcomes. It is possible that the issues with the implementation of the programme affected the outcome of the trial.

Cost

The average cost of Gen STEM for one school was around £164.29, or £17.96 per pupil per year when averaged over three years.

Impact

Figure 2: Summary of impact on the primary outcome

Outcome and group	Effect size (95% confidence interval)	Estimated months' progress	EEF security rating	Number of pupils	P Value	EEF cost rating
KS4 combined mathematics and science (intervention vs control)	0.04 (-0.07, 0.15)	0	🔒🔒🔒🔒🔒	1,524	0.51	£ £ £ £ £
KS4 combined mathematics and science (FSM pupils only)	0.08 (-0.1, 0.26)	1	n/a	479	0.31	£ £ £ £ £

Introduction

Suitable high-quality work experience is thought to impact on students' life skills and improve their ability to see the relevance of their schoolwork to their chosen career path; their motivation to engage in schoolwork; their punctuality; and their confidence and maturity. There is some evidence to support this (see, for example, Hillage et al., 2011 and Hughes et al., 2016) but further research evidence is needed. As it stands, and as far as we are aware, there is no evidence from randomised controlled trials (RCTs) showing that this increase in life skills spills over to affect attainment. This study tests the theory that greater engagement in schoolwork following the Generation STEM (Gen STEM) work experience programme leads to higher attainment in related academic subjects.

Background evidence

In 2011, the coalition government made an important change to the policy regarding work experience in secondary schools: from 2012 it was no longer mandatory for 14 to 16 year olds to undertake work experience in school. Since then, the number of teenagers who have had experience in the workplace has rapidly fallen (Hughes et al., 2016). Now the responsibility lies with schools themselves to decide which companies to work with, if at all, and what provisions to offer to help prepare their students for the world of work. Thus, work experience programmes differ from school to school, with some schools still offering work experience to their Year 10 and Year 12 students, some offering work experience solely to Year 12 students, and others offering none at all.

'Experiences of workplace' and 'Encounters with employers and employees' are two key Gatsby benchmarks of Good Career Guidance (The Gatsby Charitable Foundation, 2014). They encourage students to learn about work, employment, and the skills that are valued in the workplace, as well as enabling them to explore career opportunities. Encounters with employers and workplaces are also central to the government's Careers Strategy 2017 (Department for Education, 2017), which underlines the importance of ensuring that all young people understand the full range of opportunities available to them and learn about work and skills through first-hand experiences of the workplace. The Careers & Enterprise Company (2019) reported that 52% of schools and colleges had fully achieved Gatsby Benchmark 5 (Encounters with employers and employees) and 47% had achieved Gatsby Benchmark 6 (Experiences of workplaces) in the academic year 2018/2019. This was an increase on the corresponding figures for 2017/2018 (when the Gen STEM work experience intervention was run), which were 38% for Benchmark 5 and 37% for Benchmark 6 (Careers & Enterprise Company, 2018).

School-mediated work experience could be even more important to young people than it was for the last generation because the number of British students in part-time work has decreased from 42% in 1997 to 18% in 2014 (UKCES, 2015), so they have very limited direct experience of any workplace. It may be the case that work-related experience could improve attainment by helping students to explore and decide on their options for future work and therefore recognise the associated education required.

Previous research into the likely outcomes of work experience programmes highlight their potential to have an impact on 'life skills' and on preparation for, or decisions about, transitions into further education or work. A survey of school staff, carried out as part of Department for Education (DfE) research into work experience in schools (NatCen Social Research and SQW, 2017), suggests that it can have a positive impact on pupils' communication and interpersonal skills, confidence, understanding of the world of work and industries, employability, maturity, team working skills, independence, time management, clarity over career aspirations, motivation to engage in education, and understanding of educational career pathways. The hypothesis is that students, then, are more ready and able to focus on their studies and their attainment improves.

The EEF-commissioned Careers Education Literature review (Hughes et al., 2016) highlights evidence for similar social outcomes as a result of careers-related interventions. NFER's own research (Sims et al., 2013; des Clayes et al., 2017; Edge, 2019; McCrone et al., 2019) highlights how work experience can impact employability skills (such as communication, teamwork, and interpersonal skills) and can help young people to be more work-ready by developing an understanding of employers' expectations and of the standards required in the workplace in terms of time management, dress code, and behaviour.

Gen STEM is a work experience intervention developed by CSW Group. The intervention is focused on helping students to find STEM-related work experience and supporting them to get the most out of the experience. It aims to provide high-

quality and relevant work experience to students in Year 10, especially those who would not otherwise have an opportunity to take part in a STEM-related work experience placement of this nature. The aim is for students with an interest in STEM to get a placement in an occupational area related to their specific interests and career aspirations and to complete relevant work whilst they are at the placement.

The intervention has not been evaluated or piloted before. However, work experience placements were identified by the EEF's careers education literature review (Hughes et al., 2016) as an approach with promising evidence. For example, one study in the USA (Linnehan, 2001) found that students undertaking consistent work experience (one day per week for six months or more) had higher attainment outcomes than a control group. Another study, from the UK (Golden, et al., 2005), found that taking part in work-related learning opportunities improved GCSE outcomes. Schools that have received a Quality Award for career provision were also found to have higher rates of students attaining at least five 'good' GCSEs (Hooley et al., 2014).

An evaluation of the North East of England pilot of the Gatsby Benchmarks, which include 'Encounters with Employers and employees' and 'Experiences of workplaces', found that the greater the number of benchmarks held by schools and colleges, the greater the number of GCSE passes at A*–C or 9–4 were achieved by each learner, even when gender, ethnicity, special educational needs and disabilities (SEND) status, free school meals (FSM) status, looked after status, and Ofsted rating were statistically controlled for (Hanson et al., 2021). Research by the Careers & Enterprise Company—relating the level of Gatsby Benchmark achievement by English schools in 2017/2018 to the education, employment, and training destinations of their Year 11 leavers in 2018/2019—suggested a positive association between careers provision, as reported in the Gatsby Benchmarks, and sustained destinations post-16 (Percy and Tanner, 2021).

All four studies reviewed by the EEF which examined the impact of work experience found positive educational outcomes, though it is noted that there is variability in how academic outcomes are measured and in the rigour of the studies. Work experience is also found to have a beneficial effect on future economic outcomes. The evaluation of this intervention will contribute to limited existing evidence base on the link between work experience and educational outcomes.

The intervention was evaluated as a cluster randomised controlled trial (RCT). The randomisation was at school level, which means schools either received the intervention or were allocated to the control group. The intervention was delivered by the CSW Group and two other providers in partnership with employers across the spring and summer terms of the academic year 2017/2018 when students were in Year 10. Nominated students from the intervention group participated in the intervention, which specified that a subset of intervention students would go on to attend the work experience placement organised by the delivery provider. The control group schools continued with their usual practice. This may have included work experience placements for the nominated control group students if they were provided by the school at that time. The impact of the intervention was assessed by comparing a number of outcome measures for the nominated students in both groups of schools. The primary outcome measure was their mathematics and science GCSEs. Secondary outcome measures were non-cognitive outcomes (such as being well-informed to make future decisions, attitude to STEM, attitude to life, and attitudes to school or college), their post-16 subject choices, and their school attendance. The accompanying implementation and process evaluation assessed the quality of the intervention, implementation fidelity, and variation.

Intervention

Brief name: Generation STEM (Gen STEM) work experience intervention

Why (rationale and theory)

Relevant quality work experience, such as Gen STEM, aims to improve students' life skills, including an ability to see the relevance of their schoolwork to their chosen career path, greater motivation to engage in schoolwork, punctuality, confidence, and maturity. There is some evidence to support this but further research is needed (see Hillage et al., 2001; Hughes et al., 2016; Mann et al., 2017). The hypothesis is that, as a result of these improved life skills, students are more ready and able to focus on their studies and their attainment improves.

Who (recipients)

The recipients are Year 10 students from participating schools, who have an interest in STEM and local work experience opportunities. For the trial, the student identification process involved a mixture of self-selection and teacher input to encourage disadvantaged students based on free school meal (FSM) eligibility to apply. Eligibility was specially reserved for those who were interested in a career in a STEM-related field and who were unlikely or less likely than others to obtain a work experience placement with a STEM-related employer. Teachers aimed for at least five of the 15 students to be eligible for FSM. For this evaluation, a cohort of students who were in Year 10 in the academic year 2017/2018 took part in the intervention.

What (materials)

As part of this trial, schools used a website developed by the CSW Group: 'Generation STEM participant Hub'. This included important information to support schools to deliver the programme.

What (procedures, activities, and processes used)

The intervention uses a structured schedule that students follow from beginning to end, with ongoing employer engagement throughout the process. There are five stages:

1. A work preparation day is delivered to the whole of Year 10 across a full school day, if possible, by CSW Group and local employers who can offer a STEM-related placement. If schools are unable to accommodate the work preparation day for the whole of Year 10, then at a minimum it will be delivered to the 15 students taking part in the intervention. During this work preparation day, students learn more about the world of work, what is expected of them in a work experience placement, and how best to prepare for their work experience. Furthermore, preparation for work experience is viewed as vital as it makes young people realise what they can achieve during work experience and what its purpose is. They need to appreciate what skills they can bring back with them and how they can utilise the opportunity to progress their education, training, and career prospects.
2. A 20-minute interview with a small panel of local employers and a CSW Group coordinator is offered to each of the 15 nominated students taking part in the intervention. This interview takes place at the school and is an opportunity for the students to gain direct experience of an interview situation, and for CSW to learn more about the students' particular interests and reasons for wishing to complete a placement.
3. Detailed feedback is given to students in a post-interview debrief, lasting up to ten minutes, by the CSW coordinator who has gained detailed feedback from the employer.
4. Five students receive a bespoke STEM-related work experience placement provided by an employer, matched based on their interests and aspirations.
5. Each student receives a work experience debrief with a CSW Group coordinator who has gained detailed feedback from the employer.

Who (implementers)

The intervention is delivered by CSW Group in partnership with participating employers.

How (mode of delivery) and where (location)

The intervention is implemented within the school day and the work experience week implemented during usual office hours.

When and how much (duration and dosage)

The intervention ran across the spring and summer terms of 2017/2018. The work preparation day is a full school day; the interviews last for approximately 20 minutes; the interview debrief lasts five to ten minutes; work experience is for five full working days; and post-work experience debrief lasts 30–40 minutes.

Tailoring (adaptation to the intervention)

The Gen STEM work experience programme has been adapted to the intervention in terms of:

1. identifying the 15 students to take part in the programme (this would ideally occur after the work preparation day but has been moved to before the work preparation day to accommodate the trial and randomisation); and
2. adding in the requirement of a certain number of FSM students (this does not usually occur within the programme).

How well (planned): Strategies to maximise effective implementation

A good relationship with the school coordinator is also considered to be an effective implementation strategy, and liaison with them maximises programme efficiency.

Please see the copies of the theory of change and the logic model in Appendix C. The logic model was developed by CSW Group to illustrate required intervention processes, and the theory of change was developed collaboratively by NFER and CSW Group during the IDEA workshop in summer 2017. It was not possible to revise the original logic model based on the evaluation findings as the programme was applied inconsistently and the variation in implementation did not provide sufficient evidence to enable revision of the logic model.

Issues that arose during the project

Recruitment

Maintained secondary schools in six Local Enterprise Partnership (LEP)[1] regions were considered eligible at the start of recruitment. Since the total recruitment target was not achieved, in line with the protocol, recruitment efforts were expanded to include schools in other geographic regions. As a result, the trial includes schools across 14 LEPs, and CSW Group recruited two additional organisations (Graphic Science and STEM NOW) to deliver the intervention to schools in the new regions. Please see the recruitment section below for further details.

Implementation

As Gen STEM is a structured programme, the assessment of fidelity is central to the process and implementation evaluation. In terms of minimum student compliance set out in the protocol, each student must have completed an application for a placement; taken an interview for a placement; successfully completed at least three days of their work experience placement; and received feedback in a debrief following the placement.

The evaluation identified some issues in fidelity that we discuss in more detail in the implementation and process evaluation section below. These issues included:

1. The process of selecting young people for the trial varied between intervention schools (for example, in terms of FSM pupils).
2. There was variation in communication at provider level. This meant that the levels of communication between providers (CSW Group, Graphic Science, and STEM NOW) and the schools before the work preparation day varied between schools.
3. The three providers delivered the work preparation day in diverse ways (for example, the sequencing of the work preparation day was in some cases before and in other cases after the selection and application stages, and the duration of the work preparation day varied).
4. The application process (including the interview) was, in some cases, for a specific STEM-related position, and in others for a general position.
5. The timing of placements varied considerably from early in the spring term 2018 to during the summer holidays 2018 (March 2018 to August 2018).
6. The timing of the debrief sessions varied considerably from July 2018 to October 2018, with several schools not participating in any debrief sessions.
7. There were different perceptions of the quality of the placements.
8. Feedback following the placement was in some cases brief and generic, while other students received more detailed face-to-face feedback.

[1] A Local Enterprise Partnership (LEP) is a locally-owned partnership between local authorities and businesses. There are 38 LEPs across England.

Data collection issues

Attainment data was collected from the National Pupil Database (NPD), but we administered student surveys at baseline and follow-up. The plan was to administer online student surveys at both times. However, nearly a quarter of the schools stated it was difficult to get all the students together in an IT suite to complete the follow-up survey. This caused a delay in survey completions and therefore they were given an option of completing the paper surveys.

Evaluation objectives

The primary research question for this trial was:

> What is the impact of the Gen STEM intervention on nominated students' Key Stage 4 (KS4) attainment in mathematics and science?

The secondary research questions (using NFER's bespoke survey) were:

1. Does taking part in the Gen STEM intervention improve students' ability to make future decisions?
2. Does taking part in the Gen STEM intervention improve students' attitudes to STEM?
3. Does taking part in the Gen STEM intervention improve students' attitudes to life?
4. Does taking part in the Gen STEM intervention improve students' attitudes to school or college?

Additional research questions (using administrative data) were:

1. What is the impact of the Gen STEM intervention on nominated students' attendance when they are in Year 11?
2. What is the impact of the Gen STEM intervention on nominated students' uptake of STEM-related subjects at A-level?

The process questions outlined in the protocol were:

1. How was the programme delivered? How did staff and pupils engage with it?
2. What was the impact of any alterations to the intended programme?
3. How much did it cost to run this programme?

Further areas outlined in the protocol for investigation were:

1. How the work experience was implemented, by focusing on challenges to and the feasibility of fidelity and ways to overcome this, as well as adherence to the programme design and dosage.
2. The quality of the intervention (including the pre- and post- support and reflections on lessons learned, as well as the work experience itself) and its ability to engage students.
3. The nature of (and reasons behind) any variations or adaptations that were made to the programme, at provider, school, employer, or student level.
4. The perceived benefits of the programme, particularly in terms of STEM awareness and perceived development of transferable skills, as well as any differential benefits for different groups or types of students or employer (for example, urban or rural).
5. Usual practice for control and intervention schools, whether it changed in the trial context, and the distinctiveness of the programme.
6. The typical costs for schools, including direct costs, marginal costs, and investment of staff time.
7. Suggestions for improvements or advice for good practice for any subsequent effectiveness trial.

The trial protocol and Statistical Analysis Plan are published on the EEF website.

Trial protocol (NFER, 2017) can be found at
https://educationendowmentfoundation.org.uk/public/files/Projects/Evaluation_Protocols/Round_11-_STEM_work_experience_protocol.pdf

Statistical Analysis Plan (SAP) (Styles, Roy and Rennie, 2019) can be found at
https://educationendowmentfoundation.org.uk/public/files/Projects/Generation_STEM_Work_Experience_SAP_2019.08.16.pdf

Ethics and trial registration

Ethical approval was granted according to the NFER Code of Practice as part of the standard project set-up procedures on 5 July 2017.

School recruitment was undertaken by CSW Group and commenced on 6 September 2017. NFER supported the recruitment activities between November and December 2017 as CSW Group expanded into more regions to reach the required number of schools.

CSW Group sent the recruitment pack to maintained secondary schools. This pack included recruitment material to introduce the schools to the trial and the intervention. It included a covering letter, an information sheet, and a Memorandum of Understanding (MoU). The covering letter was addressed to the Careers Coordinator or the Head of Year 10. The information sheet presented intervention details and the order of evaluation activities. The MoU set out expectations for both the intervention and control groups along with a detailed timeline of activities. Headteachers from schools wishing to take part in the trial signed the MoU and sent it back to CSW Group via an email.

Once the schools signed the MoU, they nominated 15 students to participate in the trial. Schools were asked to share parent letters before they provided pupil data to NFER. The parent letter included information about the evaluation and details of the pupil data used for the evaluation activities. Parents were also given an opportunity to withdraw their child from data processing and analysis.

Copies of the information sheet, school MoU, and parent letter are included in Appendix D.

The trial is registered on the ISRCTN registry at https://doi.org/10.1186/ISRCTN77306152 (ISRCTN77306152; Generation STEM—an evaluation of a STEM-related work experience intervention).

Data protection

Data protection statement

All data gathered during the trial is held in accordance with the data protection framework created by the Data Protection Act 2018 and the General Data Protection Regulation 2016/679. The data is treated in the strictest confidence by NFER, CSW Group, and the EEF. No individual or school is identified in any report. Teacher and student data collected from schools by CSW Group and NFER will not be made available to anyone outside of the parties listed. NFER and CSW Group are the joint data controller for this evaluation.

Legal basis for processing personal data

The legal basis for processing personal data is covered by:

GDPR Article 6 (1) (f) which states that ‘processing is necessary for the purposes of the legitimate interests pursued by the controller or by a third party except where such interests are overridden by the interests or fundamental rights and freedoms of the data subject which require protection of the personal data’.

Our legitimate interest for processing personal data is to administer the randomised controlled trial and analyse its data.

Personal data processed and shared

For the purposes of the trial, CSW Group collected the name, job title, and contact details of a nominated lead teacher to act as a school coordinator for this evaluation. CSW Group shared this data with us via NFER’s secure data portal so that we can liaise with the individual about the evaluation.

Schools shared student personal data with NFER via a secure data portal. This included pupil names, dates of birth, and Unique Pupil Numbers. We shared this data with the NPD team based in DfE in order to access and analyse pupil data held on NPD. This data sharing took place via DfE’s secure data exchange portal. The NPD data that we requested covers pupil prior attainment at the end of Key Stage 2 (KS2), FSM eligibility, gender, attendance, GCSE performance, and post-16 learning aims. CSW Group did not see any data from the NPD.

Matched de-identified NPD dataset was transferred to the SRS for analysis (SRS is the Secure Research Service hosted by ONS, the Office for National Statistics). Accredited and approved NFER researchers accessed this dataset to evaluate the data.

In addition to the above student data, NFER also used surveys to collect data about gender and students' views, including their attitudes to learning and attitudes to school and life. These surveys were administered at baseline and follow-up. Intervention pupils' personal data obtained by NFER was shared with CSW Group for the administration of the intervention. This data was shared via NFER's secure portal, and NFER used student personal data to contact them via the schools for the purposes of telephone interviews.

NFER also collected the name, job title and contact details for each of the employers from CSW Group for telephone interviews.

NFER and CSW Group signed a data sharing agreement that set out the roles and responsibilities for this trial. This includes a description of the nature of the data being collected and how it will be shared, stored, protected, and reported by each party. In addition, CSW Group provided an MoU to schools, explaining the nature of the data being requested of schools, teachers, and students, how it will be collected, and how it will be passed to and shared with NFER.

Further information on how we comply with data protection legislation can be found at the privacy notice in Appendix E.

No individuals or schools are or will be named in any report arising from this research.

Data security and transfer

All personal data provided electronically was done so using NFER's secure data portal. All personal data provided in hard copy was transferred by a secure courier. All NPD data was accessed using ONS secure access procedures. All researchers involved directly with pupils and their data had up-to-date DBS checks. NFER survey administrations obtained personal data in accordance with the GDPR and other applicable legislation.

Data retention and deletion

At the end of the evaluation, all of the de-identified matched data or student data will be added to the EEF archive. The EEF archive is hosted by ONS and managed by the EEF archive manager. This data is archived to allow for further research. At this point, the EEF also becomes responsible for the data. Other research teams may use the de-identified data as part of subsequent research through the ONS Approved Researcher Scheme.[2] This scheme is used by ONS to grant secure access to data that cannot be published openly, for statistical research purposes, as permitted by the Statistics and Registration Service Act 2007 (SRSA).

NFER will share all of the student data with the EEF's data archive partner. Anonymised data will then be stored with DfE, ONS, and potentially other research teams. Further matching to other administrative data may take place during subsequent research.

NFER and CSW Group will delete any project data, including personal data, within one year of report publication.

Right to withdraw

Participants had the right to withdraw their data or correct any errors in it at any time. The letter to parents at baseline (in September 2017) allowed parents an opportunity to withdraw their child's data from the study through a withdrawal form. Since the GDPR came into effect in May 2018, communications sent to all participating schools included a link to the project privacy notice. Schools were asked to make the privacy notice available to parents using their usual channels. The privacy notices were available via links on the project pages of the NFER website. Contact details for how to withdraw or correct errors were provided in the project privacy notice (see Appendix E).

[2] https://www.ons.gov.uk/aboutus/whatwedo/statistics/requestingstatistics/approvedresearcherscheme

Project team

The intervention, Generation STEM (Gen STEM), was developed by CSW Group. CSW Group is a social enterprise owned by the Local Authorities of Cornwall, Devon, Plymouth, and Torbay. Its mission is to inspire, develop, and support people, communities, and organisations to make positive change through sustainable high-quality services. It delivers a number of services in schools and colleges and in the community. This includes, in schools, careers and transitions support, work experience, a volunteer STEM Ambassador programme, and SENDIASS support service. In the community it provides intensive support for young people furthest away from the labour market and guidance and practical help for young people and adults seeking to upskill or reskill. CSW Group was responsible for school recruitment and intervention delivery, including liaising with the intervention schools and participating employers. The team at CSW Group was led by Andy Hancock, who was the project manager for Gen STEM. The delivery of Gen STEM was also supported by two delivery partners: Graphic Science and STEM NOW. Graphic Science is a STEM engagement consultancy based near Bristol, UK. STEM NOW is a trading name of Winchester Science Centre, and delivers educational STEM projects and teacher and STEM professional CPD.

The evaluation team at NFER was directed by Dr Ben Styles (Head of NFER's Education Trials Unit). Until November 2017, Dr Susie Bamford (Quantitative Researcher) was responsible for leading and managing the trial on a day-to-day basis. After this point, Palak Roy (Senior Trials Manager) managed the trial and oversaw the impact evaluation. Constance Rennie (Statistician) conducted statistical analysis for the trial. The analysis was quality assured by other members of NFER's Centre for Statistics. Tami McCrone (Senior Research Manager) led the process evaluation and was supported with quality assurance by David Sims (Research Director); and Kelly Kettlewell (Research Manager) and Megan Lucas (Researcher) supported process data collection and analysis. Kathryn Hurd (Head of NFER's Survey Operations) had the overall responsibility for leading school communication, school engagement and retention, and survey administration. She was supported by Priscilla Antwi, who was responsible for day-to-day school communication for the evaluation.

Methods

Trial design

The trial was a school-level randomised controlled efficacy trial involving 113 secondary schools in England. There were two arms: intervention and control. As stated in the protocol, CSW Group initially recruited schools in six Local Enterprise Partnership (LEP) regions. Since the recruitment target was not achieved by the end of October 2017, in line with the protocol, CSW Group expanded its recruitment to include schools in other geographic regions. As a result, CSW Group recruited schools across 14 LEPs.

As per the protocol, schools were randomised at two time-points: November 2017 and January 2018. Randomisation was stratified by the LEP. In total, 115 schools were recruited and randomised, and 113 schools were retained in the trial. The randomisation process resulted in 58 intervention schools and 55 control schools. Please see Figure 3 for further details.

Each participating school nominated 15 students who were in Year 10 in the academic year 2017/2018 to take part in the trial. The intervention group implemented Gen STEM, with pupils preparing for and completing work experience programmes in the summer of 2018. A bespoke work experience placement was offered to five of the 15 students, who were matched based on their interests and aspirations with relevant STEM-related placements provided by employers. The ten students who were not offered a place on the Gen STEM work experience went through the usual school process to find an alternative placement. The control group schools continued with business as usual, which may or may not have included work experience placements. Control schools received a financial incentive of £1,000 on completion of evaluation activities to acknowledge their participation in the research.

The trial ran from 2017 to 2020. The primary outcome was an amalgamation of mathematics and science attainment, measured by GCSE results in 2019. There were several attainment and non-attainment secondary outcomes: uptake of A-level STEM subjects and school attendance in Year 11 (measured via administrative data), and student attitudes to learning and engagement (measured via a student questionnaire). There were no changes to the design from the updated protocol.

Table 3 presents the trial design in brief.

Table 3: Trial design

Trial design, including number of arms		Two-arm, cluster randomised
Unit of randomisation		School
Stratification variable(s) (if applicable)		Local Enterprise Partnership (LEP) regions (14 regions)
Primary outcome	Variable	Combined mathematics and science attainment KS4_APCOMBISCI_91 or APBIO_91/APCHE_91/APPHY_91 and KS4_APMat91
	Measure (instrument, scale, source)	Key Stage 4, 2019 (NPD)
Secondary outcome(s)	Variable(s)	**Overall attendance rate in Year 11** Overallabsence_6HalfTerms_ab19 **Uptake of A-level STEM subjects** Pl_QN **Student attitudes to learning and engagement** • Well-informed to make future decisions • Positive attitude to STEM • Positive attitude to life • Positive attitude to school/college
	Measure(s) (instrument, scale, source)	School absence data held on NPD Post-16 Learning Aims (PLAMS data held on NPD) NFER student questionnaire at follow-up
Baseline for primary outcome	Variable	**Prior attainment in mathematics and science** KS2_KS2MATPS and KS2_SCILEVTA
	Measure (instrument, scale, source)	Key Stage 2 assessments in 2014
Baseline for secondary outcome(s)	Variable	**Overall attendance rate in Year 9** Overallabsence_6HalfTerms_ab17 **Prior attainment in mathematics and science** KS2_KS2MATPS and KS2_SCILEVTA **Student attitudes to learning and engagement at baseline** • Well-informed to make future decisions • Positive attitude to STEM • Positive attitude to life • Positive attitude to school/college
	Measure (instrument, scale, source)	School absence data held in the NPD Key Stage 2 assessments in 2014 (NPD) NFER student questionnaire at baseline

Participant selection

Eligibility criteria

Originally, maintained secondary schools in six LEP regions were eligible: Cornwall and the Isles of Scilly; Heart of the South West (Devon, Somerset, Plymouth, and Torbay); Dorset (including Bournemouth and Poole); Swindon and Wiltshire; West of England (Bristol, Bath and NE Somerset, North Somerset, and South Gloucestershire); and Gloucestershire. As the recruitment target was not met from this existing area, in line with the protocol, we extended the

recruitment regions to include maintained secondary schools in additional LEP regions. These were: Buckinghamshire Thames Valley LEP, Enterprise M3 LEP, Solent LEP, Enterprise M3 LEP and Solent LEP (combined),[3] Oxfordshire LEP, Thames Valley Berkshire LEP, The Marches LEP, and Worcestershire LEP.

Year 10 pupils (14–15 year olds) with an interest in STEM and the work experience opportunities in their local area were eligible to take part in the trial. As per the protocol, this identification process involved a mixture of self-selection and teacher input to encourage disadvantaged pupils to take part in the trial. Selection took place soon after schools signed up to the trial and prior to randomisation. CSW Group provided schools with guidance on student selection, suggesting thatteachers should select students who were: (i) interested in a career in a STEM-related field (science, technology, engineering, and mathematics); (ii) unlikely or less likely than others to obtain a work experience placement with a STEM-related employer without this intervention to support them; or (iii) those who were at a disadvantage compared with their peers (students who were capable but underperforming—in need of extra support or not confident in following their aspirations in STEM). Schools were asked to select approximately five students who were eligible for FSM.

Recruitment

CSW Group was responsible for school recruitment. On 6 September 2017, they sent a recruitment pack to 322 maintained secondary schools in the six selected LEPs (see eligibility criteria above). This pack included recruitment material to introduce the schools to the trial and the intervention, to which schools could express interest. The covering letter was addressed to the Careers Coordinator or the Head of Year 10. The recruitment pack also included an information sheet that presented intervention details and all stages of evaluation activities, and an MoU which set out the expectations for both the intervention and control groups and a detailed timeline of activities. Headteachers were asked to sign the MoU and send it back to CSW Group via email.

The interim recruitment target was for CSW Group to receive at least 80 signed MoUs (from a sample of 322 schools) by the end of October 2017—i.e. within half a term. Since this target was not achieved, in line with the protocol, they expanded their recruitment efforts to include schools in other geographic regions. This way, all maintained secondary schools in additional LEP regions were also eligible to take part in the trial (see the full list in eligibility criteria). At this point, NFER supported CSW Group in school recruitment activities. NFER's research operations staff phoned interested schools to support them to sign up to the trial.

All schools that agreed to participate in the trial sent their signed MoU to CSW via email. By mid-January 2018, 124 schools signed up to the trial, which is when the trial recruitment ended. Of these, nine schools did not provide pupil data. Therefore, 115 schools were included in the randomisation. Completing the student baseline survey was regarded as one of the eligibility criteria for randomisation and to take part in the trial. However, due to the delays in school recruitment, school randomisation had to take place while some schools had not yet completed the baseline surveys. Of the 115 randomised, two schools did not complete the student baseline surveys. These two schools were randomised but were excluded from the trial without the knowledge of group allocation. In total, 113 schools continued with the trial (58 intervention schools and 55 control schools). The final sample included 1,665 students (See Figure 3 for further details).

Outcome measures

Baseline measure for the primary outcome

As the intervention was a STEM-specific work experience programme, we used the primary outcome measure to encompass mathematics and science performance.

The baseline measure for the primary outcome (GCSE attainment in mathematics and science) was an amalgamation of mathematics and science achievement at KS2. The trial cohort completed their KS2 assessments in 2014 (old-style

[3] Participating schools could fall under one LEP area or could be part of an area that is supported by more than one LEP. One participating school fell under the Enterprise M3 LEP as well as the Solent LEP. Therefore, a separate strata was created to identify the area with combined LEPs.

tests), therefore the variables available for this cohort were teacher-assessed science levels (NPD code: KS2_SCILEVTA) and mathematics points (NPD code: KS2_KS2MATPS). In 2014:

- KS2 science assessment levels had possible values of 2, 3, 4, 5 and 6 ('L' and blanks were converted to missing values).
- KS2 mathematics points had possible valid values of 15, 21, 27, 33 and 39.

Therefore the results across the two subjects were not measured on the same scale. However, levels have corresponding values on the points scale,[4] so the science level could be converted into the point score values of the mathematics measure, and summed to create the baseline measure. The baseline measure was a sum of mathematics and science points with possible values of 30, 36, 42, 48, 54, 60, 66, 72 and 78. Only participants with values on both measures were given a baseline score. Although the two measures were not originally on the same scale, this was not essential as KS2 achievement was used only to control for students' prior attainment and to contribute towards explaining variance in the outcome measure.

Baseline measure for school attendance

The baseline measure for the secondary outcome of school attendance was the school attendance rate in the academic year 2016/2017 when the trial cohort was in Year 9. This was measured by the overall absence rate during the academic year. The overall absence rate for each student was expressed as a proportion of the total number of sessions possible. The following formula was applied to create this baseline measure using the available variables from the NPD:

$$Overall\ absence = \frac{\text{OverallAbsence\_6HalfTerms\_ab}}{\text{SessionsPossible\_6HalfTerms\_ab}} X100$$

Baseline measure for STEM-related subjects at A-level

The baseline measure for the PLAMS model was the same as the primary outcome model—an amalgamation of mathematics and science achievement at KS2.

Baseline measure for students' attitudes

We measured students' attitudes via surveys that were developed in-house by NFER, as appropriate measures were not readily available. During the development of the baseline and follow-up surveys, we considered sources such as the Wellcome Science Education Tracker 2016 questions, which informed the development of the surveys. We administered two surveys: one at baseline and one at follow-up. We created secondary outcome measures and these were scored by an NFER statistician. We administered a baseline 'attitudes' survey for all nominated pupils in the autumn and early spring terms of 2017/2018. The baseline survey (see Appendix E) included questions about student attitudes to learning and school, behaviour at school, current feelings about life, amount of guidance they are getting in school about careers and their future, plans for the future, and confidence in post-16 options, decision-making, and career aspirations. The method of how we derived these measures is described in more detail in the secondary outcomes section below.

[4] https://find-npd-data.education.gov.uk/en/data_elements/0e77177b-bacd-4c4b-ab8d-92c7a3221586

Primary outcome

The primary outcome measure was a weighted sum of mathematics and science scores at GCSE, giving both subjects equal weights. This was measured using the NPD variables that capture the new grading scale of 9 to 1 for mathematics and science. We used the KS4_APMAT_91 variable that measures mathematics, KS4_APCOMBSCI variables that measure combined (or double award) science GCSE grades, and the KS4_APBIO_91, KS4_APCHE_91, KS4_APPHY_91 variables that measure single (or triple award) science GCSE grades. Values of 'U' on these variables were recoded to zero.

For each student who took the combined GCSE science, grades were averaged across the two grades they were given. For those who took single sciences, their science grade was created by taking the mean value of the individual science grades they achieved. In cases where students had grades for only one or two of the three sciences, they received a science grade based on the valid grade values present in the dataset. This means we were able to assign a science GCSE grade for those students who had one or two individual science grades missing. This method ensured that we gave equal treatment to the combined science and single sciences on a single science point scale of 0–9. Creating an average by this method resulted in non-integer values which were used to derive the primary outcome measure. In addition to this variable, we used KS4_APMAT91 that carried the grade achieved in GCSE mathematics. The primary outcome measure was created by adding GCSE grades of mathematics and science allowing equal weighting across the two subjects. Only cases that had a valid mathematics and science grade were included in the primary outcome. Thus, the primary outcome measure was a GCSE point score across mathematics and science with a range of 0–18.

In addition to the primary analysis, in which the sum of the science and mathematics grades was used, we also analysed the subjects separately, running two additional models.

Secondary outcomes

There were three secondary outcome measures.

School attendance

School attendance was measured by the number of absent sessions during the academic year when the trial cohort was in Year 11 (2018/2019), where each session represented half a day. A number of students had multiple attendance records. We used the mainrecord_ab17 and 19 variables to retain the students' main records in 2017 and 2019 respectively. As per the SAP, the intention was to use the absence rate (calculated using the same formula as the baseline measurement above). However, the chosen model was suitable for count data, so we used the number of overall absences during the academic year (variable OverallAbsence_6HalfTerms_ab that indicated the number of sessions missed). The model also took into consideration the number of sessions possible for the academic year (included as an offset in the model); this was captured in the SessionsPossible_6HalfTerms_ab variable.

STEM-related subjects at A-level

We used the PLAMS dataset available from the NPD for this cohort to test whether the proportion of students taking STEM qualifications differed between intervention and control groups. PLAMS is available for secondary schools with sixth forms (including Academies and City Technology Colleges).[5] We were able to track the majority of trial students into Year 12.[6] Trial students started Year 12 in September 2019 and the data about their post-16 choices became available in February 2020.

The outcome measure was a binary variable denoting a value of one if the student took at least one STEM qualification at Level 3 (A-level), starting in September 2019 (in National Curriculum Year 12). We used a number of NPD variables to identify such students. These were: pl_QN (qualification number) to identify STEM subjects; and pl_LearningStartDate to include only those students who were on roll and started their qualification around September 2019. Contrary to the

[5] Students studying at Sixth Form Colleges or Further Education Colleges are not covered by the School Census and do not appear on the PLAMS dataset.
[6] We recognise that the PLAMS dataset only includes the academic path that the students choose and it does not include any vocational qualifications. Therefore, this analysis may fail to meet the broader aim of the Gen STEM programme where it might have an impact on students' vocational STEM subject selection.

SAP, pl_Qual_Lev_Ref and pl_Onroll were not used, as these variables were not available on the dataset. Students who did not qualify under this selection received a value of zero. As the schools nominated the students to participate in the study (a sub-sample rather than a whole cohort), it was not known how many would have qualified this criterion. In the SAP, we pre-specified that if the number of qualifying students was more than 90%, the outcome measure would be based on students selecting at least two STEM subjects instead of one. This was not the case, and therefore the selection remained at a minimum of one STEM subject. Please see Appendix F for further information on how A-level qualifications were coded as STEM or non-STEM qualifications.

Student attitudes (NFER's student survey)

As stated before, NFER administered a baseline survey for all nominated pupils. We distributed the baseline survey to Year 10 pupils before randomisation in the autumn and early spring term of 2017/2018. We developed the questionnaire using a combination of publicly available measures such as the Wellcome Science Education Tracker (SET) 2016 and an in-house measure developed by NFER which has been used in previous research into social mobility, career, and Higher Education motivation (McCrone and Bamford, 2016; Kettlewell et al., 2019). The same questions were included in the follow-up survey that was administered in the autumn term of 2018/2019 (see Appendix G).

As outlined in the SAP, we ran an exploratory factor analysis to determine the outcome measures related to student attitudes. We ran Principal axis factor analysis on the baseline survey data (n = 1,545) and the factors were rotated using the 'varimax' function in SPSS (see Appendix H).

Table 4 presents the score range for each outcome measure, which is simply a total of constituent item scores. All items were on Likert scales that ranged from 'strongly disagree' to 'strongly agree' (five-point) or 'never' to 'always' (five-point), except the first item in the 'Positive attitude to STEM' measure, which was on a four-point scale. We scored each item such that a respondent agreeing with a positive statement received higher scoring. There were some negatively worded items, where the scoring was reversed. These are marked with an asterisk in the table. For items scaled on the 'strongly disagree' to 'strongly agree' scale, responses of 'don't know' were recoded to the midpoint value which would have been 'do not agree or disagree'. For items on the 'never' to 'always' scale, responses of 'don't know' were recoded to missing. The extent of missing data was explored and it was decided that total scores should be calculated for each composite measure for participants who had responded to more than 70% of the items within that composite measure. That means if more than 30% of the items for a given composite measure were missing, the participant was not given a total score for that measure. For those who had less than 30% missing items in a composite measure, missing data was imputed with average values on the items, and then the total score for the composite measure was calculated. All resultant measures were used as secondary outcomes of student attitudes. Reliability for each measure was also explored and, as per the SAP, only the measures with the Cronbach's Alpha of 0.7 or above were considered. Table 4 shows further details on the composite measures, their minimum and maximum values, constituent items, and Cronbach's Alpha values at baseline and follow-up.

Table 4: Student attitudes to learning and engagement

Outcome measure (min–max)	Constituent items	Cronbach's Alpha at baseline	Cronbach's Alpha at follow-up
Well-informed to make future decisions (9–45)	• I feel well-informed about how to progress to higher education • I feel well-informed about how to progress to apprenticeships • I feel well-informed about my options after Year 11 • I feel well-informed about science, technology, engineering and technology (STEM)-related careers • Adults in my school/college help me to plan for my future • I feel confident in making decisions about my post-16 options • Careers-related activities have made me confident in my careers aspirations • I know where to get careers advice • I find it easy to make decisions about my future	0.85	0.86
Positive attitude to STEM (6–29)	• Are you interested in a future career that involves science, computer science, engineering or mathematics?	0.84	0.85

Outcome measure (min–max)	Constituent items	Cronbach's Alpha at baseline	Cronbach's Alpha at follow-up
	• I enjoy STEM-related subjects • STEM-related careers are not for me* • Careers that use science are suitable for someone like me • Careers that use science are boring* • Careers that use science make a useful contribution to society		
Positive attitude to life (5–25)	• Most of the time I feel happy • Most of the time I feel positive • Most of the time I enjoy my life • Most of the time I feel stressed or anxious* • I feel positive about my future	0.87	0.87
Positive attitude school/college (9–45)	• I am well behaved in school/college/training • I am on time for school/lessons/training • I am doing well at school/college • I normally finish tasks I start • Most of the time I like being at school/college • It is important to do my homework/coursework • It is ok to truant, bunk off, skive or skip school/college if I want to* • I feel that school/college is a waste of my time* • I think that I am reaching my full potential at school/college	0.81	0.80

Sample size

Sample size during protocol

The sample size was determined in the protocol to detect an effect size of 0.15 on the attainment outcome measure with 80% statistical power. The assumptions at that time were taken from the Teacher Observation trial[7] with GCSE mathematics outcome and KS2 mathematics as a baseline covariate. This design required 130 secondary schools (65 intervention and 65 control) based on the following assumptions:

- ICC with covariates of 0.1 (based on the Teacher Observation trial with GCSE mathematics outcome and KS2 mathematics baseline had ICC = 0.087);
- correlation between KS2 and GCSE of 0.65 (Teacher Observation trial with GCSE mathematics outcome and KS2 mathematics baseline had 0.68); and
- fifteen Year 10 students per school.

Sample size calculations were not undertaken to determine the number of disadvantaged students who should take part because of the small number of students in total from each school. It was decided that schools could reasonably aim to include five disadvantaged students within the nominated 15. With five students in each school at 80% power and maintaining all the assumptions as above, the minimum detectable effect size (MDES) for FSM analysis was 0.2 (see Table 5).

Sample size at randomisation

As per the SAP, 115 schools were randomised and two schools withdrew from the trial before the knowledge of group allocation. This way, 113 schools were retained in the trial—lower than the original target of 130. This reduced the total number of students and FSM eligible students in the trial and resulted in slightly higher MDES at randomisation for the main analysis and FSM analysis (see Table 5). The MDES is calculated for the retained sample.

[7] See the full report at:
https://educationendowmentfoundation.org.uk/public/files/Projects/Evaluation_Reports/Teacher_Observation.pdf

MDES at analysis

Table 5 presents the MDES for the primary outcome analysis. As seen, there were 1,524 pupils in the analysis (781 in the intervention group and 743 in the control group). With the pre-post correlation of 0.73 and the ICC of 0.11, the MDES was at 0.16 with 0.8 power.

Table 5: Minimum detectable effect size at different stages

		Protocol		Randomisation		Analysis	
		Overall	FSM	Overall	FSM	Overall	FSM
MDES		0.15	0.2	0.16	0.22	0.16	0.24
Pre-test/post-test correlations		0.65	0.65	0.65	0.65	0.73	0.65
Intracluster correlations (ICCs)		0.1	0.1	0.1	0.1	0.11	0.13
Alpha		0.05	0.05	0.05	0.05	0.05	0.05
Power		0.8	0.8	0.8	0.8	0.8	0.8
One-sided or two-sided?		Two-sided					
Average cluster size		15	5	14.73	4.74	13.73	4.32
Number of schools	Intervention	65	65	58	58	56	56
	Control	65	65	55	55	55	55
	Total:	130	130	113	113	111	111
Number of pupils	Intervention	975	325	860	275	781	254
	Control	975	325	805	261	743	225
	Total:	1950	650	1665	536	1524	478

Randomisation

NFER conducted school randomisation. This was done at two time points (November 2017 and January 2018) due to staggered recruitment led by CSW Group. Randomisation was stratified by the LEP to aid intervention delivery within those LEPs. In total, 115 schools were recruited and randomised (see the SAP for further details). Two schools that did not complete the baseline survey were randomised but excluded from the trial without the knowledge of group allocation.

An NFER statistician carried out the randomisation using SPSS with a full syntax trail (see the syntax in Appendix I). The analysis was not carried out blinded to randomisation.

Statistical analysis

Primary analysis: KS4 mathematics and science attainment

The primary outcome was analysed by intention-to-treat (ITT). The model included all 15 students (the whole trial cohort) who were nominated at the start of the trial and included those cases who had data on all variables in the model. As described in the primary outcome section, the primary outcome measure was the total point score achieved in GCSE mathematics and science. As this was a cluster RCT with randomisation at the school level, a multilevel linear regression model was used. The model had two levels: school and student. The baseline measure included as a prior attainment covariate in the model was an amalgamation of mathematics and science achievement at Key Stage 2 (KS2).

The primary outcome was regressed on the following covariates:

- an indicator of whether the student was in the intervention school;
- students' baseline attainment in mathematics and science at KS2; and
- LEP variables as stratifiers in the randomisation.

As there were 14 LEPs across the participating schools, 13 dummy variables were included in the model with Heart of the South West LEP (the one with the highest number of schools) being used as the reference value.

Secondary analysis

School attendance

School attendance was analysed as an ITT. The model used all 15 students (the whole trial cohort) who were nominated at the start of the trial and included those cases who had data on all variables included in the model. The outcome measure was the number of overall absences when these students were in Year 11 (the academic year 2018/2019). As predicted in the SAP, the distribution of the data was positively skewed (a lot of students had lower levels of overall absence and as we progressed towards higher overall absence levels the frequency of students was lower) and therefore a negative binomial regression model was used to analyse the overall absence count. It was analysed at an individual student level and run as a multilevel model with two levels (school and student).

The secondary outcome was regressed on the following covariates:

- an indicator of whether the student was in the intervention school;
- the overall absence rate for the student when they were in Year 9;
- LEP variables as stratifiers in the randomisation (as per the primary analysis); and
- the number of sessions a student could attend during the year (included as an offset as this varied from school to school).

STEM-related subjects at A-level

Students' STEM subject selection in Year 12 was analysed as an ITT, using all 15 students (the whole trial cohort) that were nominated at the start of the trial, and included those cases who had data on all variables in the model. The outcome was a dummy variable that indicated whether a student selected one or more STEM subjects at A-level or not (1 or 0 respectively). The outcome was regressed using a multilevel logistic regression with two levels (student and pupil). We had pre-specified that we would include LEPs as dummy variables in the model. However, the model was over-specified—i.e. there was not enough variation in the outcome within different LEPs. As such, it was decided to remove the LEPs from the model.

The outcome was regressed on the following covariates:

- an indicator of whether the student was in the intervention school; and
- students' baseline attainment in mathematics and science at KS2.

Student attitudes to learning and engagement

Four student engagement measures were analysed by ITT, using all 15 students (the whole trial cohort) that were nominated at the start of the trial. As explained in the outcomes section, cases with at least 70% data for the constituent items were included in the analysis. All cases that had totals on the respective composite measures were included in each model. The measures were analysed using multilevel linear regression models with two levels (school and student).

The outcomes were regressed on the following covariates:

- an indicator of whether the student was in the intervention school;
- students' baseline score for the respective measure; and
- LEP variables as stratifiers in the randomisation (as per the primary analysis).

Analysis in the presence of non-compliance

As described in the intervention section, five out of 15 nominated intervention students were offered the Gen STEM work experience placement. This means the effect of the programme was diluted amongst the nominated intervention students. Moreover, not all selected students took up the offer of the work experience placement. It was therefore necessary to complement the primary ITT analysis with an additional analysis that captured the level of compliance. Two different types of student compliance to the intervention were carried out. One was full compliance and the other was the bare minimum.

A student would have fully complied with the intervention if they:

1. took part in the work preparation day;
2. completed an application for a placement;
3. took an interview for a placement on the interview day;
4. successfully completed **all five days** of their work experience placement; and
5. received feedback/debrief following placement.

A student would have complied at a bare minimum level if they:

1. completed an application for a placement;
2. took an interview for a placement;
3. successfully completed **at least three days** of their work experience placement; and
4. received feedback/debrief following placement.

Of the analysed sample, 21% of intervention pupils fully complied according to the above criteria. This was higher than the cut-off point specified in the SAP (10%). Therefore, both compliance measures were used in two separate CACE (complier average causal effect) analyses.

The structure of the CACE analysis was multilevel (school and pupil). In deviation from the planned analysis, the above compliance measures were treated as continuous variables, as opposed to binary measures (in which a value of one would be given if a pupil achieved all compliance criteria of the respective compliance variables). Participants were given a value of one for each compliance criterion they achieved on the respective variable and these were summed to create a total compliance value—either a full compliance measure or a minimum compliance measure. As such, the full compliance measure had values of zero to five, and the minimum compliance measure had values of zero to four. In doing so, it was acknowledged that each compliance criterion had an equal weightage in calculating the total compliance.

In running this analysis, we were able to distinguish between pupils who had a level of compliance between one and five (or four for the minimum compliance model) and the remaining intervention students who did not engage with any of the intervention activities or were control group pupils. The selection of five intervention students to attend a work experience placement was not random, therefore all nominated students were included in the analysis.

Using the primary outcome variable for models with both compliance measures, we used a two-stage least squares model to calculate the CACE estimate (Angrist and Imbens, 1995). In the first stage of the model, we regressed the

student compliance (as described above) on all covariates used in the primary outcome model. The variable indicating whether the student belongs to the intervention or the control group acted as the instrumental variable (a binary variable) to indicate their pre-intervention treatment allocation. In the second stage of the model, we regressed the primary outcome on the covariates used in the main model and also included a covariate representing the student's estimated level of compliance, which was derived from the first stage of the model. The coefficient of the compliance measure from this second model was the CACE estimate. The analysis was carried out using the R package ivpack.

Missing data analysis

As the primary analysis used administrative data, we were confident that the reasons for missing data would either be 'missing completely at random' or 'missing at random'. We ran a logistic multilevel model of whether or not the outcome was missing and regressed it on the ITT covariates, student gender, their FSM eligibility, school's Key Stage 4 (KS4) attainment measure, and school-level FSM indicator. This was to describe the missing data patterns in our sample. We were confident that the missingness mechanism was independent of group allocation and did not interfere with the internal validity. Therefore, no further missing data analysis was planned.

Sub-group analyses

To assess any potential impact for FSM-eligible pupils specifically, two models were run using the primary outcome measure as the dependent variable. FSM pupils were identified using the KS4_FSM6_P 2018/19 variable that indicated whether the student was FSM-eligible for any period in the six years prior to and including the year students took their KS4 tests.

The first analysis was a sub-sample analysis. We selected the sub-group of nominated students who were eligible for FSM and ran the model similar to the primary ITT model. This analysis was to compare the differences in FSM pupils' outcomes between the intervention and the control groups.

The second analysis used all the pupils who had data on all the model variables. It was set up identical to the primary ITT model with the addition of two variables: a flag indicating FSM eligibility (using KS4_FSM6_P 2018/19) and an interaction term between the intervention and the FSM variable. This model was to explore the differential benefits of the intervention on FSM pupils.

Additional analyses

We undertook exploratory analyses using two student compliance measures which were cross tabulated by programme delivery providers. The two compliance measures were full compliance and minimum compliance. The aim of this analysis was to examine differences in student compliance levels by delivery organisation (CSW, STEM NOW, and Graphic Science). We treated the full and minimum compliance measures as binary as well as continuous variables. Continuous compliance measure was calculated as per the CACE analysis method above. Students were given a value of one for each constituent compliance criterion they achieved on the respective variable and these were summed to create a total compliance value—either a full compliance measure or a minimum compliance measure. For binary compliance measure, students were given a value of one only when they met all five (or four for minimum compliance) constituent compliance criteria for the measure and had values of zero to one.

We also ran two additional multilevel models regressing the attainment outcome for each subject—KS4 mathematics and KS4 science. We ran this analysis to examine whether the programme had an effect on students' mathematics or science attainment at KS4 when analysed separately. These models used the same mathematics and science variables that were used to create the amalgamated primary outcome measure. The model structure and the covariates were identical to those used in the primary model.

Estimation of effect sizes

In the case of linear models, the numerator for the effect size calculation was the coefficient of the intervention group from the multilevel model. All effect sizes were calculated using total variance from a multilevel model, without covariates, as the denominator—i.e. equivalent to Hedges' *g*. Confidence intervals for each effect size were derived by multiplying the standard error of the intervention group model coefficient by 1.96. These were converted to effect size confidence intervals using the same formula as the effect size itself. For the models on STEM-related subjects at A-level and the

absence, where the outcomes were binary, the effect sizes were calculated as odds ratios and rates ratios, respectively, by exponentiation of the model coefficients.

Estimation of ICC

The school-level ICC was calculated from the ITT model.

Implementation and process evaluation

Research methods

The implementation and process evaluation (IPE) had three main research questions:

1. How was the programme delivered? How did staff and pupils engage with it?
2. What was the impact of any alterations to the intended programme?
3. How much did it cost to run this programme?

The research methods were selected to provide information and views on how the Gen STEM programme was implemented and managed by providers, schools, and employers. They were designed to offer regular and timely insights into intervention activity and to address all the required elements of high-quality IPE. Research questions were interweaved carefully across the different methods. The observation schedules and the telephone interview schedules for school staff, pupils, and employers were informed by the strategic work experience expert and the CSW manager. All interviews and observations were conducted by NFER researchers. In addition, CSW provided NFER with its programme monitoring data. This included compliance data on the number of trial students who took part in the work preparation day; completed an application for a placement; took an interview for placement on the interview day; successfully completed at least three days of their work experience placement; and received feedback or a debrief following the placement. The CSW Group monitoring data also included data about the young people's work experience placement job titles, their employer's geographic region, and the format in which the young people received feedback or a debrief after the work experience placement.

Table 6 provides an overview of the IPE methods and their contribution to answering the research questions.

Table 6: IPE methods overview

Research methods	Data collection methods	Participants or data sources	Data analysis methods	Research questions addressed	Implementation or logic model relevance
Strategic and provider interviews	In depth, semi-structured, one hour telephone interviews.	One independent academic expert on work experience with multiple research publications. One key member of the delivery/provider team.	The semi-structured interview schedules allowed observations to emerge.	Responses contributed to IPE research questions 1 and 2 (see evaluation objectives above).	These interviews contributed to the development of the IPE research instruments and allowed us to test the assumptions identified in the logic model.
Observations of the work preparation days	A one-day observation of how each of the three providers delivered the work preparation days.	Observations of work preparation days: CSW in Cornwall; STEM NOW in Oxfordshire; and Graphic Science in Gloucestershire.	Topics included factual information about the work preparation day; the aims and objectives of the day; the sequence of events; summary of inputs; and provider reflections.	Responses contributed to IPE research questions 1, 2 and 3 (see evaluation objectives above).	This provided data on the assumptions, the target audience, and the strategies outlined in the logic model.
Baseline and follow-up student surveys	Baseline survey distributed to Year 10 pupils in the autumn and early spring term of 2017/2018	1,665 students in 113 schools completed the baseline survey and 1,262 students from 100 schools completed the	Survey analysis; frequencies and factor analysis.	Secondary non-cognitive outcomes.	

	and the follow-up survey in the autumn term of 2018/2019.	follow-up survey.			
Telephone interviews with school-based staff, pupils, and employers	10 to 20 minute telephone semi-structured interviews.	We interviewed 15 employers, 15 teachers, and eight pupils.	Inductive analysis allowing research finding to emerge from data.	Responses contributed to IPE research questions 1, 2 and 3.	This provided data on the assumptions, target audience, and strategies outlined in the logic model.

Further detail on each of these methods follows.

Strategic and provider interviews

Following the IDEA workshop, we carried out two telephone interviews. In January 2018, we interviewed a lead member of the delivery team at CSW to understand exactly how the work experience programme would be implemented, including what actions CSW, STEM NOW, Graphic Science, the schools, the employers, and the young people would carry out. In February 2018, we interviewed an academic expert on work experience to gain her view on what constitutes effective work experience and what the core components should be, including preparation, the quality of the actual experience, and reflective practice following the work experience.

As well as informing the development of the process evaluation research instruments, these interviews allowed us to focus on how the programme specifically differs from usual work experience practice in schools, the elements that are intended to lead to impact, the likely (differential) impacts of the programme, and any anticipated variations or adaptations to delivery.

Observations of the work preparation day

In order to gain valuable contextual data for the process evaluation and help to assure the quality and appropriateness of our research instruments, in March, May, and June 2018 NFER researchers attended three work preparation days in Cornwall, Oxfordshire, and Gloucestershire. The timing of the three observations reflected the length of time the intervention was being delivered—January to July 2018. The three locations allowed us to observe the way in which the work preparation days were being delivered by the three providers: CSW in Cornwall; STEM NOW in Oxfordshire; and Graphic Science in Gloucestershire.

Baseline and follow-up pupil attitude surveys

As discussed in the secondary outcome measures section, we measured pupil attitudes using NFER's bespoke survey at baseline and at follow-up.

In the follow-up survey, administered in the autumn term of 2018/2019, we added an extra set of questions to ask pupils about work experience activities. These questions measured business as usual for the control group pupils, and showed what other work experience-related activity both the intervention and control group pupils were engaged in. We explored the influence of any work experience-related activities on their confidence about their career aspirations, their ability to make post-16 decisions, their confidence in communicating with other young people and adults, and their confidence in teamwork and problem-solving skills.

We compared responses between the intervention and control group pupils and between baseline and follow-up responses. Asking pupils to report on their engagement in any work experience-related activities meant that we did not need to issue control group schools with a pupil-level business-as-usual log. This reduced the administrative burden on schools and the overall evaluation budget. The outcomes of the survey analyses are presented in the secondary analysis section within the impact evaluation results below. No further pattern of change between either intervention and control groups or baseline and follow-up surveys were detected.

The quality of all NFER interview schedules is checked by the trial manager and one other colleague. All NFER schedules include an introduction to explain the purpose of the interview and an explanation of the interviewees' rights and assurance of anonymity as laid down in the Code of Practice. The structure and sequence of the schedules are logical with related questions grouped sensibly. Schedules are developed by an expert who is well informed on the subject matter and, wherever possible, schedules are piloted.

The sampling strategy was to select a representation of schools: those from the different geographical areas included in the intervention (this was synonymous with the areas covered by each of the providers—CSW, STEM NOW, and Graphic Science); different school types (schools with students up to 16 years old and schools with students up to 18 years old); and those delivering the intervention at different times of year, for example, in the spring or summer term.

Interviews with school staff

Between June and November 2018, NFER researchers carried out 10–20minute semi-structured telephone interviews with 15 staff in schools that had taken part in the Gen STEM programme. Generally, interviewees' job roles included responsibility for work experience or careers activities. Schools were selected to provide a representation of different geographical areas, providers, location (rural or urban), and school type. Teachers were responsible for the work experience programme. Teachers nominated pupils who were taking place in the programme to be interviewed by telephone.

CSW requested an extension until the end of August to complete work experience placements, so fieldwork was extended into the autumn term. We were asked to extend fieldwork further until all schools had been offered a debrief (a necessary part of the intervention) from their provider before completing the telephone interview in November 2018.

Interviews explored:

- how the programme was implemented in their school, and the nature of and reasons behind any variations or adaptations they made to the intervention model;
- the impacts of the programme (at both school and pupil level) and any differential benefits for particular groups;
- the perceived elements of the programme that led to impact or are particularly distinctive from usual practice;
- any barriers and challenges to implementation, as well as recommendations for any future roll-out of the programme;
- the associated costs of being involved in the programme (direct costs, marginal costs, and school staff time) (see Section 4);
- their usual practice, and whether it changed in light of the trial context;
- whether the programme replaced anything that their pupils might otherwise have participated in; and
- any additional careers-related activity the intervention pupils have participated in, and how this programme compares.

Interviews with pupils

At our request, the school staff we interviewed asked students who had received the intervention to have a 10–15-minute telephone interview with an NFER researcher. Students were given the option of being interviewed on their own or in pairs. After a delay in fieldwork for reasons described above, school staff organised telephone interviews with eight of the intervention pupils between June and November 2018, distributed across six schools and all three provider regions. As anticipated at the outset, although our target was 15 students, we did not achieve this number either because staff did not recruit them or because the young people did not attend the appointment.

The interviews explored:

- pupils' experience of moving through the programme—the work preparation day, the application and interview process, the supporting preparatory resources, the work experience placement, and any subsequent support;
- detail on any early impact of the programme, including impact on career intentions, improved confidence in achieving career goals, and the ability to make informed decisions about their career and post-16 options;

- the key factors that are felt to have led to impact; and
- any suggested improvements.

Interviews with employers

The sampling strategy was to select a representation of employers: those from the different geographical areas included in the intervention (synonymous with the areas covered by each of the providers—CSW, Graphic Science and STEM NOW, spanning 17 counties); different sized employers; and STEM employers (i.e. with a STEM focus) and non-STEM employers (for example, a clothes manufacturer with an IT department).

NFER researchers carried out 10–20-minute semi-structured telephone interviews with 15 employers (spanning all three provider areas) between July and September 2018 (work experience placements took place between March and August 2018). These interviews covered:

- key elements of the STEM placement and preceding interviews or debriefs;
- young people's attendance, punctuality, and perceived attitudes;
- perceived impact of the placement or intervention on the young participants (in contrast to other work experience provided to young people previously);
- any barriers and challenges to providing the placement and how, if at all, they were overcome;
- costs associated with placement provision; and
- usual work experience practice and how the STEM placements differ.

Compliance

We received programme monitoring data from CSW Group. This was supplied at pupil level and included information about whether intervention pupils took part in each intervention activity or not. This dataset was used to create compliance measures included in the impact analysis as well in the IPE findings.

Fidelity and adherence

The three work experience preparation day observations recorded details such as the number of young people, employers, and school staff attending; the duration of the day; and whether the session was held before young people applied for and were interviewed for their work experience, or after application and interview but before the commencement of the work experience. Each session was held by a different provider so observations allowed us to record the extent of delivery commonality and consistency.

The data recorded in the observations and interviews with employers, school staff, and pupils contributed to monitoring fidelity in terms of the degree to which elements of the intervention are delivered as planned (such as the interviews for the work experience, the quality of the work experience, and the extent to which pupils received feedback), and the extent to which participants in the intervention received the critical ingredients.

Usual practice

The intervention was planned to replace the schools' usual approach to work experience for the five students taking part in the intervention. The school staff interview schedule and the employer interview schedule included a question on whether they changed their usual practice as a result of taking part in the intervention.

Minimising bias

Researchers are aware of the possibility of bias and are trained to develop instruments and ask questions in a way that will retain objectivity and minimise bias. In addition, NFER has a quality assurance system that supports this process by interrogating and monitoring project management.

To minimise sample selection bias, our IPE sample selection ensured a representation of different types of schools, geographical location, and providers. By triangulating data from employers, school staff, and students, we authenticated responses. Systematic analysis of qualitative data was conducted by the team of project researchers who interrogated the data together.

Analysis

Through using the methods outlined above, we analysed the compliance data on how much of the intended intervention was delivered and received. We gathered interview and observational evidence of how well the delivery of the programme worked—whether it was delivered as planned, what challenges schools and employers encountered, and how, if at all, they addressed them. This yielded valuable data on the feasibility of the roll-out of the work experience intervention.

The process evaluation analysis used a deductive approach where the interview and observational data were analysed to test whether the school staff, employers, and providers adhered to the intervention compliance criteria outlined in the logic model. It also used an inductive approach where data was analysed to draw out patterns of behaviour on the extent to which the school staff, employers, and providers adhered to the intended intervention programme.

The IPE analysis integrated with data from the impact evaluation to validate the logic model. For example, the underlying assumption tested the link between the provision of work experience and a rise in attainment at Key Stage 4 mathematics and science (the primary outcome).

Costs

As this trial was set up in 2017, cost data was collected and analysed in line with the 2016 cost guidance provided by the EEF on direct and indirect costs to schools.

CSW Group did not have a costing model for the Gen STEM programme and as part of the trial, the programme was offered free of charge to intervention schools. As the programme was delivered by three different providers that delivered the individual programme components in slightly different formats, it was important to get cost estimates from all three organisations. We requested delivery providers' cost data that covered the cost of resources, intervention support, and monitoring provided to schools; as well as administration costs and the staff time spent in liaising with schools and employers. CSW Group was not able to obtain reliable costs from their sub-contractors. Therefore, the provider costs that they supplied included an estimate of the costs and staff time associated with delivering the entire project across all the three delivery organisations: CSW, Graphic Science, and STEM NOW.

The monetary cost and staff time provided by CSW Group was divided into ten broad categories to cover all programme activities. The structure of the programme meant that the total number of students receiving each programme component or activity was different. Therefore, it was necessary to first arrive at a per-pupil figure for each activity. To do so, each category total was divided by the number of students who took part in those specific activities. These denominator values (number of students) were extracted from the compliance data collected by CSW Group or from their monitoring reports. This way, we ascertained the provider's monetary cost and their staff time spent per pupil towards each cost category. The per-pupil cost and per-pupil time spent was totalled across all categories. This was the provider's cost and staff time spent per pupil for Year 1 delivery. Afterwards, in line with the cost guidance, the recurring costs were identified and added for Year 2 and Year 3. And once added with the start-up cost, the cumulative cost for Year 3 was averaged across the three years to derive the final cost and staff time per pupil per year.

In addition to ascertaining delivery costs borne by the providers, we also asked participating schools about the direct and marginal costs to them, if any, that were associated with delivering the programme. We explored this via school staff interviews to find out:

- the direct costs associated with implementing the intervention;
- the marginal or additional costs associated with implementing the intervention;
- staff time used to implement the intervention; and
- the estimated cost of each placement.

Employers were also asked if the cost of implementing the intervention work experience was approximately the same, more, or less than other work experience they had run previously.

Timeline

Table 7: Timeline

Dates	Activity	Organisation responsible or leading
May 2017	Trial set up	NFER, CSW Group, and the EEF
June 2017	IDEA workshop	NFER and CSW Group
Summer 2017	Research instruments and recruitment materials developed	NFER and CSW Group
Autumn term 2017–January 2018	School recruitment; schools sign MoU	CSW Group (with support from NFER from November to December 2017)
	Schools identify students to participate	Schools (with guidance from CSW Group)
October 2017–February 2018	Pupil data collection Baseline surveys	NFER
November 2017 and January 2018	School randomisation	NFER
December 2017–October 2018	Intervention delivery • Pupils attend work preparation day • Pupils invited to interviews • Interview debrief for pupils • Pupils matched to placements • Pupils complete work experience • Post work experience debrief	CSW Group and schools
Autumn term 2018	Interviews with school staff, employers, and students Follow-up survey distributed	NFER
January–February 2018	Strategic and provider interviews	NFER
March–June 2018	Observation of work preparation day	NFER
Summer term 2019	GCSEs taken by Year 10 pupils	Schools
September 2020–January 2021	Analysis (including accessing NPD data via ONS/SRS) and draft reporting	NFER
January–September 2021	Reporting	NFER

Impact evaluation

Participant flow including losses and exclusions

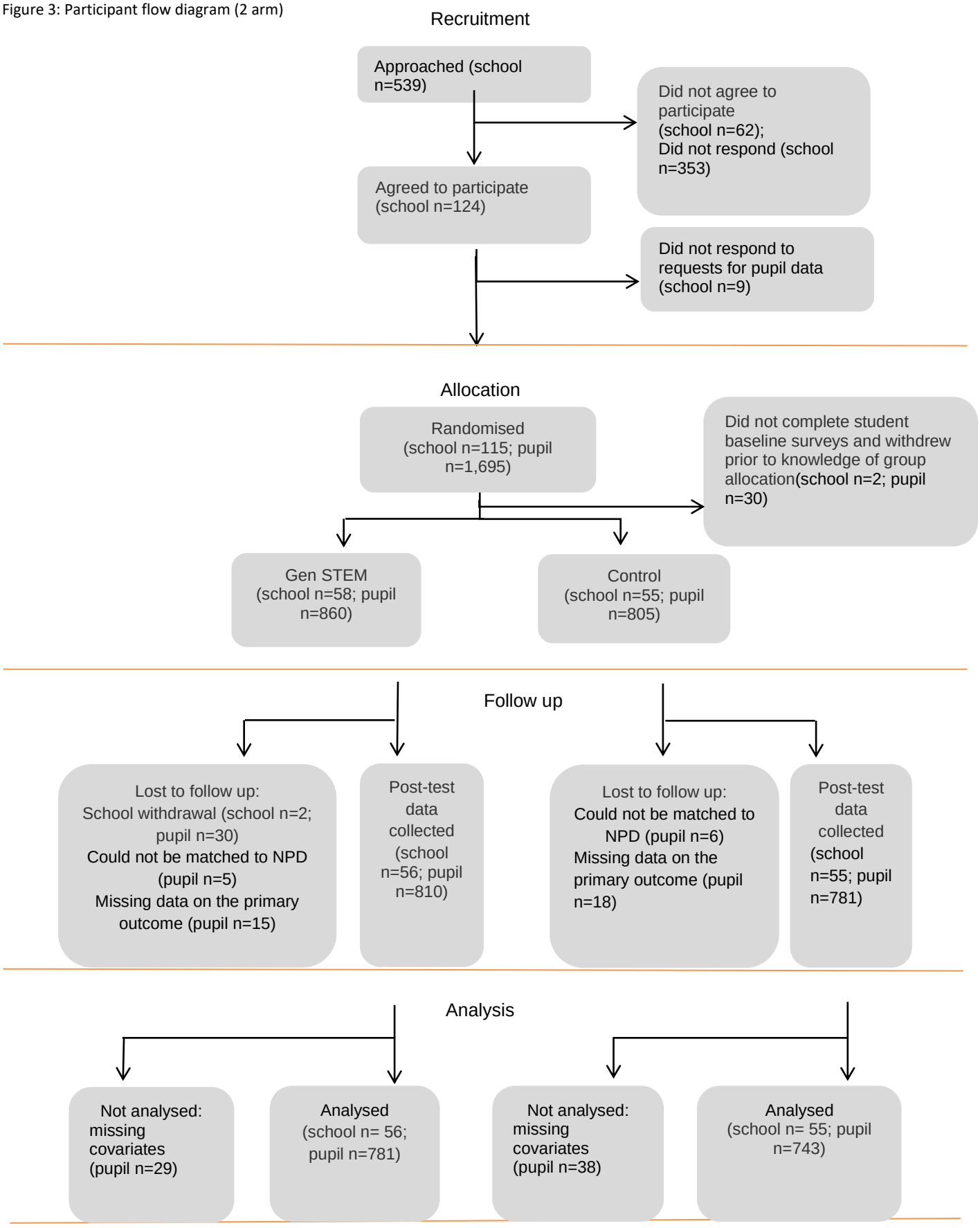
Figure 3 below presents details of the participants' flow through various stages of the trial.

As mentioned in the recruitment section, CSW Group was responsible for recruiting schools for this trial. The initial recruitment efforts were focused on six LEP regions, then expanded to additional LEPs when the interim recruitment target was not met. In total, 539 schools were invited to take part in the trial; of these, 124 expressed their interest to take part in the trial and signed an MoU. We approached these schools to collect their pupil data, and all but nine returned this data. Subsequently, we sent baseline pupil surveys to all the schools that provided us with the pupil data (n = 115). Of these, two schools did not return the student surveys. As providing pupil data and completing baseline surveys were condition to randomisation, we did not send group allocation to these two schools and as a result, we retained 113 schools (58 intervention and 55 control) in the trial with 1,665 pupils (860 pupils in the intervention group and 805 pupils in the control group). These are presented in the recruitment and allocation sections of Figure 3.

The next section of Figure 3 is the follow-up data. This section presents the number of schools and pupils for whom it was possible to collect GCSE results from the NPD. Out of 58 intervention schools, six schools withdrew their participation from the programme. However, four of these withdrawn schools agreed for us to access their pupil data from the NPD; therefore we could match the NPD data for 56 intervention and 55 control group schools. The reduced pupil numbers from allocation to follow-up are shown in 'Lost to follow-up' section. This loss was for several reasons: two intervention schools did not agree for us to access their pupil NPD data (pupil n = 30); in some cases, we could not match pupil data to NPD (intervention pupil n = 5, control pupil n = 6); and in other cases, pupils did not have the GCSE outcomes on NPD (intervention pupil n = 15, control pupil n = 18).

The next section of the flow diagram ('Analysis') presents the number of schools and pupils who were included in the primary ITT model. We did not lose any further schools from follow-up to analysis. However, we lost some pupils at this stage as a result of them not having the baseline measure at Key Stage 2. This way, the primary ITT model included 781 intervention pupils and 743 control pupils.

Figure 3: Participant flow diagram (2 arm)



Attrition

The rates of attrition are displayed in Table 8. The intervention group lost 9.19% pupils due to withdrawals, missing outcome, or prior attainment data. The control group lost 7.70% pupils due to withdrawals, missing outcome, or covariate data.

Table 8: Pupil level attrition in the primary analysis

		Intervention	Control	Total
Number of pupils	Randomised	860	805	1,665
	Analysed	781	743	1,524
Pupil attrition (from randomisation to analysis)	Number	79	62	141
	Percentage	9.19%	7.70%	8.47%

Pupil and school characteristics

In total, 113 schools were retained in the trial. As seen above, we could not access NPD data for two intervention schools. Thus, Table 9 presents the key baseline characteristics of the remaining 111 schools (56 intervention and 55 control) that were included in the primary analysis. After following the ONS statistical disclosure controls for DfE data, we have not reported school numbers less than three and pupil numbers less than ten, although they were included in the analysis. This has affected Table 9 and histograms. Looking at the school characteristics in the table, there is a broad balance between the intervention and control group schools. When compared nationally, the trial schools had slightly lower proportions of FSM pupils compared with the national population of similar schools.

Looking at pupils' prior attainment, intervention pupils had slightly higher prior attainment at Key Stage 2 (mathematics and science combined) compared with control group pupils. In addition to this, we calculated the baseline effect size using the prior attainment data for analysed groups. As seen in the table, the effect size was 0.06 with the confidence intervals straddling zero, which suggests that there is no systematic difference in the baseline scores between analysed groups. Appendix J presents the distribution of pre-test scores by analysed groups.

Table 9: Baseline comparison[8]

School-level (categorical)	National-level mean[9]	Intervention group		Control group	
		n/N (missing)	(%)	n/N (missing)	(%)
School type (2018/19)					
All through school	4%	x/56 (2)	x	x/55 (0)	x
Comprehensive to 16	33%	14/56 (2)	25%	16/55 (0)	29%
Comprehensive to 18	54%	32/56 (2)	57%	29/55 (0)	53%
Grammar	5%	x/56 (2)	x	x/55 (0)	x
Secondary modern	0%	x/56 (2)	x	x/55 (0)	x
Other secondary type	1%	x/56 (2)	x	x/55 (0)	x
Ofsted ratings (2017/18)					
Outstanding	23%	x/56 (5)	x%	x/55 (7)	x%
Good	55%	30/56 (5)	60%	29/55 (7)	60%
Requires improvement	17%	10/56 (5)	20%	8/55 (7)	17%
Inadequate	5%	x/56 (5)	x%	x/55 (7)	x%

[8] Figures replaced with an 'x' are supressed cells in line with the ONS statistical disclosure controls for DfE data.
[9] These figures are based on academies, free schools, and maintained secondary schools in England, which have both Year 10 and Year 11.

School-level (continuous)		n/N (missing)	Mean (SD)	n/N (missing)	Mean (SD)	
FSM (2017/18)	13.13%	51/56 (5)	9.90 (6.32)	48/55 (7)	8.60 (4.25)	
School performance on primary outcome (KS4 mathematics and science 2018/19)	11.86[10]	56/56 (0)	10.84 (4.09)	55/55 (0)	10.63 (3.96)	
Pupil-level (categorical)		n/N (missing)	(%)	n/N (missing)	(%)	
FSM status (KS4_FSM6_P) FSM Non-FSM	N/A	 254/781 (0) 527/781 (0)	 33% 67%	 225/743 (0) 518/743 (0)	 30% 70%	
Gender Female Male	N/A	 303/781 (0) 478/781 (0)	 39% 61%	 265/743 (0) 478/743 (0)	 36% 64%	
Pupil-level (continuous)		n/N (missing)	Mean (SD)	n/N (missing)	Mean (SD)	Effect size
Baseline KS2_KS2MATPS and KS2_SCILEVTA	N/A	781/781 (0)	61.01 (7.60)	743/743 (0)	60.17 (8.18)	0.06 (-0.14;0.26)

Outcomes and analysis

Primary analysis

Table 10 displays the raw mean values of the primary outcome—total point score at Key Stage 4 across mathematics and science results, of the intervention and control groups. The intervention group had a raw mean of 11.05. The control group had a raw mean of 10.50. Figure 4 displays the distributions of the outcome measure by randomised groups. The outcome was approximately normally distributed across both groups.

Table 10 also shows the results from the primary ITT analysis, in which a multilevel linear regression model with two levels (school and pupil) was run, which ascertains the impact of the intervention on pupil outcomes. The statistics used to calculate the effect size are displayed in the table. The effect size for the impact of the intervention on Year 11 pupils was 0.04 (-0.07, 0.15), which is estimated to be zero month's additional progress, with the true value in the range between one month of less progress and two months of additional progress. The results are not statistically significant and suggest that there is no evidence of impact of the Gen STEM programme on student's mathematics and science attainment at Key Stage 4 compared with control group students.

[10] For the national mean, this is the equivalent of a total GCSE point-score for two subjects, derived from schools' KS4 Attainment 8 average scores to make it comparable to two GCSE scores as per the primary outcome.

Figure 4: Score distributions of the primary outcome by randomisation groups[11]

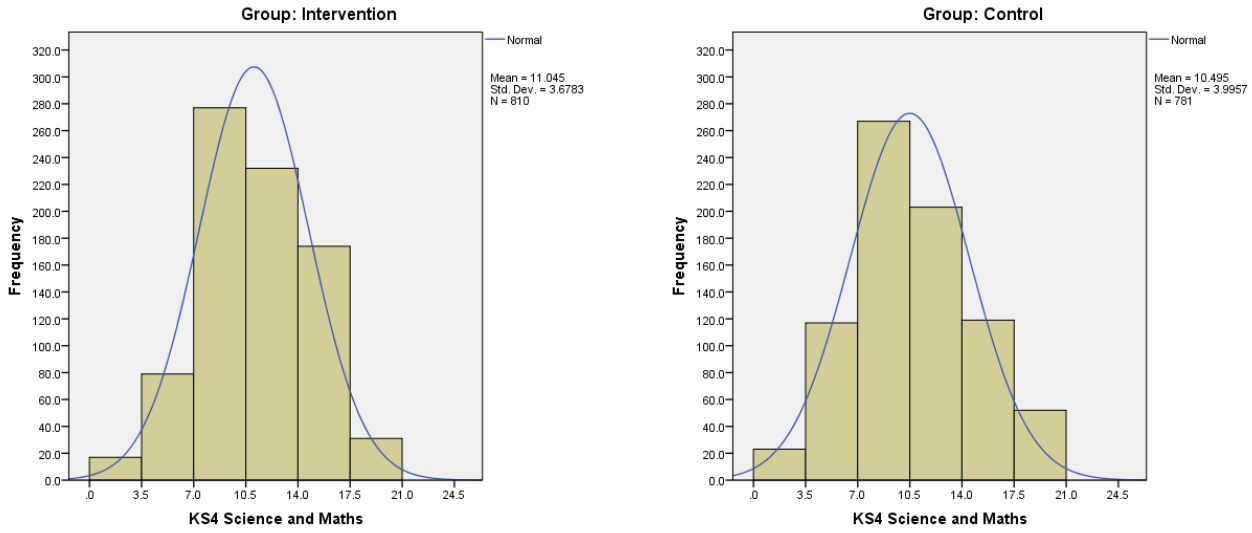


Table 10: Primary and secondary outcomes analyses including sub-group analyses and additional analyses

	Unadjusted means				Effect size		
	Intervention group		Control group				
Outcome	n (missing)	Mean (95% CI)	n (missing)	Mean (95% CI)	Total n (intervention; control)	Hedges *g* (95% CI)	*p*-value
Primary outcome KS4 mathematics and science	810 (50)	11.05 (10.79,11.300)	781 (24)	10.50 (10.21,10.78)	1524 (781:743)	0.04 (-0.07,0.15)	0.51
FSM pupils subsample[12]	259 (0)	9.71 (9.30,10.12)	233 (0)	8.89 8.42,9.35)	479 (254:225)	0.08 (-0.1,0.26)	0.31
Secondary outcomes analyses							
Outcome	n (missing)	Mean (95% CI)	n (missing)	Mean (95% CI)	Total n (intervention; control)	Rates ratio (95% CI)	*p*-value
Attendance in Y11	822 (28)	16.51 (14.95, 18.07)	795 (10)	16.52 (14.81, 18.23)	1610 (820:790)	1.08 (0.92:1.27)	0.33
Outcome	n (missing)	Mean (95% CI)	n (missing)	Mean (95% CI)	Total n (intervention; control)	Odds ratio (95% CI)	*p*-value

[11] Please note that the bin sizes and the ranges of the histograms are wider than the outcome scores. This has been adjusted to supress scores with a low cell count, as per the ONS statistical disclosure controls for DfE data.

[12] It is not possible to know the full sample of FSM pupils as we did not have access to the NPD data of the withdrawn schools.

Uptake of STEM subjects at KS5	830 (20)	0.40 (0.34,0.39)	805 (0)	0.33 (0.30, 0.36)	1555 (796:759)	1.44 (0.73:2.81)	0.28
Outcome	n (missing)	Mean (95% CI)	n (missing)	Mean (95% CI)	Total n (intervention; control)	Hedges *g* (95% CI)	*p*-value
Survey outcome 1: Well informed to make future decisions	575 (275)	32.08 (31.61, 32.55)	675 (130)	31.29 (30.84, 31.73)	1175 (638:537)	0.11 (-0.01,0.23)	0.07
Survey outcome 2: Positive attitude to STEM	573 (277)	21.93 (21.57,22.29)	674 (131)	21.17 (20.83,21.52)	1169 (634:538)	0.05 (-0.04,0.14)	0.20
Survey outcome 3: Positive attitude to life	575 (275)	18.13 (17.81, 18.45)	678 (127)	17.78 (17.47,18.08)	1181 (643:538)	0.01 (-0.09,0.1)	0.19
Survey outcome 4: Positive attitude to school	577 (273)	36.02 (35.65,36.40)	681 (124)	35.44 (35.08, 35.80)	1187 (647:540)	0.04 (-0.08,0.15)	0.27
Additional analyses							
KS4 mathematics only	819 (31)	5.58 (5.44,5.71)	795 (10)	5.21 (5.06, 5.36)	1524 (781:743)	0.06 (-0.04,0.17)	0.21
KS4 science only	810 (40)	5.44 (5.31,5.57)	781 (24)	5.22 (5.08, 5.36)	1524 (781:743)	0 (-0.12,0.12)	0.97

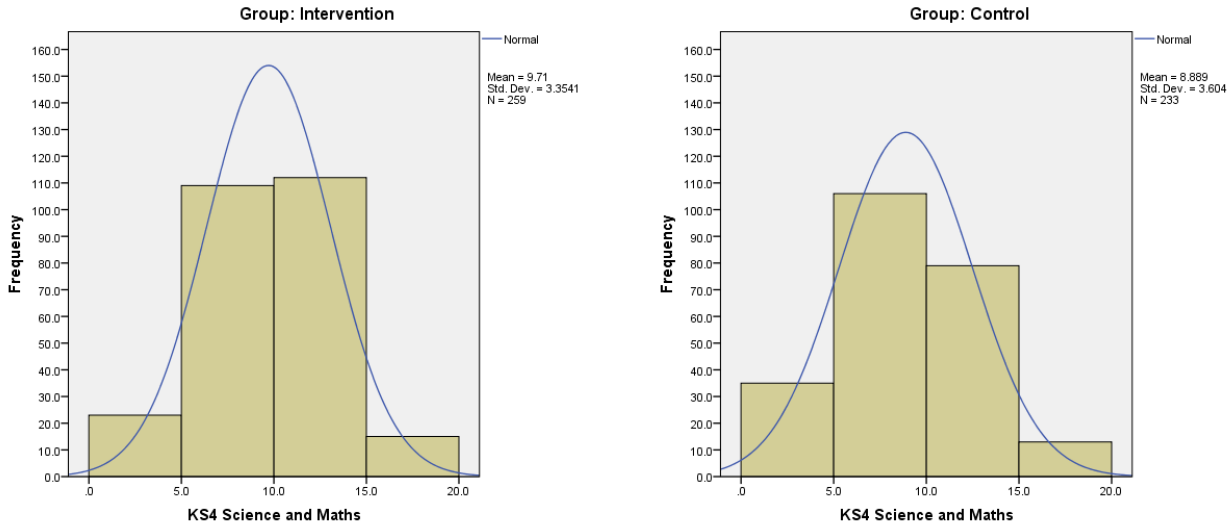
Sub-group analyses

Two sub-group analyses were carried out on the primary outcome, to investigate if there was any differential impact on the outcomes of pupils eligible for free school meals (FSM). This was measured by KS4_FSM6_P when the pupil took their GCSEs and represents if the pupil was eligible for FSM for any period in the last six years.

The first was an analysis of only the subsample of FSM pupils. The model run on the subsample was specified exactly as the primary ITT analysis. The raw means of the outcomes for the intervention and control groups of FSM eligible pupils are displayed in Table 10. The intervention group had a raw mean of 9.71 and the control group had a raw mean of 8.89. Figure 5 displays the distributions of the outcomes for the two groups. Both groups had approximately normally distributed outcomes.

The effect size for the impact of the intervention on FSM eligible pupils' combined mathematics and science KS4 attainment was 0.08 (-0.10, 0.26), which is estimated to be one month's additional progress, with the true value in the range between three months of additional progress and two months' less progress.

Figure 5: Score distributions of the primary outcome, FSM eligible pupils only[13]



The second FSM analysis involved all cases that were in the primary ITT model, and specified as the primary ITT model, with the addition of an FSM variable representing FSM eligibility and an interaction term between the intervention and the FSM eligibility. This model was run to test if there was any differential effect of the intervention on the outcomes between FSM and non-FSM eligible pupils. The results of the model are presented in Table 11. These results indicate that the intervention did not have a statistically significant differential effect on the primary outcome of combined mathematics and science attainment at KS4 when pupil FSM status was considered.

Table 11: Results from the FSM interaction model

Coefficient	Coefficient	SE	P value
Intervention	0.17	0.22	0.45
FSM	-0.94	0.21	0.00
Interaction	0.06	0.29	0.83

Secondary analysis

School attendance

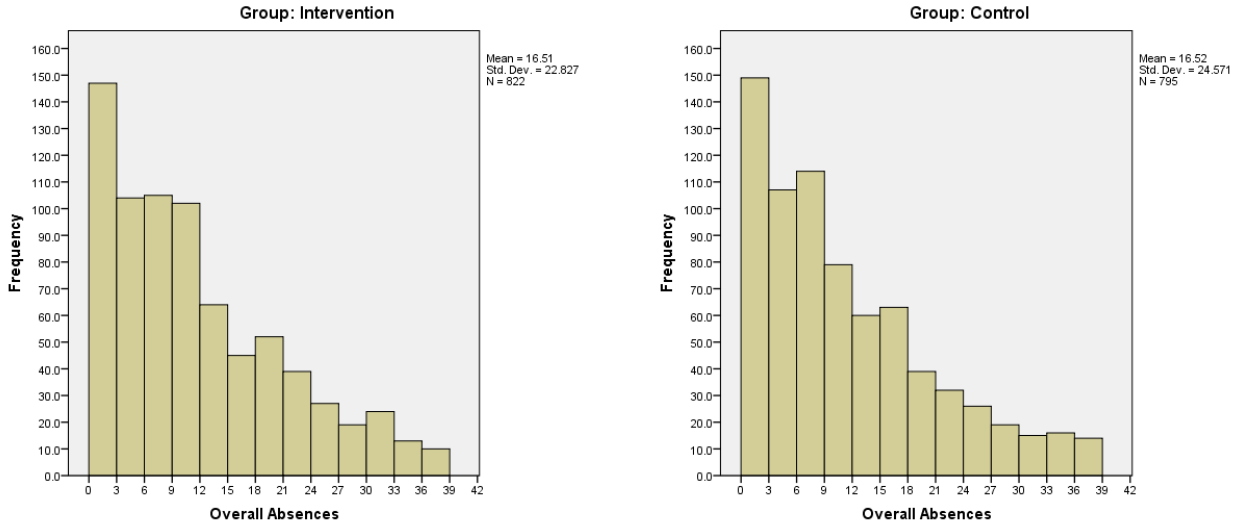
A multilevel negative binomial model with two levels (school and pupil) was run using pupil absence in Year 11 as an outcome measure. Table 10 displays the raw mean absence counts of the intervention and control groups. The absences refer to the number of recorded absent sessions during the year. In this instance the data is positively skewed (Figure 6)—i.e. a significant number of students have no or few recorded absences, and the number of cases that have higher levels of absences steadily declines. As such, a negative binomial regression was a suitable model for this data. The raw mean number of absences for the intervention group was 16.51 sessions and the raw mean of the control group was 16.52 sessions.

Table 10 shows the results of the negative binomial analysis, which ascertains the impact of the intervention on students' levels of absence (and thus on their school attendance). The effect is presented as a difference in incident rate. The

[13] Please note that the bin sizes and the ranges of the histograms are wider than the outcome scores. This has been adjusted to supress scores with a low cell count, as per the ONS statistical disclosure controls for DfE data.

incident rate for the intervention group is 1.08 times the incident rate for the control group, (p = 0.33, CI 0.92,1.27). However, this difference is not significant at the 5% level, which means the small difference between the groups is likely due to chance. The results suggest that there is no evidence of impact of Gen STEM on student absence during Year 11, compared with control group students.

Figure 6: Score distributions of the overall absence by randomisation groups[14]



STEM-related subjects at A-level

A multilevel logistic regression with two levels (school and pupil) was run on pupils' decision to take at least one STEM subject at KS5. Table 10 displays the proportion of pupils who chose at least one STEM subject within the intervention and control groups respectively. As the data is binary, logistic regression was a suitable model for this data. The proportion of those who took a STEM subject for the intervention group was 40%, and the proportion of those in the control group was 33%.

Table 10 shows the results of the logistic regression analysis, which ascertains the impact of the intervention on pupils' uptake of STEM choices at KS5. The effect is presented as odds ratios. The odds ratio for the intervention group is 1.44 times the odds ratio for the control group (p = 0.28, CI = 0.73, 2.81), however this difference is not significant at the 5% level, which means the small difference in probability of taking a STEM subject between the groups is likely due to chance. The results suggest that there is no evidence of impact of Gen STEM on pupils' uptake of STEM subjects at KS5, compared with control group pupils.

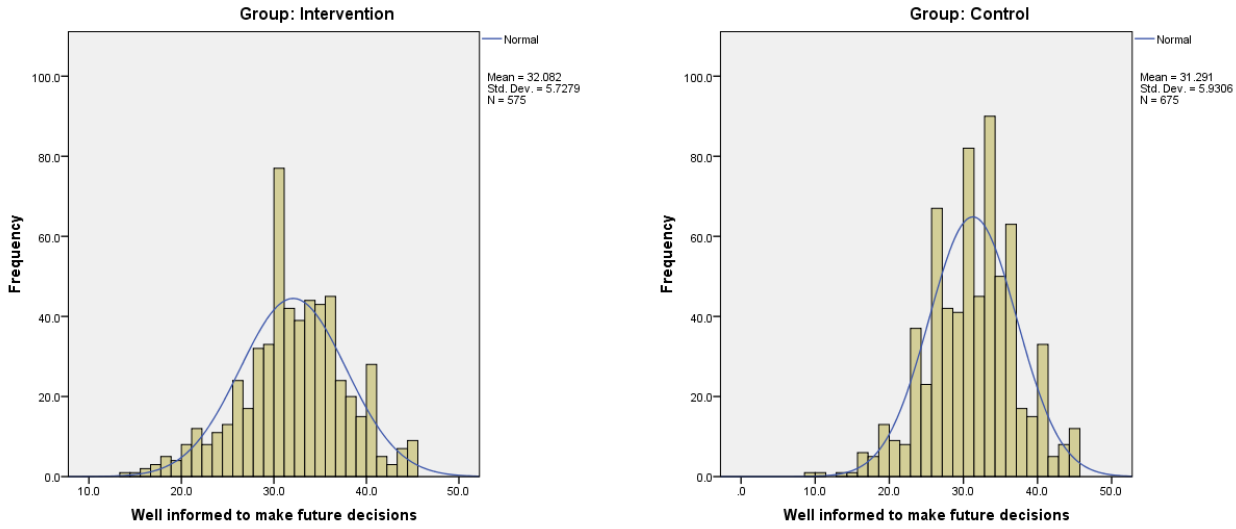
Survey outcome 1: Well-informed to make future decisions

Table 10 displays the raw mean values of the first survey outcome—'Well-informed to make future decisions'—of the intervention and control groups. The intervention group had a raw mean of 32.08. The control group had a raw mean of 31.29. Figure 7 displays the distributions of the outcome measure by randomised groups. The outcome was approximately normally distributed across both groups.

Table 10 also shows the results from the multilevel linear regression model with two levels (school and pupil), which ascertains the impact of the intervention on pupil outcomes. The statistics used to calculate the effect size are displayed in Table 10. The effect size for the impact of the intervention on Year 11 students was 0.11 (-0.01, 0.23). The results suggest that there is no evidence that Gen STEM increases students' feelings of being well-informed to make future decisions compared with the control group.

[14] Please note, the bin sizes and the ranges of the histograms are wider than the outcome scores. This has been adjusted to supress scores with a low cell count, as per the SRS disclosure rules.

Figure 7: Score distributions of the secondary outcome, 'Well-informed to make future decisions', by randomisation groups

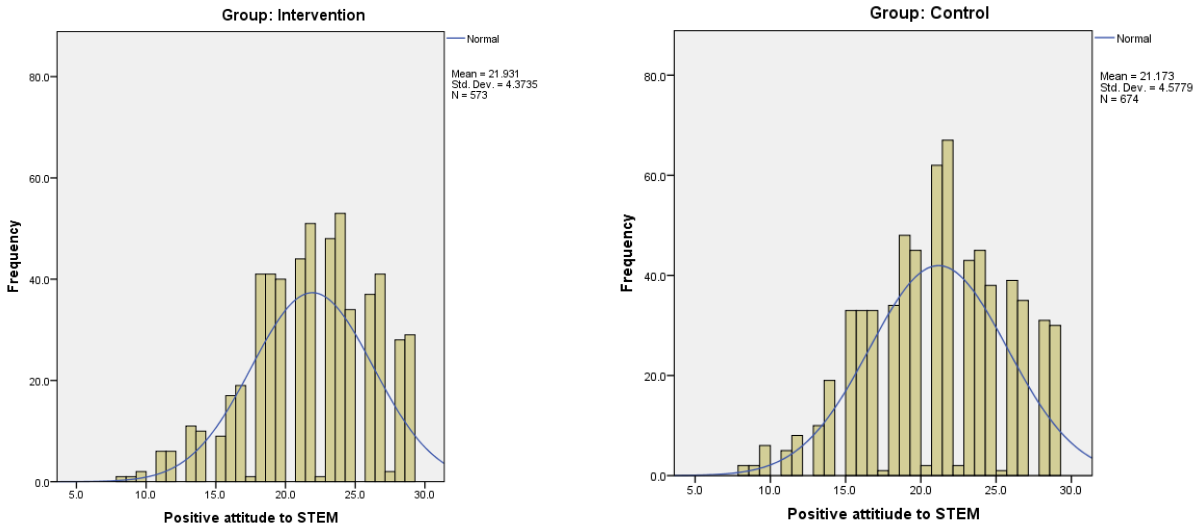


Survey outcome 2: Positive attitude to STEM

Table 10 displays the raw mean values of the second survey outcome—'Positive attitude to STEM'—of the intervention and control groups. The intervention group had a raw mean of 21.93. The control group had a raw mean of 21.17. Figure 7 displays the distributions of the outcome measure by randomised groups. Whilst the outcomes are not normally distributed, the outcome does not warrant a different statistical model.

Table 10 also shows the results from the multilevel linear regression model with two levels (school and pupil), which ascertains the impact of the intervention on pupil outcomes. The statistics used to calculate the effect size are displayed in Table 10. The effect size for the impact of the intervention on Year 11 students was 0.05 (-0.04, 0.14). The results suggest that there is no evidence that Gen STEM increases students' positive attitude towards STEM compared with control group students.

Figure 8: Score distributions of the secondary outcome, 'Positive attitude to STEM', by randomisation groups

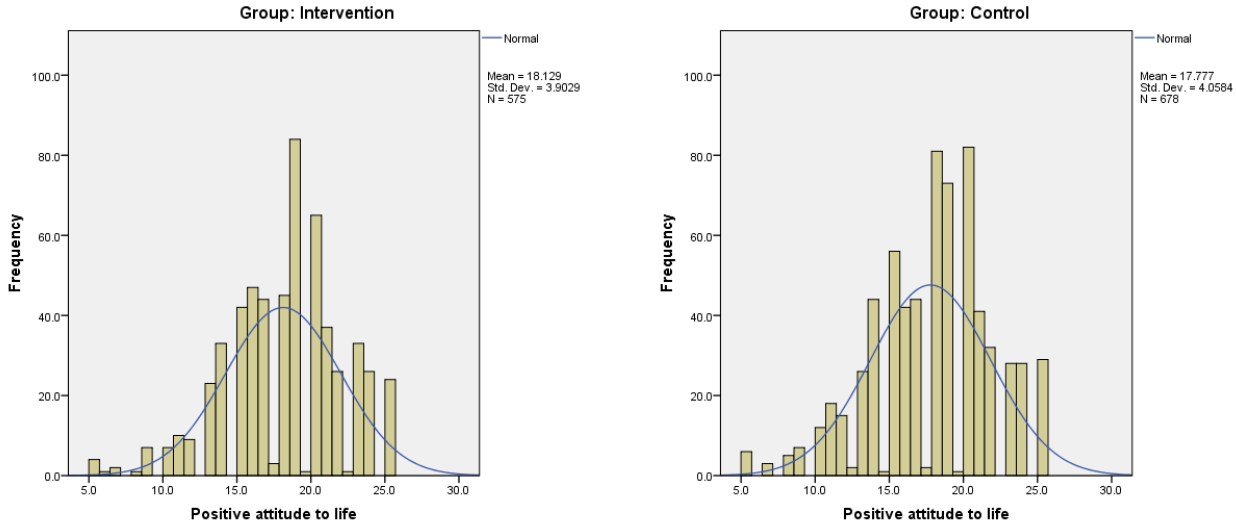


Survey outcome 3: Positive attitude to life

Table 10 displays the raw mean values of the third survey outcome—'Positive attitude to life'—of the intervention and control groups. The intervention group had a raw mean of 18.13. The control group had a raw mean of 17.78. Figure 9 displays the distributions of the outcome measure by randomised groups. The outcome was approximately normally distributed across both groups.

The effect size for the impact of the intervention on Year 11 pupils was 0.01 (-0.09, 0.10). This difference is not statistically significant at the 5% level, which means the small difference between the groups is likely due to chance. The results suggest that there is no evidence that Gen STEM increases pupils' positive attitude towards life compared with control group pupils.

Figure 9: Score distributions of the secondary outcome, 'Positive attitude to life', by randomisation groups

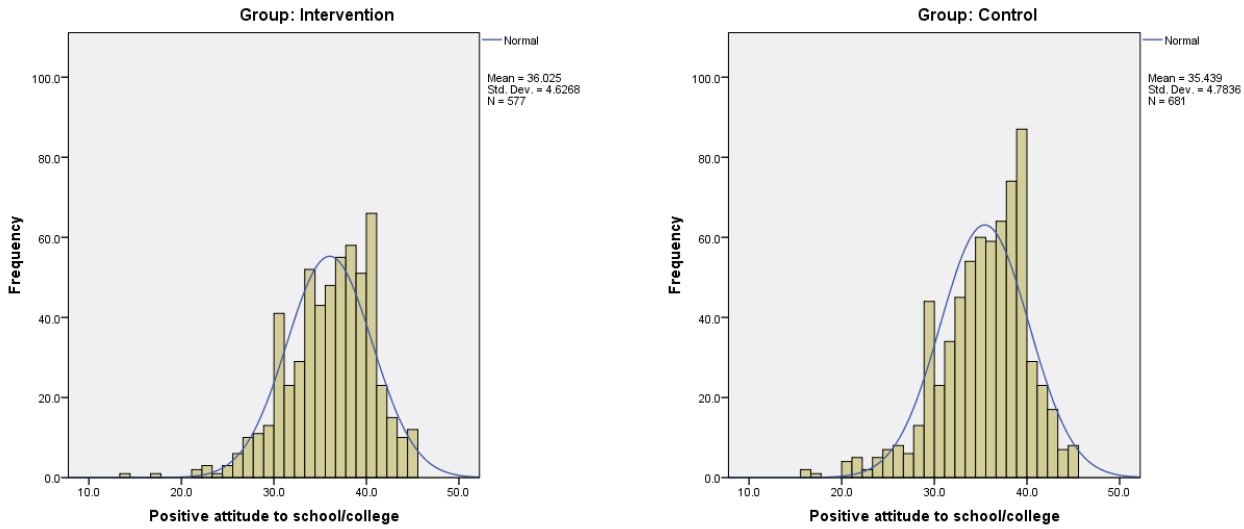


Survey outcome 4: Positive attitude to school or college

Table 10 displays the raw mean values of the fourth survey outcome—'Positive attitude to school or college'—of the intervention and control groups. The intervention group had a raw mean of 36.02. The control group had a raw mean of 35.44. Figure 10 displays the distributions of the outcome measure by randomised groups. The outcome was approximately normally distributed across both groups.

Table 10 also shows the results from the primary ITT analysis, in which a multilevel linear regression model with two levels (school and pupil) was run, which ascertains the impact of the intervention on pupil outcomes. The statistics used to calculate the effect size are displayed in Table 10. The effect size for the impact of the intervention on Year 11 pupils was 0.04 (-0.08, 0.15). The results suggest that there is no evidence that Gen STEM increases pupil's positive attitude towards school or college compared with control group pupils.

Figure 10: Score distributions of the secondary outcome, 'Positive attitude to school/college', by randomisation groups



Analysis in the presence of non-compliance

Two models were run to investigate the effect of the intervention on the primary outcome in the presence of non-compliance. These models included 1,512 cases: 769 intervention pupils and 743 control pupils. The first model included a full compliance measure that was represented on a scale of zero to five. The second model included a minimum compliance measure that was represented on a scale of zero to four (see 'Analysis in the presence of non-compliance' section on p.22 for the categorisation of the compliance measures). The compliance levels of the analysed groups are presented in Appendix K.

The coefficient of the compliance represents the effect of the intervention on KS4 mathematics and science outcomes, in the presence of non-compliance. There was no effect of the intervention on the primary outcome using the full compliance criteria (estimate = 0.05, p = 0.55, CI -0.10, 0.19). This means that increased engagement with the programme is not related to differences in the primary outcome.

The coefficient of the minimum compliance represents the effect of the intervention on KS4 mathematics and science attainment, in the presence of non-compliance. There was no effect of the intervention on the primary outcome using the minimum compliance criteria (estimate = 0.06, p = 0.55, CI -0.15, 0.27). This means that increased engagement with the programme with bare minimum compliance is not related to students' KS4 mathematics and science attainment.

Missing data analysis

A multi-level logistic regression model with two levels (school and pupil) was run on a dummy variable that represented whether the case was missing at follow-up, to ascertain whether bias may have been introduced due to attrition. The results of the analysis are presented in Table 12.

Table 12: Missing data analysis

	Estimate	Std. Error	Pr(>|z|)	Odds ratio
Intercept	0.00	3.22	0.999411	
Female	0.426257	0.51	0.41	1.53
FSM	0.422266	0.43	0.33	1.53
Attainment 8 Score	-0.11516	0.06	0.05	0.89
PercentageFSM	-0.02196	0.06	0.71	0.98
primarybaselineC	-0.09227	0.03	0.00	0.91
intervention	0.483484	0.55	0.38	1.62

Pupil gender, pupil FSM status at KS4, school's attainment 8 score, pupil KS2 baseline scores, their randomisation group allocation, LEP and school percentage of FSM students were entered into the model. Of these, only KS2 attainment scores significantly predicted whether a pupil would be missing or not, with a change in odds ratio of 0.91, signifying that pupils who had lower baseline attainment at the end of Year 6 were more likely to be missing at follow-up. Although there is attrition associated with prior attainment, the primary ITT model includes prior attainment at KS2 as a covariate, so the model is still unbiased as the outcome is missing at random given KS2. Furthermore, as the follow-up data is administrative data, we are confident that the level and pattern of attrition has not introduced bias, and no further missing data analysis is carried out.

Additional analyses

We carried out further descriptives on student-level compliance by delivery providers to examine whether there was a difference in the compliance levels of students who were supported by the three programme delivery providers. In total, there were 58 intervention schools; of these, six schools withdrew from the programme delivery. Of the remaining 52 intervention schools, 24 (46%) were supported by CSW Group, 22 (42%) by Graphic Science, and six (12%) by STEM NOW. The analysis in this section is at the student-level and excludes students from the six schools that withdrew from programme delivery—four of these schools were not assigned a delivery provider and the other two did not agree for us to continue to process their pupil data. Therefore, the resultant compliance levels reported here are slightly overestimated as it was not possible to include these students who withdrew from the programme activities at some point during the trial.

We used binary as well as continuous compliance measures. See the methods section for further details on how these measures were constructed for the two criteria—minimum compliance and full compliance.

Table 13a: Gen STEM compliance measures by providers (binary compliance measure)

		Provider					
		CSW Group		Graphic Science		STEM NOW	
		Count	Column N%	Count	Column N%	Count	Column N%
Reached minimum compliance (i.e. 'Yes' to all constituent compliance criteria)?	No	264	73.9%	248	75.4%	65	75.6%
	Yes	93	26.1%	81	24.6%	21	24.4%
	Total	357	100.0%	329	100.0%	86	100.0%
Reached full compliance (i.e. 'Yes' to all constituent compliance criteria)?	No	291	81.5%	254	77.2%	68	79.1%
	Yes	66	18.5%	75	22.8%	18	20.9%
	Total	357	100.0%	329	100.0%	86	100.0%

The results of the binary compliance measures for each provider are displayed in Table 13a. As seen in the table, the levels of minimum compliance were similar across the three organisations. When the full compliance measure was considered, although Graphic Science had the highest proportions of students who reached full compliance, the difference across the providers was not substantial. The data in the table also demonstrates that a quarter of the analysed sample had reached minimum compliance and one fifth had reached full compliance. The average compliance rates across the three providers were 25% and 21% respectively for minimum and full compliance measures. It should be noted that, as only five out of the 15 nominated students were to be selected for the work experience placement, the minimum and full compliance rates were never expected to be more than 33%. Nonetheless, these lower rates demonstrate the lack of overall compliance to the programme.

Table 13b: Gen STEM compliance measures by providers (continuous compliance measure)

	CSW Group			Graphic Science			STEM NOW			Total		
	Mean	Standard deviation	n	Mean	Standard deviation	n	Mean	Standard deviation	n	Mean	Standard deviation	n
Minimum compliance	2.18	1.31	357	2.08	1.34	329	2.26	1.18	86	2.14	1.31	772
Full compliance	3.02	1.32	357	3	1.42	329	3.13	1.25	86	3.03	1.36	772

Table 13b presents the average compliance levels per provider using the continuous compliance measure. The results in the table show that the compliance levels between the providers differ marginally when compliance is considered as a continuous measure. The key figure to note in the table is the average compliance across the analysed sample—minimum compliance with a score of 2.14 and full compliance with a score of 3.03. As noted above, as only five out of the 15 nominated students were to be selected for the work experience placement, the maximum values for the compliance measures were never expected to be more than 2.67 in the case of minimum compliance and 3.67 in the case of full compliance. These rates of continuous compliance demonstrate that the compliance level is good when compliance to individual programme activities are considered. This means students may have taken part in individual programme activities but perhaps not all of them, thus lower compliance under the binary measure above. Further details on compliance to individual programme activities are reported under implementation and process evaluation findings.

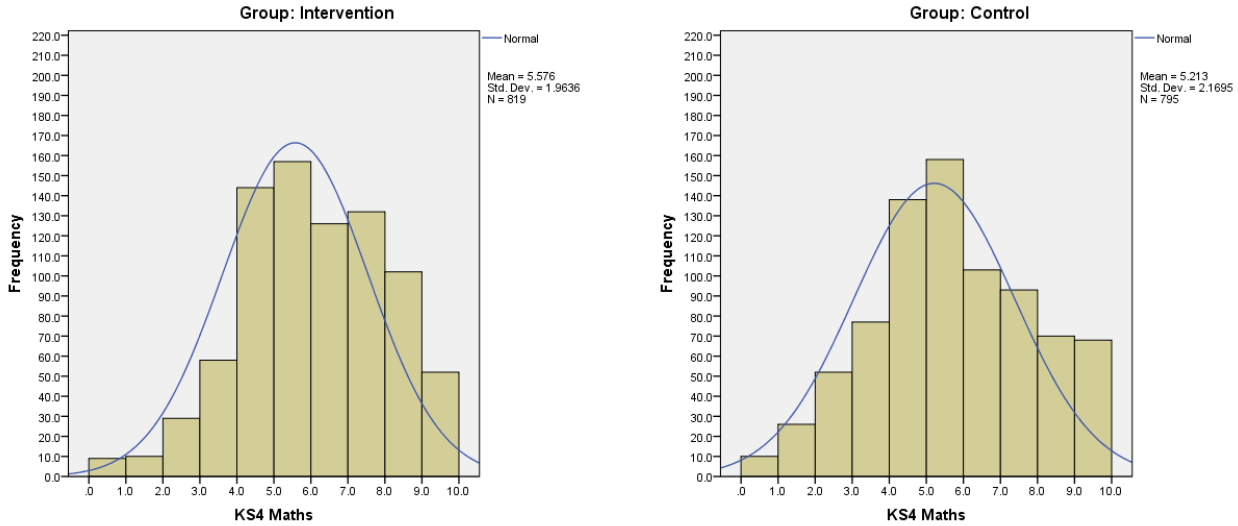
Gen STEM impact on KS4 mathematics

In addition to analysing KS4 mathematics and science combined, we ran separate analyses on the mathematics and science outcomes using the same specification as the primary ITT model—i.e. with the combined mathematics and science scores as the baseline covariate, as well as the LEP dummies. Table 10 displays the raw mean values of KS4 mathematics outcomes of the intervention and control groups. The intervention group had a raw mean of 5.58. The

control group had a raw mean of 5.21. Figure 11 displays the distributions of the outcome measure by randomised groups. The outcome was approximately normally distributed across both groups.

Table 10 also shows the results from the multilevel linear regression model with two levels (school and pupil), which ascertains the impact of the intervention on pupil outcomes. The statistics used to calculate the effect size are displayed in Table 10. The effect size for the impact of the intervention on KS4 mathematics was 0.06 (-0.04, 0.17). The results suggest that there is no evidence of the impact of Gen STEM on pupils' mathematics attainment at KS4 compared with control group pupils.

Figure 11: Score distributions of KS4 mathematics by randomisation groups

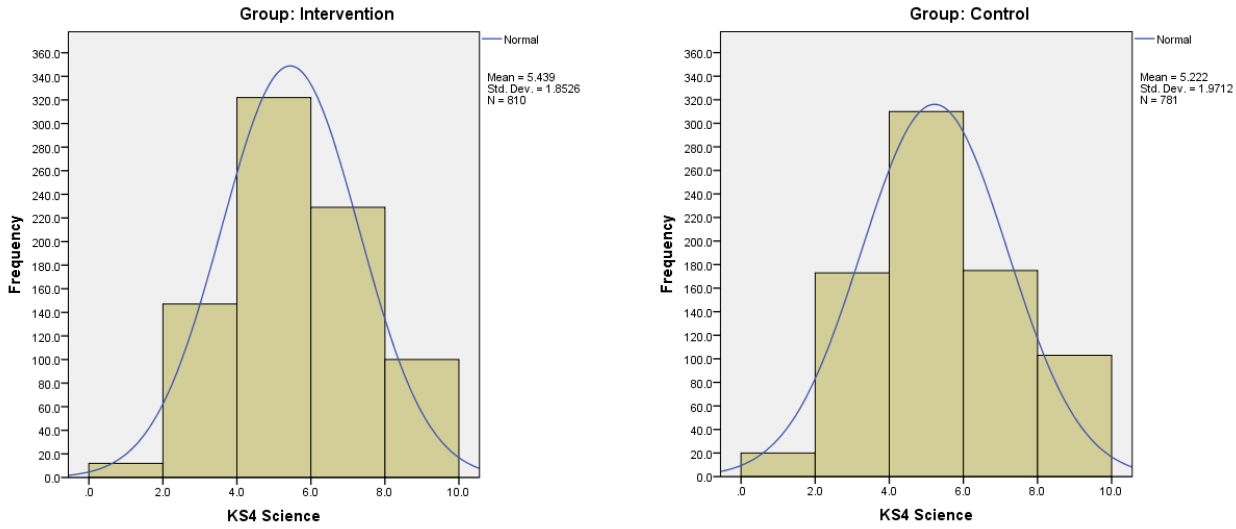


Gen STEM impact on KS4 science

Table 10 displays the raw mean values of the science outcomes of the intervention and control groups. The intervention group had a raw mean of 5.44. The control group had a raw mean of 5.22. Figure 12 displays the distributions of the outcome measure by randomised groups. The outcome was normally distributed across both groups.

Table 10 also shows the results from the multilevel linear regression model with two levels (school and pupil), which ascertains the impact of the intervention on pupil outcomes. The statistics used to calculate the effect size are displayed in Table 10. The effect size for the impact of the intervention on KS4 Science was 0.00 (-0.12, 0.12). This means there was no difference between the groups. The results suggest that there is no evidence of impact of Gen STEM on students' science attainment at KS4 compared with the control group.

Figure 12: Score distributions of KS4 mathematics by randomisation groups



Estimation of effect sizes

In the case of linear models, the numerator for the effect size calculation was the coefficient of the intervention group from the multilevel model. All effect sizes were calculated using total variance from a multilevel model, without covariates, as the denominator—i.e. equivalent to Hedges' *g*. Confidence intervals for each effect size were derived by multiplying the standard error of the intervention group model coefficient by 1.96. These were converted to effect size confidence intervals using the same formula as the effect size itself. The statistics used to calculate the effect sizes are presented in Table 14. For the STEM and absence models, where the outcomes were binary or binomial, the effect sizes were calculated as odds ratios and rate ratios, respectively, by exponentiation of the model coefficients.

Table 14: Effect size estimation

Outcome	Unadjusted differences in means	Adjusted differences in means	SE of effect	Total variance from a model without covariates
Primary outcome KS4 mathematics and science	0.55	0.14	0.21	14.67
FSM pupils subsample	0.82	0.32	0.31	12.41
KS4 mathematics only	0.37	0.13	0.11	4.17
KS4 science only	0.22	0.00	0.12	3.62
Attendance in Y11	0.01	0.78	N/A	N/A
Uptake of STEM subjects at KS5	0.07	0.37	N/A	N/A
Survey outcome 1: Well-informed to make future decisions	0.79	0.64	0.35	34.11
Survey outcome 2: Positive attitude to STEM	0.76	0.23	0.20	20.08
Survey outcome 3: Positive attitude to life	0.35	0.03	0.19	15.82

Survey outcome 4: Positive attitude to school	0.58	0.18	0.27	21.45

Estimation of ICC

The ICC for the primary model was 0.11.

Implementation and process evaluation

Implementation

- A number of aspects of the programme were not fully implemented as intended. For example, the selection, recruitment, and matching of students; the timing, format, and focus of the work preparation day; and the feedback to the young people after taking part in the programme. Furthermore, as the programme was extended by months and ultimately included three providers, there was considerable delivery disparity as detailed below. Staff and pupils mostly engaged well with the programme and were positive about it.

- The impact of alterations to the programme meant that the considerable variation in delivery makes it hard to identify what, if anything, is effective about the programme. The mechanism could have worked, but due to the low fidelity and compliance (see detail below), more work is needed to tighten the programme in order to establish if it works.

- The average cost to deliver the Gen STEM programme was £17.96 and 5.87 days of staff time per pupil per year when averaged across three years. However, this finding has a number of limitations which are discussed in detail below.

Overall, the evidence from the different data sources confirms that the intervention was not delivered consistently with the logic model outline and there was a considerable disparity between schools taking part in the intervention, indicating low overall fidelity. For example, there was variation in terms of:

- the selection of 15 students to take part in the programme;
- the approaches taken to recruit students to the work experience programme;
- the matching of young people to relevant work placements;
- employer involvement in the interview process;
- the timing, format, and focus of the work preparation day;
- young people's applications for work experience;
- feedback to the young people after taking part in the programme; and
- the provision of a STEM-related project during the work experience programme.

In terms of perceived impact:

- The majority of employers viewed the quality of the Gen STEM work experience programme to be good and believed it had a positive impact on young people through: increasing young people's confidence; providing an insight into working life; and progressing their career decision-making.

- Overall, the majority of school staff members felt pupils had benefitted from participating in the programme. They noted that their pupils had gained valuable interview skills and experience. They reported a range of perceived positive impacts for their pupils related to their confidence, STEM-awareness, and career-awareness. They primarily felt that the successes of the work experience programme related to the content and nature of the placements.

- All of the young people who undertook the work experience believed that it had confirmed or expanded their interest in STEM and had increased their self-confidence. Additionally, most of the young people felt that the experience confirmed their career interests or intentions.

- Although employers, school staff, and young people were generally positive in terms of the perceived impact of the programme on participating young people's attitudes, the majority felt unable to comment on the additional value and any potential impact on educational attainment.

Stages of the intervention

The details of the IPE results are considered at each stage of the intervention, including views from multiple sources, compared against the logic model. It also comments on the compliance criteria relating to each intervention component.

Information prior to meeting young people

All 15 employers interviewed stated that they had received information about the Gen STEM work experience prior to meeting the young people. Three interviewees said this included a visit from the provider, while the remaining 12 said contact had been by email, phone, or post.

Work preparation days

The logic model indicated that the Gen STEM programme of support, over the 2018 spring and summer terms, must include one work preparation day for all pupils in Year 10. Our observations of work preparation days by three different providers in different locations indicated that the days focused on providing young people with knowledge and skills related to job applications and STEM career options. However, in two cases the whole of Year 10 attended, and in the third school, just ten Year 10 students attended, representing all nominated students. The duration of the day varied from four to six hours. Overall, the evidence from the different data sources confirms that there was considerable variation in the timing, format, and focus of the work preparation day, possibly reflecting delivery by different providers and at different stages of the school year.

There was considerable variation in the way the days were structured and delivered—for example, the level of communication with the schools before the work preparation day; the resources (such as videos) used by the three providers; the use of group and whole-cohort work; and the variable input from school staff, employers, and volunteers. There was also variation in the timing of the day (for instance, some happened before selection and application, others happened after selection but before placement). The role of employers (some of whom were STEM ambassadors and others were employer volunteers for the day) varied depending on the focus of the day—for example, the focus in one school was on job applications and in another it was on future career options.

Three of the 15 employers interviewed by telephone took part in the work preparation days and found their participation a positive experience. For example, one described how they had 'exercises to get them [the young people] to start thinking about extra-curricular activities and how these can be positive for their CV'. The remaining employers did not take part in the work preparation days; four of them said they had not been aware of the days (one pointed out that they only became involved in the intervention after the work preparation day had taken place and would have liked to have participated in it).

Staff accounts largely endorsed our observations and employer accounts. Eight of the 14 staff members interviewed reported that the whole year group participated in the work preparation day. Within this group, there was variation in the length of the activities. For example, two schools only ran half-day sessions, while another school only had an hour-long session for the year group on work preparation skills, followed by a three-hour workshop for the young people selected to participate in the programme. Among the schools that did not run work preparation days for the whole year group, there were three instances where this was due to extenuating circumstances, such as snow closures and provider cancellation. In these instances, the staff members reported that the activities for the work preparation day were rearranged and delivered to just the young people who had been selected to take part.

According to school staff, there was also variation in when the work preparation day was held. In two schools, it was held following the 15 selected young people's application deadlines. In one school, snow closures delayed the work

preparation day and so this ended up taking place after the 15 young people had already completed their applications and interviews.

The 15 staff members agreed that the core focus of the work preparation day was developing job application skills, CV writing, and interview skills. Some staff also reported that the day focused on transferable skills, preparing for a work experience placement, and what businesses want from employees. Only two staff reported that employers were involved in delivering the work preparation day.

One young person was unable to participate in the work preparation day due to illness, but the other seven all participated . For three of the young people, the day occurred after they had completed their applications. One young person said they were given time to prepare their application as part of the preparation day.

From the interviews with the young people, the format and focus of the preparation day varied. Two young people reported that they received a whole year group assembly and then broke out to complete different activities, while another young person said that it was half-day off timetable. The young people were in agreement that a core focus of the preparation day was writing CVs, the application process, and interviewing. Some young people reported additional areas of focus. For example, one said that they focused on employability skills, such as collaboration and working in a team, while another said they were presented with different work-based scenarios they might be faced with. Only one young person said that employers were involved in the work preparation day.

Application for work experience placement (minimum compliance criteria 1)

According to staff interviews, there was considerable variation in the approaches taken to select students for the work experience programme. There were three broad approaches:

- selecting students based on their characteristics, such as gender, ethnic background, pupil premium, academic ability, and known STEM interests;
- approaching the triple science classes or highest-ability group; and
- advertising to all students in the year group and taking the first 15 applicants.

The logic model outlined that young people should be matched to a relevant placement. The evidence from the process evaluation suggests that when matching did occur, it did not happen in a consistent manner. For example, in some cases, the work placement employer was not secured before the young person completed the application. The young person did not know what they were applying for, so they completed a general STEM-related application form. Examples of the types of placements students were given included working as a healthcare assistant in a hospital, an office-based role with a highway maintenance organisation, a technical role at an organisation specialising in audio-visual equipment, and a customer-facing role at a science centre. In other organisations, students were matched more broadly to engineering, manufacturing, IT, and dentistry, for example.

According to 12 of the 15 employers interviewed by telephone, applications for work experience were not conducted in a consistent format. They reported that the young people had not applied directly for their placements—for example, in five cases, they pointed out that the students were ‘assigned’ or ‘allocated’ to them.

Three employers said that the young people applied directly to them. One came through an organisation linked to the providers. Another was interviewed by the employer at the school alongside the provider. The third had been assigned a placement over an hour from her home, which was not possible for her to reach, so she had applied directly to obtain an alternative placement closer to home. All the school staff interviewed were in agreement that their young people completed general applications that Gen STEM then matched to an employer as placements were secured. In some cases, they reported that young people were able to specify the type of STEM they were interested in.

In a few instances, school staff reported that the application process clashed with their own school’s work experience offer, which made it a ‘messy’ process for young people. For example, one school started identifying work experience in the autumn term of Year 10, so some of the 15 students already had secured placements which they subsequently had to cancel in order to carry out the Gen STEM placement. Furthermore, the school did not realise that only five students would obtain a placement, and a few of the ten students not selected ended up missing out altogether on work experience.

Only one of the eight young people interviewed reported applying specifically to their placement employer. The other seven completed a general STEM-related application form, though two of these said that as part of their general application they were able to express a preference of the type of placement in which they would be interested.

As per CSW Group's programme monitoring data which was used to create compliance measures, 72% of young people had completed an application for a work experience placement.

Interviews for work experience placement (minimum compliance criteria 2)

The logic model indicated that the 15 young people selected to be part of the intervention should be provided with one mock interview with an employer(s) and a CSW (provider) representative. As discussed above, the 15 students would be partly self-selected based on interest in STEM and the placements, and partly selected by teachers to encourage less confident or more disadvantaged students to apply. They should all be provided with a post-interview debrief delivered by CSW. The evidence suggests that this did not uniformly take place.

Interviews with staff as part of the observations suggested that the interview criteria were not always adhered to. All school staff said that the young people were interviewed by a Gen STEM representative. In most cases, this was a one-to-one interview. In one instance, the representative was accompanied by a representative from the local Jobcentre. Only one school reported that an employer was involved in their young people's interviews.

Fourteen out of the 15 employers interviewed said they did not take part in interviewing the students for their work experience placements. Tthree of them were asked to interview but declined. One asked the young person to come in prior to commencement of the placement as they wanted to discuss their interests, while another felt they would have liked to have interviewed as they would probably have selected different students. One employer took part in the interviewing process at two schools.

All eight young people reported that they were interviewed by their work experience provider. None of the young people reported an employer being involved in their interview.

According to CSW Group's programme monitoring data, just under three quarters (73%) of young people taking part in the intervention had an interview for the placement.

Successfully completing at least three days of work experience (minimum compliance criteria 3)

According to the logic model, young people should complete five days of work experience to reach full compliance, but at a minimum, they should successfully complete three days. According to CSW Group's monitoring data, 253 young people were selected for work experience placements. Four fifths (81%) of these young people (205 out of 253) successfully completed at least three days of their work experience placement, and 67% (170 out of 253) successfully completed all five days.

Ten employer interviewees reported that all their young people completed the full five days of work experience. Reasons cited by the remaining five employers for completion of only three or four days included the young person attending a school trip, a sports event, and exams.

According to the interviews with school staff, the number of placement days attended by students was highly varied. In some cases, an appropriate placement was not successfully found for the young people or the placement was arranged to be shorter than five full days. In one instance, an employer cancelled the placement as the required equipment for the young person had not arrived. At the same school, two young people were withdrawn by their parents because they felt the placements were inappropriate. In another placement, one pupil was told not to come in by the employer on one day as he 'didn't have much for him to do'. Other reasons for not completing the full placement included school trips or the young person dropping out. Due to delays with the organisation of the placements, some were offered to young people in the summer holidays, and they could not complete them because of clashes with holiday plans.

According to the young people, all of the placements took place in June- and July, with some falling in the summer holidays. There was considerable variation in the number of days of work experience completed, although all completed the minimum of three days. Three of the eight young people said they completed all five placement days. One young person said that only three days had been made available to them by their employer, but that they had attended all three

days. Two young people attended four days of the placement, missing one day each due to a school trip and illness. Two young people only attended three of the five placement days due to illness and a previously arranged holiday.

Eleven of the employers adhered to the plan outlined by CSW that they should provide a STEM-related project for the young person to complete, culminating in a presentation. Examples of projects included setting traffic flow controls on smart motorways, experiments on airflow around a ship, and creating a three-dimensional model to see how water flows. In some cases, young people contributed to the project design—for example, 'one of the students was really interested in the waterside so we designed one [a project] especially for her. She looked at a Thames crossing, where you put the bridge, how you re-route the river.'

Examples of work experience placement job titles suggest that the majority appeared to be STEM-related placements (for example, spacecraft operations assistant, animal care assistant, marine engineering assistant, design and engineering assistant, and medical laboratory assistant). A few suggested that they were not STEM-related (such as customer services assistant, assistant theatre technician, and assistant editor).

Four employers (two of which provided project-based work experience to one young person and non-project based to other young people) outlined how, to provide a breadth of experience, they arranged for their young people to rotate through the departments of the organisation.

Feedback or debrief following the work experience placement (minimum compliance criteria 4)

The logic model outlined that the Gen STEM young people should benefit from a post-work experience debrief. According to CSW data, 94% of young people, who had attended at least one day of their placement, received feedback or a debrief either by phone, in person, through their school, or sent to their home. Feedback to the young people was not provided in a consistent format. Eleven of the 15 employers spontaneously described how they provided verbal feedback to the young people through the week and at the end of the week. Some described the workbooks that the young people used to record their thoughts through the week. Seven employers discussed the feedback forms supplied by CSW and how they completed them, often alongside a Survey Monkey survey.

All but one of the school staff interviewed agreed that the young people had received some form of feedback at the end of their placement. Most staff felt that the feedback was generic and varied in quality. One staff member described the feedback forms as 'a waste of time as [the employers] barely completed them'. Some reported that their young people received a certificate and feedback form, while others said that their young people received verbal feedback while they were with their employer. A minority of schools received some form of feedback from providers on how their young people had performed. Two staff members reported that their young people attended a debrief session with the provider following their placements, but that this was focused on gathering feedback on the quality of the placement rather than providing feedback to the young people or schools.

Seven of the eight young people said they had received direct feedback from the employer. They described this as a brief summary of how they had performed on their placement. Two of the young people reported that they were given feedback in relation to particular skills areas and characteristics, such as their willingness to learn and attitude.

Consistency of work experience programme with the original explanation

While nine employers felt the programme was largely as originally explained to them, six felt it was not. Moreover, a few did not recall an explanation at all. For example, one employer said, 'I didn't have it explained to me. There was confusion. I based the structure of the week on what I did when I carried out work experience.' Another described how he organised work experience for three young people with one week's notice, as the entire process ran late.

Only five staff members interviewed felt that the work experience programme was consistent with the original explanation. The other ten felt that to varying extents the programme was inconsistent with their expectations. Some of these staff identified comparatively minor inconsistencies. For example:

- Implementing the programme in school took more time than expected.
- The work preparation day occurred after the interviews.
- They did not get as much help as anticipated from the provider.

- Poor communication resulted in a misunderstanding of the number of placements available.
- Placements were not as directly STEM-related as they could have been.

A few schools reported more substantial inconsistencies. One member of staff felt that the programme did not offer anything more than the work experience offered routinely by the school, and that none of the young people were placed with an employer that the school could not have found themselves. One young person was withdrawn by their parents because their placement was not STEM-based. Another staff member reported that the process became very labour intensive and that their working relationship with the provider deteriorated. Overall, they described the process as 'a nightmare'. Similarly, at a different school, the staff member believed that the programme was labour intensive and expensive. In addition, not all of the five young people selected ended up with a suitable placement. This staff member reported that they had an issue with the amount of money and time it costed the school.

Perceptions of quality of Gen STEM work experience programme

Ten employers viewed the quality of the Gen STEM work experience programme to be good; moreover, three of these described the quality as 'very good' or 'excellent'. Reasons for this perception included that the paperwork was comprehensive; the provider responded promptly to questions from the school work experience coordinator; the programme was well-organised; young people wanted to be at the employer's workplace; and the programme appeared to achieve a good balance between bureaucracy and letting the employer 'get on with it'.

Three further employers felt that the quality of the programme was good 'in theory'—for example, the programme had 'potential'.

Ten employers (five of whom viewed the quality as good) felt that there was scope for improvement in the programme. For example, one believed the quality of the programme to be 'not poor but at the lower/middle end, that is not quite as good as it should be … there was total lack of communication prior to the work experience … and there was no guidance as to how to do the work experience.' Other comments included the 'last minute' nature of the communication; the need for more clarity on work experience expectations; and the observation that work experience organised by the provider did not run as smoothly as when the employer had worked directly with the school. It is worth noting that six of the employers who believed there was scope for improvement were working with one provider.

Among school staff interviewed, perceptions of the quality of the whole work experience programme ranged from very poor to very good, with one staff member saying they 'would rate it highly' and another describing it as 'rubbish'. Those who felt the programme was of good quality gave the following reasons: high-quality placements that the young people would not have access to otherwise; specialised support; good organisation; and good communication. Those who felt the programme was of poor quality gave the following reasons: the programme provided no additional value to the work experience routinely offered by the school; the process was labour-intensive; there were poor-quality placements that were not STEM-related; and there was poor communication between the school and the providers.

Others thought that the quality of the programme was variable. For example, one staff member felt that the support they received was good but that the work preparation day was poor because the provider representatives changed at the last minute and they had not prepared to deliver the session properly. Similarly, staff from other schools felt that the support was good quality but that the placements did not represent good quality. Some staff were unsure about the benefit of having a middleman (i.e. the provider), particularly if they had their own work experience programme in place in school.

Suggestions for improvement included starting the programme earlier in the year, running the preparation day earlier in the year, and providing a clear overview document that explained the offer of the programme rather than lots of detailed documents to read.

Fidelity

The evidence from the process evaluation revealed that the critical factors of this intervention were not adhered to consistently and as outlined in the logic model. Aspects of the programme that were not fully implemented as intended included:

- the selection of the 15 students to take part in the programme;

- the timing, format and focus of the work preparation day;
- young people's applications for work experience;
- employer involvement in the interview process;
- the matching of young people to relevant work placements;
- the provision of a STEM-related project during the work experience programme; and
- feedback to the young people after taking part in the programme.

Usual practice

According to the programme developer:

a) Some schools had dropped work experience in Year 10 altogether, so in these schools, just the five Gen STEM young people would have had any work experience.

b) Some schools offered work experience in Year 10, so the five Gen STEM young people would have had the standard one week of work experience that all Year 10 have, plus the additional Gen STEM week—two weeks of work experience in total.

c) Some schools ran the Gen STEM work experience in the same week as their 'business as usual' work experience, so all other young people also experienced the schools' standard work experience that week.

In the follow-up survey, we asked students to indicate whether they had carried out any work experience placement and if so, whether this was with an employer involved in STEM. Of the 1,248 students who responded to this question, 1,022 had undergone a work experience placement (82% overall: 546 control group students and 476 intervention group students). Of those who went on to a work experience placement, more of the intervention students (58%, 274) indicated that they had carried out work experience with a STEM employer compared with fewer intervention students (42%, 202) going on to work experience in another area (i.e. non-STEM). This was in contrast to the control group, where fewer students (34%, 186) had undertaken work experience with an employer involved in STEM, and more students (66%, 360) indicated that they had undertaken work experience in another area. This suggests that usual practice included considerably less STEM-related work experience.

Seven employers interviewed by telephone reported that they had not changed their normal work experience practice as a result of taking part in the Gen STEM programme, although one employer did observe that the Gen STEM workbook was a valuable tool. Three further employers described changes they had made such as the provision of more technology-focused work experience; the improvement of processes to track work experience paperwork; and the inclusion of presentations as 'it locks in learning, so we will get them [young people] to do that in the future'. The remaining five employers commented that as work experience was comparatively new to them, there was no usual practice.

Eleven of the 14 school staff members interviewed by telephone did not feel that the programme had influenced their usual practice, though it is important to note that three of them reported that their school does not currently operate any kind of work experience programme. Interestingly, one of these staff members felt that the Gen STEM programme had highlighted how challenging it is to get placements, match students to them, and organise practicalities such as transport. In cases where schools did offer their own work experience programme, some of the eight staff members mentioned that the Gen STEM programme was similar to their usual practice but with an explicit STEM offer. They perceived the programme to be an additional opportunity for students interested in STEM as they believed it is difficult to access placements in the STEM sectors.

Among the school staff interviewed, only one said that the Gen STEM programme had encouraged their school to implement a work preparation day for their Year 9 students prior to launching their own work experience and sending students to find their own placements. Another staff member reported that the programme had filled a gap in their school's provision caused by the departure of the work experience coordinator. For example, the programme had reinforced the importance of work experience while the school devised a new work experience programme. At a different

school, a staff member agreed that the programme had filled a gap as the school does not offer work experience any more, but gave no indication that it had prompted any changes to the school's practice.

Outcomes

This section explores the perceived successes and challenges of the Gen STEM programme and the perceived outcomes for young people.

Perceived successes and challenges of the Gen STEM programme

Employers described a range of diverse aspects of the Gen STEM work experience that they felt worked particularly well. For example:

- selection and matching of the young people for the placements (four employers);
- the work preparation day (three employers);
- the application process (including the interview) (three employers);
- the ability to reach young people they would not normally reach (one employer);
- links to schools that the programme opened up (one employer);
- communication with schools and parents (one employer);
- the structure of the programme and the way the student integrated into the company's workflow (one employer);
- the focus and consistency the project brought to the experience (one employer);
- the workbook (one employer);
- preparatory work carried out prior to the work experience (one employer); and
- the Gen STEM list of activities, which provided scope for ideas (one employer).

Four employers said they had experienced no challenges in terms of implementing the Gen STEM work experience. However other employers described challenges that included:

- **Issues with timing:** for example, one employer felt the timescales were very 'tight' and would have appreciated more flexibility in arranging the work experience week. Another believed that the paperwork came through late, while another described a lack of organisation: 'There were lots of changes of dates and changes of young people coming … it ended up with young people coming on a week when I wasn't around a lot.'
- **Poor communication:** for example, one employer described how a lack of communication meant they were unclear what the programme expectations were and how it would be set up. Another explained that they had not realised that without attending the interview day they would not have a choice over the students selected for work experience.

School staff primarily felt that the successes of the work experience programme related to the nature of the placements, the work preparation day, and the application and interview process. For example, four school staff said that their pupils were able to access high quality placements through the Gen STEM programme, including some that the pupils would not have found themselves. Two other staff members commented that the preparation day and interview process were highly successful and pupils derived considerable value from these experiences.

Staff members highlighted other successful aspects of the programme:

- It provided the school with the opportunity to promote STEM and it facilitated discussions around STEM careers (two staff members).

- It provided the opportunity for a diverse group of pupils with different characteristics to participate in the programme (one staff member).
- It enabled some pupils to experience the world of work, which staff believe helped to raise and broaden their aspirations (one staff member).
- It enabled pupils to develop workplace skills (one staff member).

However, many school staff also reported that they faced extensive challenges while participating in the programme. Two staff members felt that the challenges were so significant and pervasive that no aspect of the programme was successful.

In contrast to some observations that a few work placements were of high quality (see above), staff members reported widespread issues with the placements. Over a third (five staff members) felt that the pupils got nothing new out of the placements. For example, one staff member reported that this programme offered nothing different to the school's own work experience scheme and so pupils missed large periods of school without reaping much additional benefit. Four staff members also reported difficulties due to placements not being identified early enough and some having to be completed in the summer holidays. Three staff members said that the school had to assist the provider in finding placements.

Furthermore, three staff members said that when placements were identified, their location often caused travel issues for the pupils. For example, some placements were more than an hour away, leaving pupils reliant on the willingness of their parents and school to facilitate or pay for transport costs. Other challenges related to placements not being STEM-related, pupils not being matched to specific placements, and the placements being poor quality.

Additionally, school staff reported a range of challenges in how the programme was delivered and implemented in the school, such as:

- Delivery and implementation of the programme were disorganised and providers struggled to operate in the school's area—for example, they did not have any pre-existing relationships with employers or understand the transport limitations of the area (five staff members).
- Providers demonstrated a poor understanding of teacher commitments and how schools operate (two staff members).
- There was poor communication from the providers—for example, some teachers felt overburdened by paperwork and emails (two staff members).
- The quality of the delivery of the preparation day needed to improve—for example, by providing example CVs and targeted support for the 15 participating students (two staff members).
- There were difficulties scheduling the programme around school timetables (one staff member).
- Providers did not deliver the preparation day for the whole year group (one staff member).

Overall, the young people indicated that they felt well supported through the process, primarily by their school and parents. For example, a few of them highlighted that their teachers were particularly helpful in preparing them for and supporting them through the interview process. One young person said that they had received extensive support from Gen STEM and their supervisor at their placement, while another felt that they were well supported because they obtained a relevant placement that would not have been possible otherwise, and received good feedback. Three young people said that the work experience preparation day empowered them to ask questions while on their placement.

However, one young person said that their parents had to prepare them for their placement as they received no support from Gen STEM following their interview.

The young people enjoyed various aspects of their placements, despite observing that they were often not on a placement directly relevant to their interests and ambitions. For example, they enjoyed:

- observing different environments, teams, and processes;

- learning about new STEM fields;
- travelling to work and being independent;
- using new software;
- interacting with customers and clients;
- completing hands-on tasks;
- experiencing working life and gaining insights into possible options for the future; and
- having opportunities to be creative and collaborative.

There were also aspects of their placements that the young people did not enjoy, such as:

- health and safety restrictions limiting what they could do;
- extensive PowerPoint-based introductory sessions;
- the distance between the placement and students' homes, requiring extensive travelling or staying away from home;
- being given tedious and repetitive tasks;
- extenuating circumstances resulting in the employer not being prepared for the young person; and
- the original placement being cancelled at short notice and the replacement work experience not being relevant to the young person's interests.

Outcomes for young people

The majority of employers believed that Gen STEM work experience had a positive impact on young people:

- It increased young people's confidence. For example, one employer described how the young person who carried out work experience with them was very quiet initially and did not talk much as she thought she did not want to work there. By the end of the week, she had grown in confidence a lot and even did the presentation. She then sent them a thank you letter and asked for summer work. Another employer felt that their young person departed with 'increased confidence and communication skills as a result of rising to the challenge of the presentation to 100 people'.

- It provided an insight into working life. Employers felt that the Gen STEM work experience provided an understanding of how business works; the context of real working life; real-life practical knowledge of what a job role involves; an understanding of what working in a team in the workplace involves; and hands-on experience on how an office runs and 'how important boring tasks can be'.

- It progressed their career decision making. Employers reported that young people appeared to have developed, for example, 'an increased knowledge about the routes into engineering', and an insight into what they might want to do when they had previously been unsure about a future career. The work experience was also reported to challenge young people's thoughts about future jobs. For example, one employer explained that one of their students who was really engaged had planned to go straight into the navy, as this was the family tradition. However, after the work experience, he said that he wanted to be an engineer. Another employer felt that the work experience had developed an awareness of careers in STEM and had helped to break stereotypes.

All 15 employers enthused about the positive attitudes demonstrated by the young people taking part in the work experience. For example, the young people's skills and capability were perceived to be good, they were not afraid to ask questions, they were punctual, they joined in, and they were engaged in their work. Indeed, one employer said, 'I told him [the young person] if he wanted to work here to phone me. I would have offered him a job there and then.'

Three employers expressed mild concerns, for example, that the young people were quiet and reserved, but this was attributed to a lack of confidence. The majority of employers could not comment on any potential impact on educational attainment. Indeed, one said that it was impossible to estimate the impact of one week of work experience on educational attainment.

Over half of the employers felt taking part in the Gen STEM work experience benefitted the development of their own staff. Some felt that the skill involved in explaining to a young person what a particular job involves benefits staff. For example, one employer believed that staff career development is enhanced by mentoring work experience students, inspiring them, and gaining an insight into employees of the future and the things that they are currently learning. Another employer pointed out that there is an additional benefit to staff well-being: 'Our staff are passionate about their jobs so they say they get a buzz about explaining to what they do to young people. There is a well-being aspect for employers'.

A couple of employers also felt there were wider benefits to their company and more broadly to schools and young people in general. They wanted more schools to be aware of their business, what they do, and the options available to young people. One said: 'It's about getting the message out to the wider community about what we do. And it hopefully raises the profile of engineering.'

Overall, school staff members felt pupils had benefitted from participating in the programme. More than half said that their pupils had gained valuable interview skills and experience. For example, one staff member said that their pupils had learnt how to conduct themselves in an interview and discuss relevant experiences. Similarly, more than half said that the placements had been a useful or enjoyable experience of the working world for their pupils. A few staff members reported that their pupils had learnt transferable work skills, such as presentation skills. Only one staff member reported that some of their pupils had obtained higher GCSE mock grades than expected.

Staff also reported a range of positive impacts for their pupils related to their confidence, STEM-awareness and career-awareness. For example:

- Pupils had raised aspirations and awareness of career options (six staff members).
- They had increased confidence (four staff members).
- They had increased motivation—for example, pupils now see the connection between their GCSEs and work (two staff members).
- They have a better understanding of what STEM is, and some have been able to confirm their interest in a STEM career (two staff members).
- There was an offer of further work experience with the employer and consideration of taking an apprenticeship in the STEM sector (one staff member).
- Pupils were exposed to positive role models at their work experience placements (one staff member).

However, some staff members said that the experience had no positive impact or a negative impact on their pupils. Three staff members reported that some pupils were discouraged by aspects of the programme, such as not being selected as one of the final five students, placements falling through, or no placement being identified. Three staff members also reported that the challenges pupils had faced meant that the programme had had a negative impact on them. Other staff members observed that the programme had not had an impact beyond that of the school's existing work experience programme.

All of the young people who undertook the work experience believed that it had confirmed or expanded their interest in STEM. In some cases, young people had been exposed to a new aspect of STEM that enabled them to understand that STEM-related work is not limited to the typical science subjects they study at school. They had developed a better understanding of how these subjects apply to the real world. For some young people, the placement had confirmed their broad interest in STEM, while others had confirmed more specific interests. For example, one young person reported that the experience had confirmed their intention to take science A-levels, while another had started looking specifically into architectural engineering. Only one young person believed that the experience had increased their motivation to do

well at GCSE. A few young people found it motivating to see how they could be part of the workplace in future and could see what they are capable of outside of an academic setting.

In addition, some young people felt that they had developed key employability skills such as completing job applications, interview skills, working independently, organisation, communication skills (including talking to customers or clients), and presentation skills. Similarly, most of the young people reported that they felt much more confident talking to new people and colleagues following their placement, and now felt empowered to ask questions and speak up. For example, one young person had gained confidence by realising that they enjoyed the workplace environment and interacting with adults as colleagues.

All the young people felt that increased confidence was a key outcome from their placements. Additionally, most of the young people considered that the experience confirmed their career interests or intentions and their overall interest in STEM subjects, even when their work experience was not in their specific industry or area of interest. In one instance, the placement had resulted in helpful advice from colleagues about courses, education routes, and university courses that the young person could take to achieve their career ambition. This individual also thought they had gained key knowledge about the healthcare system and insights into shift work.

All of the young people agreed that the work experience placement had built their confidence in their career goals and broadly speaking felt less concerned about finding and applying for a job in the future. They gave three key reasons:

- **Better understanding of available opportunities:** Some young people had come to realise the breadth of careers and roles in the job market and felt less intimidated about the future as a result.

- **Improved knowledge and experience of applying for positions and working:** Some young people highlighted that the experience had ‘demystified’ the process of completing applications, being interviewed, and being in the workplace. They felt that they had a better understanding of what to expect in the future.

- **Increased confidence in their own abilities:** Their experiences and positive feedback from employers had built the confidence of some of the young people and shown them their capability and potential value in the workplace. For example, one young person was told that they were adaptable and one of the best placement students the employer had worked with.

In addition to the qualitative telephone interviews, we looked at student responses to the survey questions at baseline and follow-up, in particular, those questions not included in the secondary outcomes. There was no pattern of any significant changes in students’ attitudes between the two groups.

Suggested improvements to the programme

In terms of how to improve STEM-related work experience in the future, employers’ advice for schools was limited, but included suggestions that they should:

- prepare young people for work experience—for example, make them aware that they must have the confidence to ask questions;

- involve the employer in student interviews;

- clearly define work experience expectations so each party knows exactly what they are doing; and

- ensure teachers know the opportunities available to young people and their local companies.

In addition, a few employers felt that work experience worked best when the employer and school had an ongoing relationship.

Most employers offered advice to their peers such as to plan the work experience (and have back up plans), preferably in collaboration with the school and the young person. For example, it is important to know what the young person’s interests and expectations are. Equally, it is essential to provide targets for the week, monitor progress, encourage questions and answer them, and make the experience worthwhile and motivating, so it engages the young person and

they learn from it. Additionally, work experience should be as real-life as possible so the young person gains an understanding of what working life involves—both the inspiring parts and the more mundane, such as the importance of being punctual and understanding that boring tasks need to be done.

Finally, the majority of employers said they would offer Gen STEM work experience in the future, but three employers stipulated provisos:

- They would not want to offer as many placements as there is more work involved in setting it up compared with their own work experience offer.
- The weeks involved must be compatible with the employer's needs, as it has to work for them as well.
- The problems (such as poor communication and timing) must be resolved and they would need assurance that the programme is in the interests of the young people and not just the provider.

In addition, two employers pointed out that they are likely to continue to offer work experience, but probably with the schools with which they already have links.

School staff offered suggestions for improvements to the work experience programme across four main areas: the role of employers, the work experience placements, the work preparation day, and the implementation of the programme in schools.

School staff felt that employers could have an increased presence throughout the duration of the programme, such as coming in to talk to pupils about STEM careers and routes into the industry they represent; participating in a STEM careers fair in school; and contributing to pupil interviews. Staff thought that interacting with employers was beneficial for developing pupils' interpersonal skills and knowledge of how to conduct themselves. Staff also observed that the programme could have more of a focus on establishing and sustaining good relationships between schools and employers, and supporting employers to become more involved in local schools.

In terms of the work experience placements, staff suggested that the following would improve the experience for the school and pupils:

- recruiting better quality placements (four staff members);
- identifying placements before the application process so that there are specific placements for pupils to apply for (two staff members);
- ensuring that what pupils will be doing on their placements is STEM-related (two staff members);
- ensuring that placements are age appropriate so the pupil can do meaningful activities that are not prevented by health and safety regulations, for example (one staff member);
- refining the process of matching pupils with placements and employers—for example, speaking to employers to identify gaps they have in their organisation, then working with the school to find appropriate students (one staff member);
- encouraging employers to make their availability known—for example, to proactively indicate how many placements they could offer and at what time of year (one staff member); and
- encouraging pupils to be open-minded to different types of work experience and the benefits of these experiences (one staff member).

While staff were very positive about the work preparation day, they felt some adaptations might add further value. For example, school staff thought that setting objectives would help maintain the focus of sessions. Similarly, some considered that including personal coaching for the 15 pupils participating in the programme would allow tham all to develop further. One staff member also suggested that some of the organisation and delivery of the day could be improved if short briefing sessions between the school, employers, and provider were held prior to the preparation day.

There was a strong feeling among the school staff that the programme should be expanded and offered to more or all students. One suggestion included allowing all STEM-interested pupils to participate in the programme, even if only a small number of placements were available, as this would provide a useful experience for real-world situations.

Other suggestions for practical improvements included:

- allowing more time for organising and setting up the programme;
- running placements earlier in the year;
- improving communication between different parties;
- making it clear to schools at sign-up that only five placements were on offer;
- improving follow-up support to help pupils recognise the skills and experience they have gained; and
- reducing the evaluation burden.

The young people suggested that the programme could be improved in the following ways:

- Introduce a relevant adult from the employer organisation to the young person before they start their placement so that they are familiar with someone on arrival.
- Make the placement as interactive and hands-on as possible, including teamwork.
- Make introductory sessions short and snappy.
- Do more preparation for a back-up plan, so that when extenuating circumstances arise, disruption is minimised and the placement can still be relevant and impactful.
- Provide more support on the forms used within the follow-up process.
- Find enjoyable placements that inspire the young people involved and encourage them to work hard.
- Offer the opportunity to more young people.

All of the young people said that they would recommend the work experience programme to their friends, largely because they felt that any work experience builds skills and confidence, the programme would help pupils struggling to find relevant work experience, and it had been a good programme. One young person said that they would recommend it but highlighted that it was similar to the work experience that the schools already offered. These comments suggest that there is a lack of clarity as to whether the perceived benefits of the programme relate to the intervention specifically or work experience in general.

Cost

Cost of implementing Gen STEM work experience: schools' and employers' views

Eight employers believed that the cost of implementing the Gen STEM work experience programme was approximately the same as for other work experience they had provided. Four employers perceived it to be slightly more expensive due to tasks such as completing more paperwork, conducting more checks, and attending interview days (although two of these employers did point out that offering work experience was relatively new to them).

There was a lot of variation in the cost and time commitment required to implement the programme as reported by school staff members. This was believed to be due to a large number of component parts of the intervention, including the work preparation day, the interview process, the placement, and the feedback or debrief sessions. While some reported that there was a minimal additional cost of providing lunch to employers supporting the work preparation day, for example, others reported costs of more than £250. Largely, those who experienced higher costs had to pay for cover and to provide the resources required for the whole year group for the work preparation day. Similarly, in terms of time commitments, this ranged from less than a day to over seven days of staff time to facilitate the programme over the

course of the year. Staff who reported higher time commitments often said that the programme had not gone smoothly. They spent time finding placements, supporting the preparation day, supporting students with the application and interview process, preparing students to go on their placement, chasing students and parents, and replying to emails with Gen STEM. One staff member pointed out that there was an additional layer of work the programme generated in terms of selecting 15 pupils, extensive liaising with the provider, the additional paperwork, and getting ready for the work preparation day.

Only one staff member estimated the cost of the programme per pupil. This individual considered it was similar to their normal work experience placements at £55 per pupil.

The cost analysis in EEF evaluation reports usually includes an estimate of the time required by school staff members for the delivery of the intervention. However, in this evaluation, staff members were not able to provide accurate estimates of the time spent supporting delivery of the programme due to the large number of component parts of the intervention and differences in how the intervention was applied in each school. As a result, school staff members' time is not presented in the executive summary. The staff time of the intervention providers (CSW Group, STEM NOW, and Graphic Science) is reported below.

Cost of implementing Gen STEM work experience: provider costs and staff time

As explained in the methods section, provider costs and staff time were categorised for specific programme activities. Total unit values (either in pounds or number of days of staff time) are presented in Table 15. For the purpose of this analysis, it was assumed that all programme activities were taken up by all 56 intervention schools. The last two columns indicate the cost per pupil for each category. As mentioned in the methods section, this was derived by dividing the total cost of providers' staff time by the number of students who were part of the programme at each stage or those who benefitted from these activities. The total at the end of the table shows the per-pupil figures for the first year.

Table 15: Cost of delivering Gen STEM programme (estimated costs as reported by the providers)

Cost category	Type of cost	Total monetary cost	Total staff time (in days)	Monetary cost per school	Provider staff time spent per school	Monetary cost per pupil	Provider staff time spent per pupil
Recruiting and providing an initial briefing for the schools on intervention (e.g. selection of students)	Start-up cost	£600	250	£10.71	4.46	£0.72	0.30
Coordinating and delivering the work preparation days in schools (including feedback)	Recurring cost	£3,500	350	£62.50	6.25	£4.89	0.49
Recruiting (or liaising with) the employers, i.e. securing work experience placements	Recurring cost	£300	500	£5.36	8.93	£1.17	1.95
Assisting schools and students with the work experience placement application	Recurring cost	£100	50	£1.79	0.89	£0.16	0.08
Interviewing the students or organising interviews	Recurring cost	£2,000	100	£35.71	1.79	£3.19	0.16
Ensuring feedback is provided to the students on their applications and interviews	Recurring cost	£100	25	£1.79	0.45	£0.16	0.04
Matching and booking the placements (e.g. ensuring employers, students, and parents and carers complete administrative paperwork related to work experience placement)	Recurring cost	£300	150	£5.36	2.68	£1.43	0.71
Assisting employers and schools in completing the work experience placements (i.e. monitor student attendance)	Recurring cost	£100	50	£1.79	0.89	£0.47	0.24
Collecting the feedback from employers and providing it to the schools	Recurring cost	£100	50	£1.79	0.89	£0.50	0.25
Organising and delivering the debrief sessions	Recurring cost	£100	30	£1.79	0.54	£1.14	0.34
Total				**£128.57**	**27.77 days**	**£13.83**	**4.56 days**

As per the EEF's cost guidance, the categories were identified as start-up costs or recurring costs. Based on these, per-pupil monetary cost and providers' staff time were calculated for the first three years. See Table 16 for further details about the cost for each year. Based on the estimates sent by CSW Group, the cost of delivering the programme for one school was around £164.29 and 34.05 days of providers' staff time, averaged across three years. It was £17.96 and 5.87 days of providers' staff time per pupil per year, averaged across three years.

Table 16: Cumulative costs of Gen STEM programme (based on estimated provider costs assuming programme delivery over three years)

	Monetary cost per school	Provider staff time in days per school	Monetary cost per pupil	Provider staff time in days per pupil
Cost per pupil 1st year	£128.57	27.77	£13.83	4.56
Additional cost per pupil 2nd year (only recurring cost)	£117.86	23.30	£13.11	4.25
Additional cost per pupil 3rd year (only recurring cost)	£117.86	23.30	£13.11	4.25
Cost per pupil 1st year	£128.57	27.77	£13.83	4.56
Cumulative cost per pupil 2nd year	£246.43	51.07	£26.94	8.81
Cumulative cost per pupil 3rd year	£492.86	102.14	£53.88	17.62
Total cost per pupil per year over three-year period	**£164.29**	**34.05 days**	**£17.96**	**5.87 days**

The estimates of per-pupil costs and staff time for delivery have some limitations: (i) they do not include the cost data from schools and employers, and (ii) CSW Group estimated the total delivery cost for the whole programme as they could not obtain the data from the other two providers. In addition, CSW Group emphasised that they spent considerably longer delivering the programme and supporting the schools and employers than initially envisaged. Moreover, they felt that the whole programme was far too time-intensive to deliver in its current form.

Conclusion

Table 17: Key conclusions

Key conclusions	
1.	Children in Generation STEM schools made the equivalent of 0 months' additional progress in mathematics and science, on average, compared with children in other schools. This result has a high security rating.
2.	Children eligible for free school meals in Gen STEM schools made the equivalent of one month's additional progress in mathematics and science, on average, compared with children in other schools. This finding should be interpreted with caution, as it is based on a small sub-group of pupils and there is considerable uncertainty around the result.
3.	There was no evidence in the secondary outcome data that Gen STEM had an impact on students' attendance in Year 11, uptake of STEM-related subjects at A-level, ability to make future decisions, or attitudes to STEM, life and school.
4.	The intervention was not consistently delivered as intended in the design of the programme and there were considerable disparities in how different providers, employers, and schools delivered the intervention.
5.	The intervention was complex with a considerable number of component parts and was implemented very variably across different programme providers and schools. Due to the providers being unable to recruit enough schools to the programme in the target region, the timescale and the geographical regions for the programme were also extended, introducing more inconsistencies into the programme.

Impact evaluation and IPE (implementation and process evaluation) integration

The logic model was developed by CSW Group when the programme was being finalised in summer 2017. The intervention was not piloted prior to this trial. The logic model was constructed based on existing evidence on what constituted quality work experience and incorporated core components of a quality work experience placement into the programme. These were identified as Gen STEM programme activities or processes. It must be noted that not all elements of the intervention were in place before the trial. During the set-up phase of the trial, it was planned that the ten young people who were not selected for placements would be supported with an activity to help them find an alternative placement, but this activity was not defined. For the five undergoing the work experience placement, the post-experience debrief sessions were not taking place consistently prior to the trial. It was acknowledged that these needed to be defined more clearly. During the development of the logic model, secondary outcome measures were carefully chosen, aligned with the existing literature at the time. No previous large-scale work experience trial had demonstrated a link with attainment but this was selected as a primary outcome given this step in the logic model and the EEF's funding requirements. While the IPE explored the fidelity to these important features of the programme, the main objective of the impact evaluation was to ascertain the impact of taking part in the Gen STEM programme on a range of non-academic and academic outcomes. The lack of evidence of impact across all measures does not support the logic model.

However, the process evaluation identified some perceived positive impact on student outcomes, such as increased overall confidence. These observations are based on the telephone interviews with 15 school staff and eight pupils, whereas the impact data on secondary outcomes was based on all nominated young people, two thirds of whom had not taken part in the work experience placement by Gen STEM (as only five out of 15 received a placement). Additionally, in the case of the 15 interviews with school staff, the analysis is not comparing like with like—i.e. staff views versus young people's views. But findings on programme implementation were mixed, with considerable variation in programme delivery and low fidelity to implementation. Only a quarter of the analysed sample had reached minimum compliance (25%) and one fifth had reached full compliance (21%). Furthermore, the logic model indicated that employers should be involved in the interview. Only one school staff member (out of 15) and none of the young people (out of eight) said that an employer had been involved, and 14 out of the 15 employers interviewed reported not taking part in the interview process, illustrating low fidelity to this minimum compliance criterion.

Different data sources in the process evaluation confirmed that the intervention was not delivered consistently with the logic model and suggested an overall low implementation in terms of fidelity. For example, the evidence suggested that participating schools used three broad approaches in the selection of the 15 students to take part in the intervention: (1) they selected students based on characteristics such as gender, ethnic background, pupil premium, academic ability,

and known STEM interests; (2) they approached the triple science classes or highest-ability group and asked if students were interested in taking part; or (3) they advertised to all students in Year 10 and took the first 15 applications.

In addition to this, there was a considerable disparity between the ways in which the schools and providers took part in the intervention. There were differences in the way the young people applied to the work experience placement and received feedback following the placement. In some cases, the young people reportedly applied to the employers directly, and in other cases, employers said that the young people were 'assigned' to them. One person was reported to have changed her placement to one closer to home. Furthermore, the post-work experience feedback that was provided was not systematic as there was no common format used. Of those young people who attended at least one day of a work experience placement, the majority (62%) were provided with feedback from their school; 18% had feedback sent to their home address; and a minority received feedback in person (11%) or by phone (4%). A further 6% received no feedback at all. Inconsistent application of elements of the logic model calls into question whether the lack of impact seen was due to the mechanisms of the programme per se or its implementation.

Interpretation

The aim of the Gen STEM programme was to improve students' life skills, such as an ability to see the relevance of their schoolwork to their chosen career path, greater motivation to engage in schoolwork, punctuality, confidence, and maturity. The rationale behind the programme was then expanded to incorporate attainment outcomes. The hypothesis was that, as a result of these improved life skills, students would be more prepared to study STEM subjects, which would potentially improve their attainment in STEM subjects.

This evaluation, however, did not find evidence that the programme had an impact on students' outcomes. These outcomes included their attainment at Key Stage 4 (combined mathematics and science point score), STEM-related subject choices at A-level, school attendance during Year 11, whether they were well-informed to make future decisions, and their attitudes to STEM, life and school or college. The evaluation found that the programme may have contributed to one month's additional progress (in GCSE attainment in mathematics and science combined) for students from disadvantaged backgrounds, but this finding had considerable uncertainty around it. There was also no evidence that the programme had an impact on students' GCSE attainment in mathematics or science when analysed separately.

As per the trial design and the intervention logic model, 15 students were selected in each school to be the trial cohort in that school. The design meant that the 15 students in the intervention schools would attend the work preparation day and undergo the interview process but only five would go on to attend the work experience placement, so there was a dilution effect of the intervention. This was acknowledged in the protocol and an analysis of student compliance was planned in the SAP. The findings from this analysis indicated that there was no evidence that the Gen STEM programme had an effect on students' combined GCSE attainment in mathematics and science, taking compliance into account. It should also be noted that, although student selection was not a core criterion, interviewees reported different selection processes contributing to a lack of focus in this intervention, making it hard to evaluate.

Various data sources in the process evaluation identified a range of perceived impact on students:

- The majority of employers viewed the quality of the Gen STEM work experience programme to be good and believed it had a positive impact on the young people, but would have liked improved communication with the provider.
- Overall, the majority of school staff members felt pupils had benefitted from participating in the programme. They primarily felt that the successes of the work experience programme related to the content and nature of the placements.
- A minority of school staff were discouraged or frustrated by the programme. This was due to delays in the organisation of the work experience placements, difficulties securing appropriate and timely placements, poor communication, and the programme becoming very labour intensive for them.
- All of the young people who undertook the work experience believed that it had confirmed or expanded their interest in STEM and had increased their confidence in general.

It should be noted that some of these perceived impacts could relate to work experience in general as well as to the intervention; although a unique aspect of the programme was its focus on STEM. Some school staff and employers

thought the programme provided high quality placements that the young people would not have access to otherwise. Additionally, the programme, including paperwork, was well organised and communication between parties was good. Others felt the programme represented poor quality because it provided no additional value to the work experience routinely offered by the school; the process was labour-intensive; there were poor quality placements that were not STEM-related; and there was poor communication between the school and the providers. Some school staff and employers were unsure about the benefit of having a middleman (i.e. the provider), particularly if they had their own work experience programme in place in school.

The theory of change specified that approved CSW trainers must deliver the work preparation day and CSW Group staff must deliver the key elements of the intervention, such as the interviews and debriefs. This intervention programme was complex, with many component parts (such as the work preparation day, the matching of young people with the placement, the work experience placement, and employer engagement with the provider throughout the process). This complexity meant that achieving high fidelity was ambitious. Furthermore, the intervention was not piloted before the trial. For example, there was a lack of consistency in the way the post-work experience feedback was provided before the trial. This led to an additional layer of variability.

As the recruitment of schools to the programme proved challenging, the geographical region was expanded from the south west of England to encompass 17 counties, and two additional providers were recruited. The evaluation provided evidence that all three providers delivered their work preparation days in different ways. The challenging recruitment and expansion of the geographical regions meant that the work experience placements were delivered later in the year (with some during summer holidays) and post-work experience debriefs were similarly delayed, with some taking place during the autumn term when pupils were in Year 11.

The results of this trial are similar to research findings from studies of young people's participation in world-of-work experiences. Studies such as Hughes et al., 2016 report perceptions of improvements to young people's life skills, including communication and interpersonal skills, self-confidence, and maturity, as well as their developing clearer career aspirations. Although the studies report an increased motivation to engage in education, they do not evaluate the impact of world-of-work experiences on young people's educational outcomes. However, a recent small-scale pilot RCT of Key Stage 4 pupils' participation in career talks with volunteers from the world of work provides limited evidence that such career talks can change pupils' attitudes to education, influence their future plans and subject choices, motivate them to study harder, and support an improvement in academic attainment. The report from this RCT noted that the effects are modest and indicative and need further exploration as part of a larger trial (Kashefpakdel et al., 2019). The present larger trial showed no evidence of the impact of work experience on pupils' non-cognitive outcomes, including attitudes to STEM, life, and school or college, and pupils' subsequent mathematics and science GCSE outcomes. However, it was limited by poor fidelity of implementation.

Limitations

The original sample size was based on recruiting and randomising 130 secondary schools with 15 students per school, and to have a statistical power of 0.8 to detect an effect size of 0.15 of a standard deviation between the intervention and control groups, with an intra-cluster correlation coefficient (ICC) of 0.1 and a pre-post correlation of 0.65. Based on the primary analysis, the ICC was 0.11 and the pre-post correlation was 0.73 with a minimum detectable effect size (MDES) of 0.16. This is similar to what was planned in the protocol and at randomisation. However, due to the dilution effect brought about by only five of the 15 eligible students going on work experience placements, MDES at analysis is arguably ambitious to achieve given the proportion of the sample actually experiencing the intervention. This is related to the important fact that there was no literature or pilot work upon which to base the original MDES assumptions. Lower implementation fidelity was a threat to the internal validity of the findings as essential intervention components were not implemented properly. Null results coupled with this lower implementation fidelity does not necessarily preclude that the intervention could work if implemented appropriately. Moreover, the 'business as usual' was not established properly.

Another limitation is the use of the PLAMS dataset in running a model on the post-16 STEM-related subject choices which were limited to A-level qualifications. This dataset only included the academic path that students chose and it did not include any vocational qualifications. Therefore, this analysis may have failed to meet the broader aim of the Gen STEM programme where it might have had an impact on students' vocational STEM subject selection.

As CSW Group could not recruit sufficient schools from the original geographies, they had to expand into additional regions and to sub-contract two additional providers to deliver the Gen STEM programme in the newly recruited regions.

As a result, the three providers delivered the programme in dissimilar ways and intervention activities were delayed. The providers also felt that the programme was time intensive to deliver in its current form.

In addition to this, there was a lack of fidelity to full implementation by schools and employers. This could also have been due to the programme being quite complex and having multiple sequential component parts. The intervention was not implemented as intended due to its complexity leading to variability in its roll-out: lack of impact could be due to this rather than the programme itself.

It could be that a simplified work experience programme that had undergone a rigorous pilot might yield different impact results. It should be noted here that the school staff and the employers felt that the programme could be enhanced by improved organisation and communication. This could result in a better common understanding of the importance of each component part and the expectation of each player (providers, schools, and employers). For example:

- The selection of the young people needs to be consistent—for instance, targeting students with relatively lower attendance would have more scope for improving attendance and so outcomes.
- The work preparation day needs to be consistent and include topics such as writing CVs, how to interview well, how to present oneself during work experience. It should also be an opportunity to meet the employer prior to placement so expectations of employer and student are clear.
- The post-experience debrief sessions need to be tightly defined and delivered so students receive consistent feedback on their strengths and areas for development and fully appreciate the skills and knowledge they have gained.

This would mean that each young person would benefit from an intervention that is consistently delivered.

Future research and publications

The logic model for the Gen STEM programme suggests that there could be a number of pathways in which STEM work experience placements in Key Stage 4 can impact on maths and science attainment at GCSE. Due to the lack of fidelity in this trial, it was not possible to investigate this change mechanism fully—how taking part in each of the activities before and after the work experience placement improves young people's life skills (such as the motivation to learn STEM subjects) and ultimately improves attainment. Despite this, the employers and school staff identified some quality features of the programme. The developers may therefore wish to simplify and streamline the intervention to retain these aspects of the intervention. They could improve the communication and support offered to the schools and retain processes of the programme that schools cannot implement themselves without substantial resources.

Once the intervention undergoes further development, perhaps a small scale pilot would be beneficial to explore how each programme component is implemented. A pilot could also focus on the change mechanisms to investigate how this particular intervention affects young peoples' life skills and attitudes to STEM. Work experience is not compulsory at Key Stage 4 and some schools do not provide work experience at all. Therefore, it is important for future research to clearly establish how the intervention is different from business as usual, and it could compare types of schools or types of young people. In case of schools, it could include those who do not offer anything at all, those who provide work experience (but without preparation before or feedback afterwards) and those who receive the full Gen STEM intervention.

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Appendix A: EEF cost rating

Cost ratings are based on the approximate cost per pupil per year of implementing the intervention over three years.

More information about the EEF's approach to cost evaluation can be found here. Cost ratings are awarded as follows:

Figure 13: Cost rating

Cost rating	Description
£ £ £ £ £	*Very low:* less than £80 per pupil per year.
£ £ £ £ £	*Low:* up to about £200 per pupil per year.
£ £ £ £ £	*Moderate:* up to about £700 per pupil per year.
£ £ £ £ £	*High:* up to £1,200 per pupil per year.
£ £ £ £ £	*Very high:* over £1,200 per pupil per year.

Appendix B: Security classification of trial findings

OUTCOME: KS4 combined mathematics and science attainment

Rating	Criteria for rating			Initial score		Adjust		Final score
	Design	**MDES**	**Attrition**					
5	Randomised design	<= 0.2	0-10%	5				
4	Design for comparison that considers some type of selection on unobservable characteristics (e.g. RDD, Diff-in-Diffs, Matched Diff-in-Diffs)	0.21 - 0.29	11-20%					4
3	Design for comparison that considers selection on all relevant observable confounders (e.g. Matching or Regression Analysis with variables descriptive of the selection mechanism)	0.30 - 0.39	21-30%			Adjustment for threats to internal validity **[X]**		
2	Design for comparison that considers selection only on some relevant confounders	0.40 - 0.49	31-40%					
1	Design for comparison that does not consider selection on any relevant confounders	0.50 - 0.59	41-50%					
0	No comparator	>=0.6	>50%					

Threats to validity	Risk rating	Comments
Threat 1: Confounding	Low	RCT design, independent randomisation described in SAP. Pre-test imbalance was moderate (0.06 SD) but this was controlled for in regression model. Some issues around variability in which students participated which may have affected the outcome (but is captured in threat #2 below).
Threat 2: Concurrent Interventions	Moderate	Not clear the extent to which the intervention condition was different with regard to work experience as to control condition (other than for a third of pupils), reports that intervention not that distinctive from business as usual.
Threat 3: Experimental effects	Low	Did not report anything that would suggest instances of compensatory rivalry or contamination.
Threat 4: Implementation fidelity	**High**	Implementation fidelity is well defined and aligned to logic model AND fidelity and compliance was low (i.e. implementation highly variable). **This is likely to underestimate the impact estimate.**
Threat 5: Missing Data	Low	Less than 10% from randomisation to analysis, Some evidence that missingness is related to lower prior attainment (but not any other variables). This is controlled for in the analysis and outcome deemed MAR.
Threat 6: Measurement of Outcomes	Low	Robust measures (NPD data of attainment) used and attitude scales (measuring secondary outcomes) also shown to be psychometrically robust (pca & cronbach's satisfactory). All measures justified.
Threat 7: Selective reporting	Low	Study is registered and protocol and SAP published prior to analysis and followed. Any deviations are reported and justified.

- **Initial padlock score:** [5] Padlocks – randomised design, MDES= 0.16 and attrition = 8.5%
- **Reason for adjustment for threats to validity**: [-1] Padlocks – Evidence of low implementation fidelity which could lead to impact estimate being underestimated.
- **Final padlock score:** initial score adjusted for threats to validity = [4] Padlocks

Appendix C: Theory of Change and the logic model

Overall purpose of the evaluation

To evaluate the impact of the Generation STEM intervention on KS4 science and maths scores, life skills, and KS5 choices for year 10 pupils including a good proportion of EverFSM pupils.

Purpose of the intervention

Pupils get a more structured valuable stem related work experience programme, gain a realistic experience of the working world, improve their ability to see the relevance of their school work, are more readily able to identify further education and career choices, gain employability skills, and have a better quality CV than they would otherwise, in order to support their educational development and transitions.

Assumptions

Limited research has shown a link between work experience and life skills but more evidence is needed to show a link between work experience and attainment via life skills. (e.g. Hillage et al 2011: Hughes et al 2016)

For Gen STEM to achieve success certain conditions must be met, including:

- committed schools and students who are happy with all aspects of the programme and are engaged in the intervention
- employers who are engaged and committed to providing high quality STEM work placements
- reasonable number and variety of employers offering stem related WEX
- pupils attending all aspects of the intervention including prep and debrief
- planned programme with employer to ensure experience is quality
- high quality 5 days of WEX

Approved CSW trainers must deliver the work prep day and CSW staff must deliver the key elements of the intervention; interview, debriefs, matching.

Target Groups

- Schools: with year 10 pupils
- Pupils: KS4, Target 5/15 EverFSM

Strategies

What is the approach?

Programme of support over spring and summer term consisting of:

- 1 work preparation day for all pupils in year 10
- 1 mock interview with an employer(s) and CSW representative for 15 students (partly self-selected based on interest in STEM and placements, partly selected by teachers who want to encourage less confident/more disadvantaged students to apply)
- 1 post interview debrief delivered by CSW for all 15 students
- Matching of pupils with relevant placement
- 5 days of stem work experience for 5 students
- 1 post work experience debrief
- Employer engagement with CSW throughout this process.

Resources:

- CSW pack of materials for employers and pupils.

Impact, e.g. I would expect Gen STEM to make the following difference(s):

Outputs:

- Number of pupils receiving quality, stem related relevant work experience

Outcomes:

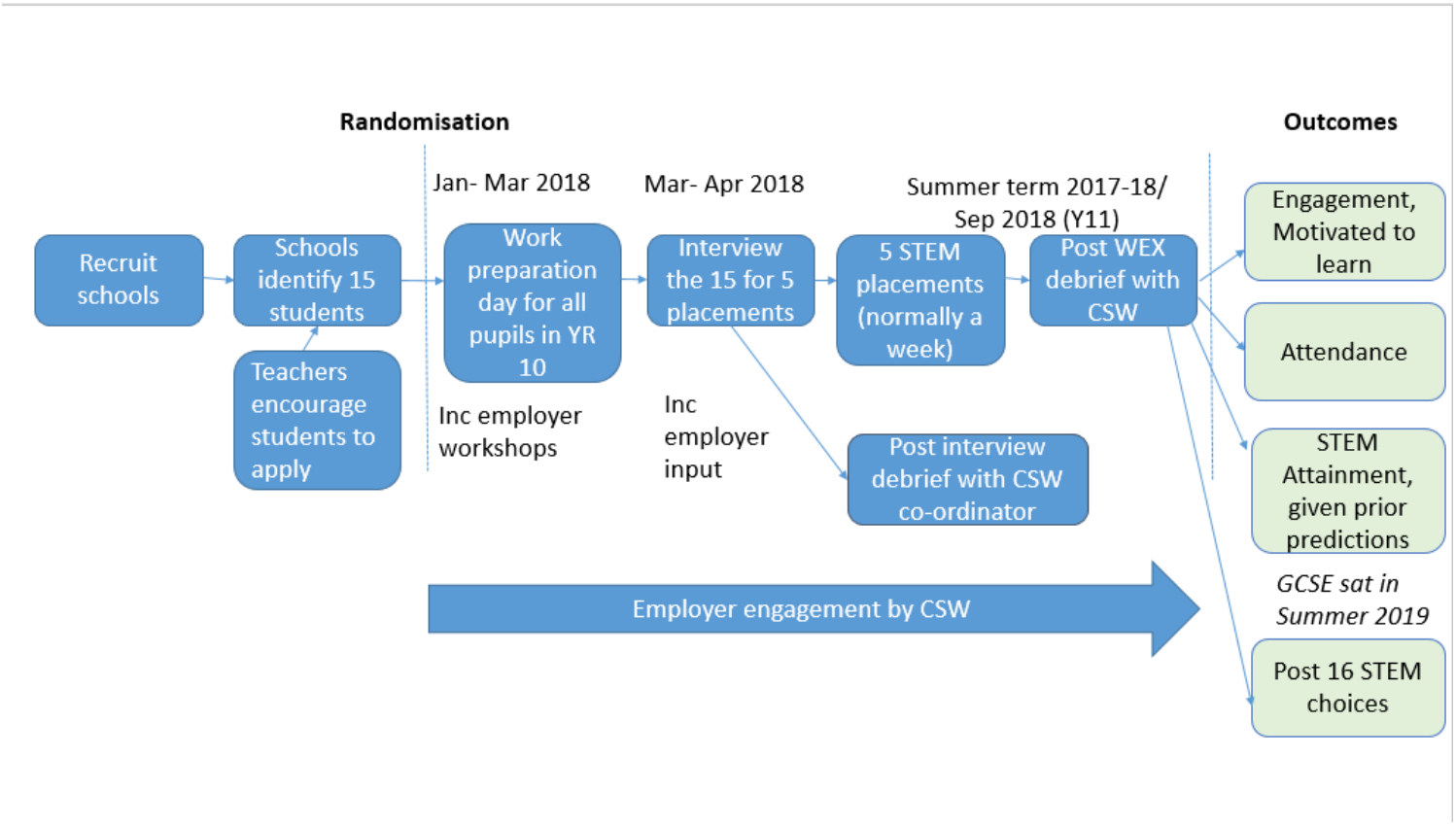
- Improvement in pupils' stem related skills e.g. science and maths.
- Improvement in pupils life skills e.g. confidence, time keeping, behaviour, motivation to learn, attitudes to school work/career
- Improvement in knowledge / interest in stem related further education and career choices

Impact:

- Attainment measured through KS4 scores in science and maths when compared to a control group.
- Pupils' life skills and knowledge/interest in STEM careers will be measured through scores on the NFER questionnaire when compared with a control group.
- Pupils A level subject choices using ILR compared to control group will show number of actual STEM subjects taken
- Pupils, teachers and employers' perceived impact of the intervention on the pupils.

Wider impact:

We will explore whether there is any Impact on the whole-school community, e.g. teachers, senior leaders, non-teaching staff, parents/carers? This will be measured by light touch qualitative questions.



Note: it was not possible to revise the original logic model based on the evaluation findings as the programme was applied inconsistently and the variation in implementation did not provide sufficient evidence to enable revision of the logic model.

Appendix D: Recruitment material

PROJECT INFORMATION SHEET FOR TEACHERS

Generation STEM

INVITATION TO TAKE PART

State-funded secondary schools are being invited to take part in the 'Generation STEM' research project. Participating schools will have the opportunity to involve their Year 10 cohort in a Work Preparation Day and selected students in STEM work experience placements, or be financially compensated for their time.

This information sheet tells you more about what is involved in the project. Please read it and if you have any questions get in touch using the details at the end of the document.

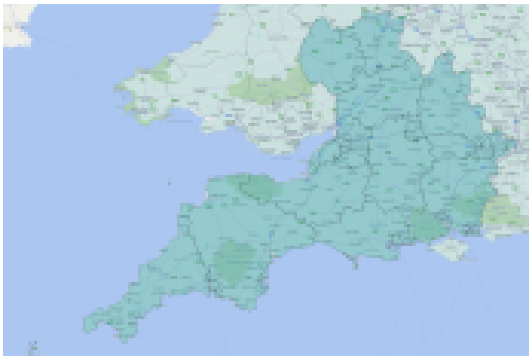
If you are happy for your school to take part in the project, please **complete the enclosed Reply Form and Memorandum of Understanding**, scan a copy and return to us at workexperience@cswgroup.co.uk. Our team will confirm and inform you of the next steps.

What is the purpose of the project?
This project aims to explore whether engaging in a structured work experience programme, involving work preparation activities, support in applying for a STEM-related placement, and post-placement support improves young people's outcomes. The delivery will take place during academic year 2017/18 to Year 10 students and will primarily have a focus on supporting work experience opportunities within STEM for a target group of 15 students, particularly disadvantaged learners, who could benefit from support. The evaluation of the programme will continue until 2019 when the attainment data for the cohort is released.

The programme has been developed by CSW Group, building on their established activities to produce a comprehensive and supported work placement experience.

Who is conducting the research?
A team of researchers at the National Foundation for Educational Research (NFER) have been commissioned by the project funders (Education Endowment Foundation, Careers and Enterprise Company and Bank of America Merrill Lynch) to carry out an evaluation to assess the impact of the programme on academic attainment, destination choices, and motivation to learn, as well as exploring how the programme was implemented.

Which schools can take part?
'Generation STEM' is aiming to recruit 130 secondary schools in the defined geographical area (see map).



All state-funded secondary schools in Cornwall, Devon, Somerset, Bristol, Bath, Gloucestershire, Herefordshire, Worcestershire, Oxfordshire, Berkshire, Swindon, Wiltshire, Dorset, Bournemouth and Poole, Hampshire, Southampton and Portsmouth are invited to participate.

This project is managed by CSW Enterprise Team

Which students can take part?
The Work Preparation Day will be delivered with any student in Year 10 (number to be agreed with the school), but the more in-depth support provided for 15 students to apply and interview for 5 STEM-related work experience placements is aimed at pupils who may not always have access to these types of opportunities. Schools should aim for at least 5 of the 15 to be eligible for free school meals and select students who are:

- Interested in a career in a STEM-related field
- Unlikely, or less likely than others, to obtain a work experience placement with a STEM-related employer without this intervention to support them
- At a disadvantage compared to their peers

Does my school have to take part?
This is a voluntary project and is completely up to you if you choose to take part or not.

What will participation involve?
This research is a randomised controlled trial (RCT) and participating schools will be randomly assigned to either an **Intervention Group** (IG) and be asked to take part in the work experience programme, or to a **Control Group** (CG) and asked to continue with their normal practices in relation to work experience.

Those who are placed in to the **Control Group (CG)** will not receive the delivery of the programme, but will receive a payment of £1,000 for taking part and participating in follow up data collection.

For **both Groups** there will be a number of activities for schools and students to undertake, both at the start, during, and at the end of the study. A detailed description of the tasks is provided later, but the key tasks are listed below:

- provide a link contact within the school to work with CSW Group and NFER
- provide Pupil Data to NFER (identifying 15 target pupils and submitting their Unique Pupil Numbers)
- share consent information with parents
- for the 15 nominated students to complete the online baseline survey of life skills
- agree to take part whether they are allocated to the control group or the intervention group

In addition all schools will agree to, if allocated to the **Intervention Group**:

- **Commit to a 1 day 'Work Preparation' Day for Year 10** (number of students to be agreed with the school). Held in the school in an appropriate venue, organised and facilitated by a CSW Group Co-ordinator and involving employer volunteers.

- **Support the group of 15 students to fully participate. This will include allowing time for:**
  - CV / application writing and the interview process
  - Briefings and de-brief
  - The work placement itself
  - Supporting those students who do not get a placement through the process

- Allow NFER evaluators to visit their school during the course of the evaluation

What are the benefits and risks of taking part?
We hope that your school will find taking part in the project rewarding. Participation presents an excellent opportunity for pupils in Intervention Group schools to take part in work experience, and understand the 'real life' elements of an application and interview.

By participating you are helping us to increase understanding of the importance of work experience placements to young people, their attainment and motivation, and ultimately their post-16 destination choices.

We do not foresee any risks associated with participation. All work experience placements will be fully checked by CSW Group to ensure that Duty of Care standards are met.

How will your data be used, and will the data generated during the project be kept confidential?
All the information that we gather about individual pupils, teachers and schools will be kept completely confidential in accordance with the Data Protection Act (1998). Pupil data collected from schools by NFER and pupil questionnaire will not be made available to anyone outside of these research teams.

For the purpose of research, the responses will be linked with information about your pupil's from the National Pupil Database (held by the Department for Education), other official records, and shared with NFER, CSW Group, the Department for Education, EEF, Careers and Enterprise Company, EEF's data contractor FFT Education and in an anonymised form to the UK Data Archive and for research purposes. Your pupil's data will be treated with the strictest confidence. We will not use pupil names or the name of the school in any report arising from the research.

On conclusion of the project, the Fischer Family Trust (see http://www.fft.org.uk/) will collate and anonymise the data for upload to the UK Data Archive. The archived data will be available in an anonymised form with restricted access for research purposes only.

No school or pupil will be identified in any report arising from the research.

What will happen to the results of the research project?
The independent evaluation will be publicly available from the Education Endowment Foundation and partners' websites, and will be shared with participating schools. The findings will feed into the funders' future work in this area, and integrated into future reviews about the impact of work experience. If positive, it could lead to further funding for similar initiatives.

Who is overseeing the project?
Palak Roy is the Trial Manager and will be overseeing all elements of the project at NFER.

How is the project funded?
The project is jointly-funded by the Education Endowment Foundation (EEF) the Careers and Enterprise Company and Bank of America Merrill Lynch. For further details visit https://educationendowmentfoundation.org.uk/our-work/projects/generation-stem-work-experience/

Concerns about the project
If you have a concern about any aspect of the project, you should contact the Trial Manager Palak Roy: p.mehta@nfer.ac.uk

For Enquiries about School Recruitment:
Please contact CSW Group on workexperience@cswgroup.co.uk or 01392 215 501.

For Enquiries about the Evaluation: Please contact Palak Roy p.mehta@nfer.ac.uk

This project is managed by CSW Enterprise Team

Overview of Required Tasks

(CG = Control Group, IG = Intervention Group)

TASK	CG	IG
Return completed reply form to CSW providing details of the key link person at the school	✓	✓
Provide NFER with the following pupil data for at least 15 selected Year 10 pupils: first name, last name, gender, date of birth, Free School Meal eligibility, form group and Unique Pupil Number (UPN).	✓	✓
Distribute project information sheets and forms to parents/guardians of the current Year 10 pupils (and to the pupils).	✓	✓
Schools must allow a researcher to visit the school when required	✓	✓
Schools ensure that the 15 selected pupils complete the baseline online life skills	✓	✓
Commit to a 1 day 'Work Preparation' Day for all year 10 students. To be held in the school in an appropriate venue, organised and facilitated by your assigned CSW Group co-ordinator and involving business representatives attending and supporting.		✓
Provide a 'link' contact within the school for CSW Group to work with. This will ensure the smooth running of the programme for the school and its students.		✓
Support the group of 15 students to fully participate. This will include allowing time for; • CV / application writing and the interview process • Briefings and de-brief • The work placement itself • Supporting those students who do not get a placement through the process		✓
Schools ensure that the 15 selected pupils complete the follow-up online life skills	✓	✓

How to select 15 students for the Generation STEM trial

Please select students who are:

- Interested in a career in a STEM related field. (Science, Technology, Engineering and Mathematics)
- Unlikely, or less likely than others, to obtain a work experience placement with a STEM related employer without this intervention to support them.
- Students who are at a disadvantage compared to their peers. For guidance please aim for 5 of the 15 to be eligible for free school meals.

Some examples of disadvantage are students who are:

- Capable but underperforming – in need of extra support.

And/Or

- Capable but not confident in following their aspirations in STEM.

If you would like to discuss further please contact:

CSW via email at workexperience@cswgroup.co.uk

OR

NFER via email at workexperience@nfer.ac.uk

Restricted

Supported work experience for 14-15 year olds, promoting careers in Science, Technology, Engineering and Maths

CSW Enterprise

ACCREDITED Industrial Cadets

What is Generation STEM?

Generation STEM is a new programme of work experience related to Science, Technology, Engineering and Maths (STEM) for young people aged 14-15 delivered by employers in cooperation with the CSW Enterprise Team.

The programme is accredited by Industrial Cadets, an industry-led scheme endorsed by His Royal Highness The Prince of Wales and supported by employers such as British Steel, GlaxoSmithKline, Müller, Nissan, AkzoNobel, Steelite, Jaguar Land Rover, BAE Systems and many more.

What's involved?

Employers taking part in Generation STEM agree to host one or more young people (aged 14-15) for a structured, week-long work experience placement, sometime during the spring or summer 2018. Optionally, you can also take part in the pre-placement Work Preparation Day and Interview Day activities delivered at the young person's school.

What will the young person do whilst on placement?

Young people on placement will follow a structured programme that will include standard elements such as a workplace tour, health and safety briefing, self-reflection activities and employee interviews, but will also include a student-led project that fits the context of your organisation. Our project coordinators will discuss the details of the project with you and ensure it meets the needs of your organisation and the young person alike.

What support can we expect?

A designated project coordinator from our team will support you throughout the process and will be on hand to answer any questions or concerns you might have. The CSW Enterprise Team has over 20 years' experience of managing work opportunities for thousands of young people, so we know the barriers and how to overcome them.

Are there any costs to being involved?

There are no direct costs for employers to take part.

What are the benefits to my organisation?

Employers who offer work experience to young people report a range of benefits including:

- **Recruitment opportunities:** access the local labour market and explore a talent pipeline you might not have considered
- **Staff development**: coaching young people on work experience offers an excellent development opportunity for your future managers
- **A more engaged workforce:** send a positive message to the wider workforce about the values of your organisation, supporting employee engagement
- **Engagement with the local community:** build on the positive image of your organisation; help address local issues related to unemployment and young people

What about health and safety/safeguarding?

Our experienced project coordinators will be able to advise you on all aspects of health and safety, insurance and safeguarding – all of which can be easier than you think!

How are young people selected for the placement?

All young people taking part in Generation STEM will complete a formal application and interview process at their school. If you would like to be involved in the Interview Day and help select the individual young person you will take on placement, then you are most welcome to do so, however this is completely optional.

How are young people prepared for the placement?

One of the unique aspects of Generation STEM is the Work Preparation Day that all participants will undertake ahead of their placements at their school. The Work Preparation Day brings the young people into contact with volunteers from local employers and covers a variety of topics:

- Developing transferrable employability skills
- Preparing a CV
- Writing effective applications
- Interview technique


Who is funding Generation STEM?
The programme is funded by the Education Endowment Foundation, Careers and Enterprise Company and Bank of America Merrill Lynch.
Who are CSW?
The CSW Enterprise Team (formerly Education Business Partnership - South West) is part of CSW Group - transition management specialists offering information, guidance and support to people and organisations as they move through different stages of their lives. We are a not-for-profit social enterprise with over 20 years' experience of managing learning and work opportunities for thousands of young people.
How do I get involved?
To register your interest and arrange a call or face-to-face visit to discuss your participation in more detail, please contact our project team:
Generation STEM Project Team
workexperience@cswgroup.co.uk
01392 215 501
www.cswenterprise.co.uk
Follow us on Facebook and Twitter

NFER/CSW No: _____

Evaluation of the GENERATION STEM Work Experience Programme – Reply Form

If you would like to participate in the evaluation of the Generation STEM Work Experience Programme, please read the Memorandum of Understanding (MOU), **complete and sign page 1 and page 4**, then scan and return it to CSW Group via email: workexperience@cswgroup.co.uk

	Details
School Name	
Headteacher	
Phone	
Email	

My school **will** take part in this evaluation and agrees to the conditions stated in the Memorandum of Understanding (MOU).

Headteacher / SMT signature……

Name of nominated GENERATION STEM contact in the school:

Mr/Mrs/Miss/Ms/Dr:……

Job title: ……

Contact phone number: ……

Contact email address: ……

Best time to contact you: ……

How many students do you currently have in Year 10: ☐

Do you currently have a work experience programme in place for Year 10: Yes / No

On receipt of your completed form you will receive a confirmation email from our evaluation partner National Foundation for Educational Research (NFER) outlining the next steps. Please note this email will come from the email address workexperience@nfer.ac.uk

RCT Evaluation of Generation STEM Work experience programme for Schools

Memorandum of Understanding

The following outlines our expectations from schools/colleges and teachers taking part in the evaluation. Please read the following statements and sign the reply form provided to confirm that you have read the document, please also sign and keep this copy for your reference.

Our overall expectations of the school;

- A named contact within the school needs to be allocated to the project to work with CSW Group (guidance can be provided on who this should be). They should have sufficient capacity to be able to respond promptly to requests and facilitate meeting requirements as appropriate.
- Participating students in Year 10 should be given sufficient time to fully undertake all the activities that are asked of them.
- For all events and activities, suitable venues should be provided, in line with guidance given by CSW Group, and refreshments provided.
- All data required by the evaluation team in relation to the project to be provided in a timely fashion.
- For the purpose of research, the responses will be linked with information about your pupils from the National Pupil Database (held by the Department for Education), other official records, and shared with NFER, CSW Group, the Department for Education, EEF, Careers and Enterprise Company, EEF's data contractor FFT Education and in an anonymised form to the UK Data Archive and for research purposes. Your pupil's data will be treated with the strictest confidence. We will not use pupil names or the name of the school in any report arising from the research.

Our expectations on the day of the Work Preparation workshop;

- Teachers are required to stay with the facilitator for the duration of their time at the school – the appropriate ratio of teachers to students will be agreed in advance.
- A teacher will meet the CSW Group co-ordinator at the school/college reception at least 30 minutes prior to the Work Preparation Day being delivered. The presenter will then be shown to the room that the workshop will be delivered in.
- All equipment for the workshop, including projector and laptop should be supplied by the school and set up ready *prior* to the presenter arriving at the school/college.
- Workshops are aimed at attendance from the whole year 10 cohort.

Expectations from teachers during the Work Preparation workshop

- The school are ultimately responsible for the management of the cohort and teachers are expected to lend support to presenters / facilitators in delivering workshops and ensuring students are respectful and cooperative.
- Teachers should be on hand to support the presenters and to reinforce the structure of workshop and to limit any student distractions.
- Teachers are expected to be engaged and involved in the workshop/topic supporting the students; an engaged teacher will result in more engaged students.
- Teachers should be on hand to support the presenter with IT related issues.

Expectations of School during the application / interview / placement stage

- Link contact will work with CSW Group co-ordinator to arrange dates, venues for activities.
- School will enable the selected students to have sufficient time to undertake the required activities.
- School will release the students for the period of the work placement, which will be agreed between CSW Group and the School.
- School will support students not successful in securing a placement to find an alternative

Timelines

Date	Activity
September – December 2017 ALL SCHOOLS	Schools sign up to take part in the trial: • Return reply form and signed MOU to CSW via email • Take a copy of the MOU to keep for school records • Provide NFER with the pupil data of the 15 students when requested using the secure school portal provided by NFER (Opt-out parental consent to be obtained) • The 15 students complete the online baseline survey of life skills provided via email by NFER When a school has completed all four of the above steps they have completed the sign up process and will receive an email from NFER confirming this.
November-December 2017. ALL SCHOOLS	Schools randomly allocated to intervention or control group by NFER. Schools will receive an email to confirm which group they are in and the next steps involved.
November 2017 – March 2018. INTERVENTION SCHOOL	Work Preparation Day delivered on agreed date to all in Year 10 cohort.
March – May 2018. INTERVENTION SCHOOL	Application- including preparation session and interview process takes place for x 15 students in selected group. Placements allocated, de-briefing takes place. Briefing for those going on placement takes place. (Parental Consent to be obtained for those students going on a work placement)
May – July 2018. INTERVENTION SCHOOL	Work Placement takes place. (pre-May placements also possible, dates to be agreed as outset of project) Post placement de-brief with CSW Group.
July / September 2018. INTERVENTION SCHOOL	Post placement evaluation questionnaire with NFER
September 2018. ALL SCHOOLS	Online Follow-Up questionnaire with NFER for Intervention group and Control group school (15 students).
October 2018 CONTROL SCHOOL	Payment of £1000 made to the Control Group Schools that have completed the questionnaires required

Please read the following statements and sign at the bottom if you agree with the statements:

I confirm that I have read and understand the information provided about the project and I have passed a copy of the letter to my designated key contact. I have had the opportunity to ask questions, and have had these answered satisfactorily.

This is a project that aims to evaluate the impact of work experience on Year 10 students; I understand that my school will be randomly assigned to either an intervention or a control group. The project is to be delivered in academic year 2017-18.

I understand that my school's participation is voluntary and that I am free to withdraw my school at any time, however I will let my CSW Group assigned co-ordinator and NFER know if I choose to cancel a workshop or withdraw from the trial.

I agree to facilitate the activities involved in the evaluation project as described above and in the Project Information Sheet, including;

I agree to arrange for the CSW Group Co-ordinator to come into the school and conduct the workshop(s) with our agreed cohort.

I know who I can contact if I have any concerns or complaints about the study.

I agree that my school will take part in the above study.

Signed.....

Print name.....

Position.....

Date.....

Parent letter

Dear Parent / Guardian

Research into work experience for students interested in careers in STEM (Science, Technology, Engineering and Mathematics)

We are writing to let you know that your child's school has been asked to be part of our research into Generation STEM which is a work experience programme developed by CSW Group to provide quality, relevant work experience to students in year 10. Generation STEM aims to improve students' life skills such as ability to see the relevance of their schoolwork to their chosen career path, greater motivation to engage in schoolwork, punctuality, confidence, and maturity.

The National Foundation for Educational Research (NFER) has been asked to carry out this research to find out whether Generation STEM makes a difference to improving students' confidence and knowledge. All schools taking part in the research will be asked to nominate 15 pupils who will participate in the research; NFER will collect the name, date of birth and UPN for each pupil. The UPN will then be used to link with information about each pupil including SEN and attainment data. Schools that have been asked to participate in the research will be randomly assigned to having Generation STEM programme or to continue with their normal work experience practice. If your school is selected to receive the Generation STEM programme then the whole of year 10 will participate in a workshop about careers and work experience. Then a group of around 15 students will participate in further activities including mock interviews with employers and then some of these students will go on to a work experience week organised by CSW Group. Students not selected to participate will continue with the schools normal work experience week if there is one. Students in all participating schools will be asked to complete a short questionnaire in October 2017, and then again in January 2018. Students' questionnaire survey responses and any other information collected as part of the research will be treated with the strictest confidence.

If you would prefer for your son/daughter not to take part in the research, please complete the form below and return to the school. If you are happy for your child to take part in the research, you do not need to complete the reply slip. Your child may withdraw from the research at any time. Please inform their teacher if your son/daughter would like to withdraw from the evaluation at a later stage.

All data collected will only be used for the purpose of research; the responses will be linked with information about your child including SEN from the National Pupil Database (held by the Department for Education), other official records, and shared with NFER, CSW Group, the Department for Education, Careers and Enterprise Company, The Education Endowment Foundation (EEF), EEF's data contractor FFT Education and in an anonymised form to the UK Data Archive and for research purposes. Your child's data will be treated with the strictest confidence. We will not use your child's name or the name of their school in any report arising from the research.

If you would like more information about the research, please contact me or Priscilla Antwi on 01753 637429 or email workexperience@nfer.ac.uk.

Yours sincerely

Kathryn Hurd

Head of Survey Administration

NFER, The Mere, Upton Park, Slough SL1 2DQ

www.nfer.ac.uk

Evaluation of Generation STEM

OPT-OUT SLIP – you only need to complete this form if you do NOT wish your child's data to be stored and used for research purposes.

I DO **NOT** give permission for data about my child that is collected as part of the Generation STEM project to be stored, and used for research purposes.

Your child's name……Child's class:… ……

Name of School……...

Your full name……..

Your telephone number (optional)..……

Your signature…….. Date……...

Appendix E: Privacy notice

Privacy notice for 'Generation STEM'

Why are we collecting this data?

'Generation STEM' is a work experience (WE) programme developed by CSW Group to provide quality, relevant work experience to students in year 10. NFER is undertaking a randomised controlled trial (RCT) to evaluate its effectiveness. To carry out the RCT, it is necessary for CSW Group and participating schools to provide data to the National Foundation for Educational Research (NFER) and the Education Endowment Foundation (EEF). This data will be used to identify the participating schools and pupils in the Department for Education's (DfE) National Pupil Database (NPD) and access attainment data for the relevant pupils from this. It will only be used for the purposes of analysis and will be treated with great care to achieve high levels of security. Further information on this process is provided below.

Who is this research project sponsored and funded by?

The Education Endowment Foundation (EEF) commissioned CSW Group to develop and deliver Generation STEM. The Careers Enterprise company has provided also provided some funding. The National Foundation for Educational Research (NFER) is undertaking the independent evaluation which is funded by EEF. NFER and CSW Group are joint data controllers for this study.

What is the legal basis for processing activities?

The legal basis for processing personal data is covered by:

> GDPR Article 6 (1) (f) which states that 'processing is necessary for the purposes of the legitimate interests pursued by the controller or by a third party except where such interests are overridden by the interests or fundamental rights and freedoms of the data subject which require protection of the personal data'.

Our legitimate interest for processing personal data is to administer the randomised controlled trial.

How will personal data be obtained?

CSW Group is responsible for recruiting schools for this trial. Each school will then invite 15 students to put themselves forward. Schools will share personal data from the participating students with NFER using NFER's secure data exchange portal.

NFER will obtain background pupil data from the Department for Education's (DfE) National Pupil Database (NPD) using DfE's secure data exchange portal.

NFER will also administer surveys of the participating students requiring the use of personal data to link responses from the beginning of the evaluation to those from the follow-up survey.

NFER will carry out telephone interviews with one member of staff in a sample of 15 schools; with 15 employers and with 15 of the intervention students.

What personal data is being collected by this project and how will it be shared between the research partners?

Personal data will include data about teachers and students from the participating schools and employers as described below:

- Teacher data: CSW Group will collect data (name, job title and contact details) about a nominated lead teacher so that NFER can liaise with the individual about the evaluation.
- Student data: NFER will collect personal data about students from the schools. This includes pupil names, dates of birth and Unique Pupil Numbers. This will be shared with DfE in order for them to link it to the NPD. The NPD data that we will request covers pupil prior attainment at the end of Key Stage 2, free school meal eligibility, gender, attendance, GCSE performance and post-16 learning aims. CSW Group will not see any data from the NPD but they will use other personal data obtained by NFER for the administration of the work experience placements. Data will be shared via secure portal. NFER will also use this personal data to administer a student survey and to contact students via the schools for the purposes of telephone interview. NFER will share all of the student data with EEF's data archive partner. Anonymised data will then be stored with the DfE, the Office for National Statistics (ONS) and potentially other research teams. Further matching to other administrative data may take place during subsequent research.
- Employer data: NFER will collect data (name, job title and contact details) for each of the employers from CSW Group for the purposes of telephone interview.

Is personal data being transferred outside of the European Economic Area (EEA)?

No personal data is stored or transferred outside of the EEA.

How long will personal data be retained?

NFER and CSW Group will delete any personal data within one year of report publication.

NFER will send all the student data to EEF's data archive partner within three months of the end of the project. At this point, EEF will become the Data Controller.

Can I stop my personal data being used?

NFER handles your personal data in accordance with the rights given to individuals under data protection legislation. If at any time you wish us to withdraw your data or correct errors in it, please contact Priscilla Antwi at workexperience@nfer.ac.uk.

In certain circumstances data subjects have the right to restrict or object to processing, in which case please contact NFER's Compliance Officer at compliance@nfer.ac.uk or CSW Group's Data Protection Lead, Nik Dunn at data.protection@cswgroup.co.uk. You also have the right to see information held about you. NFER and CSW Group will cooperate fully when a subject access request (SAR) is made.

Who can I contact about this project?

NFER and CSW Group are responsible for the day-to-day management of this project. Contact Priscilla Antwi at workexperience@nfer.ac.uk or Vashti Stimpson at Vashti.Stimpson@cswgroup.co.uk with any queries.

If you have a concern about the way this project processes personal data, we request that you raise your concern with NFER or CSW Group in the first instance (see the details above). Alternatively, you can contact the Information Commissioner's Office, the body responsible for enforcing data protection legislation in the UK, at https://ico.org.uk/concerns/.

Updates

We may need to update this privacy notice periodically so we recommend that you revisit this information from time to time. The date when this privacy notice was last updated is shown in the footer at the bottom of this document.

Appendix F: List of Level-3 STEM qualifications at Key Stage 5

Code	Qualification Name	STEM dummy
60321295	AQA Level 1 Certificate in Spanish (FCSE) Short Course in Spoken Language	0
60142923	AQA Level 1/Level 2 GCSE (9-1) in English Language	0
60146084	AQA Level 1/Level 2 GCSE (9-1) in Mathematics	0
60309325	AQA Level 1/Level 2 GCSE (9-1) in Psychology	0
60144567	AQA Level 3 Advanced GCE in Art and Design	1
60146254	AQA Level 3 Advanced GCE in Biology	1
60143368	AQA Level 3 Advanced GCE in Business	0
60157318	AQA Level 3 Advanced GCE in Chemistry	1
60145699	AQA Level 3 Advanced GCE in Computer Science	1
60182970	AQA Level 3 Advanced GCE in Dance	0
60311046	AQA Level 3 Advanced GCE in Design and Technology: Fashion and Textiles	1
60311332	AQA Level 3 Advanced GCE in Design and Technology: Product Design	1
60184942	AQA Level 3 Advanced GCE in Drama and Theatre	0
6014371X	AQA Level 3 Advanced GCE in Economics	0
60146400	AQA Level 3 Advanced GCE in English Language	0
60146412	AQA Level 3 Advanced GCE in English Language and Literature	0
60153271	AQA Level 3 Advanced GCE in English Literature A	0
60153283	AQA Level 3 Advanced GCE in English Literature B	0
60309787	AQA Level 3 Advanced GCE in Environmental Science	1
6018727X	AQA Level 3 Advanced GCE in French	0
60318417	AQA Level 3 Advanced GCE in Further Mathematics	1
6018940X	AQA Level 3 Advanced GCE in Geography	0
60187293	AQA Level 3 Advanced GCE in German	0
60149735	AQA Level 3 Advanced GCE in History	0
60310091	AQA Level 3 Advanced GCE in Law	0
60311642	AQA Level 3 Advanced GCE in Mathematics	1
60323723	AQA Level 3 Advanced GCE in Media Studies	0
60183044	AQA Level 3 Advanced GCE in Music	0
60306841	AQA Level 3 Advanced GCE in Philosophy	0
60147477	AQA Level 3 Advanced GCE in Physics	1
60314035	AQA Level 3 Advanced GCE in Politics	0
6014838X	AQA Level 3 Advanced GCE in Psychology	1
60188303	AQA Level 3 Advanced GCE in Religious Studies	0
60139948	AQA Level 3 Advanced GCE in Sociology	0
60187323	AQA Level 3 Advanced GCE in Spanish	0
60147064	AQA Level 3 Advanced Subsidiary GCE in Art and Design	1
60146242	AQA Level 3 Advanced Subsidiary GCE in Biology	1
6014337X	AQA Level 3 Advanced Subsidiary GCE in Business	0
60157306	AQA Level 3 Advanced Subsidiary GCE in Chemistry	1
60146990	AQA Level 3 Advanced Subsidiary GCE in Computer Science	1
60311083	AQA Level 3 Advanced Subsidiary GCE in Design and Technology: Product Design	1
60143721	AQA Level 3 Advanced Subsidiary GCE in Economics	0
60148469	AQA Level 3 Advanced Subsidiary GCE in English Language	0
60152576	AQA Level 3 Advanced Subsidiary GCE in English Literature B	0
60187268	AQA Level 3 Advanced Subsidiary GCE in French	0
60316044	AQA Level 3 Advanced Subsidiary GCE in Further Mathematics	1
6018971X	AQA Level 3 Advanced Subsidiary GCE in Geography	0

Code	Qualification Name	STEM dummy
60187281	AQA Level 3 Advanced Subsidiary GCE in German	0
60149747	AQA Level 3 Advanced Subsidiary GCE in History	0
60311654	AQA Level 3 Advanced Subsidiary GCE in Mathematics	1
60322469	AQA Level 3 Advanced Subsidiary GCE in Media Studies	0
60147465	AQA Level 3 Advanced Subsidiary GCE in Physics	1
60148378	AQA Level 3 Advanced Subsidiary GCE in Psychology	1
6013995X	AQA Level 3 Advanced Subsidiary GCE in Sociology	0
6018730X	AQA Level 3 Advanced Subsidiary GCE in Spanish	0
60171455	AQA Level 3 Certificate in Applied Business	0
60149450	AQA Level 3 Certificate in Mathematical Studies	1
60171467	AQA Level 3 Extended Certificate in Applied Business	0
60171054	AQA Level 3 Extended Certificate in Applied Science	1
60095349	AQA Level 3 Extended Project	0
60170797	AQA Level 3 Foundation Technical Level Engineering	1
60171248	AQA Level 3 Foundation Technical Level IT: Cyber Security	1
50043286	Cambridge International Level 3 Pre-U Certificate in Geography (Principal)	0
50042683	Cambridge International Level 3 Pre-U Certificate in History (Principal)	0
50036853	Cambridge International Level 3 Pre-U Certificate in Literature in English (Principal)	0
60158001	EAL Level 3 Certificate in Engineering Technologies	1
6008537X	LIBF Level 3 Certificate in Financial Studies	0
60329142	NCFE CACHE Level 3 Applied General Certificate in Health and Social Care	1
60104879	NOCN_Cskills Awards Level 2 Diploma in Building Maintenance, Multi-Trade Repair and Refurbishment Operations (Construction)	0
60145754	OCR Level 1/Level 2 GCSE (9-1) in English Language	0
60146060	OCR Level 1/Level 2 GCSE (9-1) in Mathematics	0
60303712	OCR Level 2 Cambridge Technical Certificate in IT	0
60150889	OCR Level 3 Advanced GCE in Art and Design (Art, Craft and Design / Fine Art / Graphic Communication / Photography / Textile De	1
60142601	OCR Level 3 Advanced GCE in Biology A	1
60152552	OCR Level 3 Advanced GCE in Chemistry A	1
60153714	OCR Level 3 Advanced GCE in Chemistry B (Salters)	1
60149115	OCR Level 3 Advanced GCE in Computer Science	1
60311319	OCR Level 3 Advanced GCE in Design and Technology (Design Engineering / Fashion and Textiles / Product Design)	1
60182726	OCR Level 3 Advanced GCE in Drama and Theatre	0
60147027	OCR Level 3 Advanced GCE in English Language	0
60147040	OCR Level 3 Advanced GCE in English Language and Literature (EMC)	0
60147258	OCR Level 3 Advanced GCE in English Literature	0
60311204	OCR Level 3 Advanced GCE in Film Studies	0
60313250	OCR Level 3 Advanced GCE in Further Mathematics A	1
6031364X	OCR Level 3 Advanced GCE in Further Mathematics B (MEI)	1
60185764	OCR Level 3 Advanced GCE in Geography	0
60307821	OCR Level 3 Advanced GCE in Geology	0
60147015	OCR Level 3 Advanced GCE in History A	0
60307067	OCR Level 3 Advanced GCE in Law	0
60310388	OCR Level 3 Advanced GCE in Mathematics A	1
60310029	OCR Level 3 Advanced GCE in Mathematics B (MEI)	1
60323395	OCR Level 3 Advanced GCE in Media Studies	0
60182428	OCR Level 3 Advanced GCE in Music	0
60183226	OCR Level 3 Advanced GCE in Physical Education	0
6014743X	OCR Level 3 Advanced GCE in Physics A	1

Code	Qualification Name	STEM dummy
60147453	OCR Level 3 Advanced GCE in Physics B (Advancing Physics)	1
60188686	OCR Level 3 Advanced GCE in Religious Studies	0
60139973	OCR Level 3 Advanced GCE in Sociology	0
60150877	OCR Level 3 Advanced Subsidiary GCE in Art and Design (Art, Craft and Design / Fine Art / Graphic Communication / Photography /	1
60142613	OCR Level 3 Advanced Subsidiary GCE in Biology A	1
60152564	OCR Level 3 Advanced Subsidiary GCE in Chemistry A	1
60154469	OCR Level 3 Advanced Subsidiary GCE in Chemistry B (Salters)	1
60306713	OCR Level 3 Advanced Subsidiary GCE in Classical Civilisation	0
60150300	OCR Level 3 Advanced Subsidiary GCE in Computer Science	1
6014726X	OCR Level 3 Advanced Subsidiary GCE in English Literature	0
60313900	OCR Level 3 Advanced Subsidiary GCE in Further Mathematics B (MEI)	1
60186653	OCR Level 3 Advanced Subsidiary GCE in Geography	0
60183238	OCR Level 3 Advanced Subsidiary GCE in Physical Education	0
60147428	OCR Level 3 Advanced Subsidiary GCE in Physics A	1
60147441	OCR Level 3 Advanced Subsidiary GCE in Physics B (Advancing Physics)	1
6015312X	OCR Level 3 Advanced Subsidiary GCE in Psychology	1
60188698	OCR Level 3 Advanced Subsidiary GCE in Religious Studies	0
60139961	OCR Level 3 Advanced Subsidiary GCE in Sociology	0
60170591	OCR Level 3 Cambridge Technical Certificate in Health and Social Care	1
60170979	OCR Level 3 Cambridge Technical Certificate in IT	1
60170967	OCR Level 3 Cambridge Technical Diploma in Sport and Physical Activity	0
60176994	OCR Level 3 Cambridge Technical Extended Certificate in Business	0
60172599	OCR Level 3 Cambridge Technical Extended Certificate in Digital Media	0
60170608	OCR Level 3 Cambridge Technical Extended Certificate in Health and Social Care	1
60170980	OCR Level 3 Cambridge Technical Extended Certificate in IT	1
60170943	OCR Level 3 Cambridge Technical Extended Certificate in Sport and Physical Activity	0
60061777	OCR Level 3 Cambridge Technical Extended Diploma in Media	0
60304054	OCR Level 3 Cambridge Technical Extended Diploma in Sport and Physical Activity Development	0
60170992	OCR Level 3 Cambridge Technical Introductory Diploma in IT	1
60042357	OCR Level 3 Cambridge Technical Subsidiary Diploma in Business	0
60042370	OCR Level 3 Cambridge Technical Subsidiary Diploma in IT	1
60061005	OCR Level 3 Cambridge Technical Subsidiary Diploma in Media	0
6006142X	OCR Level 3 Cambridge Technical Subsidiary Diploma in Sport	0
60147830	OCR Level 3 Certificate in Core Maths A (MEI)	1
60147829	OCR Level 3 Certificate in Core Maths B (MEI)	1
60190176	Pearson BTEC Level 2 95-GLH Award in Workskills	0
60304820	Pearson BTEC Level 2 Technical Certificate in Business Enterprise	0
50081548	Pearson BTEC Level 3 Diploma in Engineering (QCF)	1
50094658	Pearson BTEC Level 3 Diploma in Health and Social Care (QCF)	1
50067552	Pearson BTEC Level 3 Diploma in Sport (QCF)	0
50067461	Pearson BTEC Level 3 Extended Diploma in Business (QCF)	0
50081652	Pearson BTEC Level 3 Extended Diploma in Engineering (QCF)	1
50095018	Pearson BTEC Level 3 Extended Diploma in Health and Social Care (QCF)	1
50091499	Pearson BTEC Level 3 Extended Diploma in IT (QCF)	1
50067643	Pearson BTEC Level 3 Extended Diploma in Sport (QCF)	0
60330417	Pearson BTEC Level 3 National Certificate in Applied Human Biology	1
60330570	Pearson BTEC Level 3 National Certificate in Applied Psychology	1
60174341	Pearson BTEC Level 3 National Certificate in Applied Science	1
60304480	Pearson BTEC Level 3 National Certificate in Art and Design	1

Code	Qualification Name	STEM dummy
60171935	Pearson BTEC Level 3 National Certificate in Health and Social Care	1
60171558	Pearson BTEC Level 3 National Certificatein Business	0
60174353	Pearson BTEC Level 3 National Diploma in Applied Science	1
60171571	Pearson BTEC Level 3 National Diploma in Business	0
60175801	Pearson BTEC Level 3 National Diploma in Engineering	1
60171947	Pearson BTEC Level 3 National Diploma in Health and Social Care	1
60172320	Pearson BTEC Level 3 National Diploma in Performing Arts	0
60304601	Pearson BTEC Level 3 National Diploma in Sport	0
60190437	Pearson BTEC Level 3 National Extended Certificate in Applied Law	0
60330582	Pearson BTEC Level 3 National Extended Certificate in Applied Psychology	1
60174365	Pearson BTEC Level 3 National Extended Certificate in Applied Science	1
60172289	Pearson BTEC Level 3 National Extended Certificate in Art and Design	1
60171595	Pearson BTEC Level 3 National Extended Certificate in Business	0
60174675	Pearson BTEC Level 3 National Extended Certificate in Creative Digital Media Production	0
60319112	Pearson BTEC Level 3 National Extended Certificate in Digital Content Production	0
60175849	Pearson BTEC Level 3 National Extended Certificate in Engineering	1
60171972	Pearson BTEC Level 3 National Extended Certificate in Health and Social Care	1
60175758	Pearson BTEC Level 3 National Extended Certificate in Information Technology	1
60170906	Pearson BTEC Level 3 National Extended Certificate in Music Performance	0
60172332	Pearson BTEC Level 3 National Extended Certificate in Performing Arts	0
60312336	Pearson BTEC Level 3 National Extended Certificate in Sound Engineering	0
60172186	Pearson BTEC Level 3 National Extended Certificate in Sport	0
60190231	Pearson BTEC Level 3 National Extended Certificate in Travel and Tourism	0
60174377	Pearson BTEC Level 3 National Extended Diploma in Applied Science	1
60173427	Pearson BTEC Level 3 National Extended Diploma in Computing	1
60175886	Pearson BTEC Level 3 National Extended Diploma in Engineering	1
60171984	Pearson BTEC Level 3 National Extended Diploma in Health and Social Care	1
60304595	Pearson BTEC Level 3 National Extended Diploma in Sport	0
60172344	Pearson BTEC Level 3 National Extended Diploma inPerforming Arts	0
60171601	Pearson BTEC Level 3 National Extended Diplomain Business	0
6017576X	Pearson BTEC Level 3 National Foundation Diploma in Information Technology	1
50071440	Pearson BTEC Level 3 Subsidiary Diploma in Art and Design (QCF)	1
50067503	Pearson BTEC Level 3 Subsidiary Diploma in Business (QCF)	0
50091475	Pearson BTEC Level 3 Subsidiary Diploma in IT (QCF)	1
50073801	Pearson BTEC Level 3 Subsidiary Diploma in Production Arts (QCF)	0
50078628	Pearson BTEC Level 3 Subsidiary Diploma in Public Services (QCF)	0
50098639	Pearson BTEC Level 3 Subsidiary Diploma in Travel and Tourism (QCF)	0
60342900	Pearson Edexcel Functional Skills Qualification in English at Level 2	0
60342687	Pearson Edexcel Functional Skills Qualification in Mathematics Level 2	0
60186112	Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Chemistry	0
60148366	Pearson Edexcel Level 1/Level 2 GCSE (9-1) in English Language	0
60147003	Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Mathematics	0
10015516	Pearson Edexcel Level 3 Advanced Extension Award in Mathematics	1
60149589	Pearson Edexcel Level 3 Advanced GCE in Art and Design	1
60152990	Pearson Edexcel Level 3 Advanced GCE in Biology A (Salters-Nuffield)	1
60153015	Pearson Edexcel Level 3 Advanced GCE in Biology B	1
60146734	Pearson Edexcel Level 3 Advanced GCE in Business	0
60156466	Pearson Edexcel Level 3 Advanced GCE in Chemistry	1
6030697X	Pearson Edexcel Level 3 Advanced GCE in Design and Technology (Product Design)	1
60183020	Pearson Edexcel Level 3 Advanced GCE in Drama and Theatre	0

Code	Qualification Name	STEM dummy
60141050	Pearson Edexcel Level 3 Advanced GCE in Economics A	0
60147672	Pearson Edexcel Level 3 Advanced GCE in Economics B	0
60150099	Pearson Edexcel Level 3 Advanced GCE in English Language	0
60150464	Pearson Edexcel Level 3 Advanced GCE in English Literature	0
60187025	Pearson Edexcel Level 3 Advanced GCE in French	0
60314990	Pearson Edexcel Level 3 Advanced GCE in Further Mathematics	1
60184176	Pearson Edexcel Level 3 Advanced GCE in Geography	0
60187049	Pearson Edexcel Level 3 Advanced GCE in German	0
60146771	Pearson Edexcel Level 3 Advanced GCE in History	0
6031333X	Pearson Edexcel Level 3 Advanced GCE in Mathematics	1
60148482	Pearson Edexcel Level 3 Advanced GCE in Physics	1
60312233	Pearson Edexcel Level 3 Advanced GCE in Politics	0
60155735	Pearson Edexcel Level 3 Advanced GCE in Psychology	1
60187414	Pearson Edexcel Level 3 Advanced GCE in Religious Studies	0
60187062	Pearson Edexcel Level 3 Advanced GCE in Spanish	0
60152989	Pearson Edexcel Level 3 Advanced Subsidiary GCE in Biology A (Salters-Nuffield)	1
60153003	Pearson Edexcel Level 3 Advanced Subsidiary GCE in Biology B	1
60183032	Pearson Edexcel Level 3 Advanced Subsidiary GCE in Drama and Theatre	0
60141062	Pearson Edexcel Level 3 Advanced Subsidiary GCE in Economics A	0
60150476	Pearson Edexcel Level 3 Advanced Subsidiary GCE in English Literature	0
60313456	Pearson Edexcel Level 3 Advanced Subsidiary GCE in Further Mathematics	1
60184164	Pearson Edexcel Level 3 Advanced Subsidiary GCE in Geography	0
6014676X	Pearson Edexcel Level 3 Advanced Subsidiary GCE in History	0
60313079	Pearson Edexcel Level 3 Advanced Subsidiary GCE in Mathematics	1
60179296	Pearson Edexcel Level 3 Advanced Subsidiary GCE in Music	0
60148470	Pearson Edexcel Level 3 Advanced Subsidiary GCE in Physics	1
60187074	Pearson Edexcel Level 3 Advanced Subsidiary GCE in Spanish	0
60148573	Pearson Edexcel Level 3 Certificate in Mathematics in Context	1
5002372X	Pearson Edexcel Level 3 Extended Project	0
60176830	RSL Level 3 Extended Diploma in Creative and Performing Arts	0
60186173	RSL Level 3 Extended Diploma in Creative and Performing Arts	0
6017691X	RSL Level 3 Subsidiary Diploma for Music Practitioners	0
60185867	SLQ Level 3 Qualification in Sports Leadership	0
50096667	TCL Level 3 Certificate in the Arts	0
60319938	TQUK Level 3 Diploma in Design, Engineer, Construct! The Digital Built Environment (RQF)	1
60169977	VTCT Level 3 Diploma in Advanced Professional Cookery	0
60148913	WJEC Eduqas Level 3 Advanced GCE in Art and Design	1
60157069	WJEC Eduqas Level 3 Advanced GCE in Biology	1
60148688	WJEC Eduqas Level 3 Advanced GCE in Business	0
60311782	WJEC Eduqas Level 3 Advanced GCE in Design and Technology (Fashion and Textiles/Product Design)	1
60185545	WJEC Eduqas Level 3 Advanced GCE in Drama and Theatre	0
60141037	WJEC Eduqas Level 3 Advanced GCE in Economics	0
60150221	WJEC Eduqas Level 3 Advanced GCE in English Language and Literature	0
60148706	WJEC Eduqas Level 3 Advanced GCE in English Literature	0
60311472	WJEC Eduqas Level 3 Advanced GCE in Film Studies	0
60188479	WJEC Eduqas Level 3 Advanced GCE in Geography	0
6030859X	WJEC Eduqas Level 3 Advanced GCE in Geology	0
60311496	WJEC Eduqas Level 3 Advanced GCE in Media Studies	0
6015522X	WJEC Eduqas Level 3 Advanced GCE in Physics	1

Code	Qualification Name	STEM dummy
60187001	WJEC Eduqas Level 3 Advanced GCE in Religious Studies	0
60147489	WJEC Eduqas Level 3 Advanced GCE in Sociology	0
60300693	WJEC Eduqas Level 3 Advanced GCE in Spanish	0
60148925	WJEC Eduqas Level 3 Advanced Subsidiary GCE in Art and Design	1
60311502	WJEC Eduqas Level 3 Advanced Subsidiary GCE in Media Studies	0
60162491	WJEC Level 3 Applied Certificate in Criminology	0
60145535	WJEC Level 3 Applied Certificate in Food Science and Nutrition	1
6016248X	WJEC Level 3 Applied Diploma in Criminology	0
60145523	WJEC Level 3 Applied Diploma in Food Science and Nutrition	1
60308266	WJEC Level 3 Applied Diploma in Tourism	0
60146989	WJEC Level 3 Extended Project Qualification	0

Appendix G: Baseline and follow-up NFER Gen STEM surveys

Baseline:

The National Foundation for Educational Research (NFER) is doing some research to find out about your views of school/college, yourself and your future plans. The questionnaire should not take more than 15 minutes to complete. Please answer the questions honestly. Your opinions are really important to us. Next year, we will give you another survey to see if your responses have changed.

The survey is being conducted by the National Foundation for Educational Research (NFER) on behalf of the Education Endowment Foundation (EEF) and CSW Group (a social enterprise company providing work experience services). No one at your school or at EEF or CSW Group will see your responses and you will not be identifiable or named in any reports. The research team at NFER will keep your answers private. We will not use your name in any of our reports.

If you have any questions before you start this survey, please speak to your teacher.

Please use a BLACK PEN to fill in this questionnaire.

First name	
Last name	
Pupil ID	
School name	

1. Please indicate how much you agree with the following: *Please tick one box on each*

	Strongly agree	*Agree*	*Do not agree or disagree*	*Disagree*	*Strongly disagree*	*Don't know*
	1	*2*	*3*	*4*	*5*	*6*
Most of the time I like being at school/college	☐	☐	☐	☐	☐	☐
I am doing well at school/college	☐	☐	☐	☐	☐	☐
Teachers listen to students	☐	☐	☐	☐	☐	☐
Teachers explain why it is important to have school/college rules	☐	☐	☐	☐	☐	☐
It is important to do my homework/coursework	☐	☐	☐	☐	☐	☐
My teachers tell me what I am doing well	☐	☐	☐	☐	☐	☐
My teachers tell me where I need to improve	☐	☐	☐	☐	☐	☐
It is ok to truant, bunk off, skive or skip school/college if I want to	☐	☐	☐	☐	☐	☐
I feel that school/college is a waste of my time	☐	☐	☐	☐	☐	☐
I think that I am reaching my full potential at school/college	☐	☐	☐	☐	☐	☐
I normally finish tasks I start	☐	☐	☐	☐	☐	☐

2. Please describe yourself at school/college/training: *Please tick one box on each row.*

	Always	*Often*	*Sometimes*	*Rarely*	*Never*	*Don't know*
	1	*2*	*3*	*4*	*5*	*6*
I am well behaved in school/college/training	☐	☐	☐	☐	☐	☐
I am on time for school/lessons/training	☐	☐	☐	☐	☐	☐
I feel confident about speaking in class	☐	☐	☐	☐	☐	☐
I like getting involved in school activities	☐	☐	☐	☐	☐	☐

3. Please indicate how much you agree with the following: *Please tick one box on each row.*

	Strongly agree	***Agree***	***Do not agree or disagree***	***Disagree***	***Strongly disagree***	***Don't know***
	1	***2***	***3***	***4***	***5***	***6***
Other people always do things better than I do	☐	☐	☐	☐	☐	☐
I get on well with my family	☐	☐	☐	☐	☐	☐
Most of the time I enjoy my life	☐	☐	☐	☐	☐	☐
I feel positive about my future	☐	☐	☐	☐	☐	☐
Most of the time I feel happy	☐	☐	☐	☐	☐	☐
Most of the time I feel stressed or anxious	☐	☐	☐	☐	☐	☐
Most of the time I feel positive	☐	☐	☐	☐	☐	☐
Most of the time my family are supportive	☐	☐	☐	☐	☐	☐

4. Please indicate how much you agree with the following: *Please tick one box on each row.*

	Strongly agree	***Agree***	***Do not agree or disagree***	***Disagree***	***Strongly disagree***	***Don't know***
	1	***2***	***3***	***4***	***5***	***6***
My school/college is giving me skills I need for the future	☐	☐	☐	☐	☐	☐
I find it easy to make decisions about my future	☐	☐	☐	☐	☐	☐
Adults in my school/college help me to plan for my future	☐	☐	☐	☐	☐	☐
I know where to get careers advice	☐	☐	☐	☐	☐	☐
I know what sort of job I want	☐	☐	☐	☐	☐	☐
I'll be able to get the sort of job I want	☐	☐	☐	☐	☐	☐
I want to do more education or training in the future	☐	☐	☐	☐	☐	☐
I feel well-informed about my options after Year 11	☐	☐	☐	☐	☐	☐
There aren't any suitable education and training opportunities for me after Year 11	☐	☐	☐	☐	☐	☐
It is important to get qualifications to get on in life	☐	☐	☐	☐	☐	☐

5. Which of the following are you most likely to do once you no longer have to take part in education or training? (After you have reached age 18) *Please tick one option.*

Stay in full-time education	☐ 1
Do work-based learning e.g. an apprenticeship	☐ 2
Do part-time education or training with a job or volunteering	☐ 3
Do part-time education or training without a job or volunteering	☐ 4
Get a job without education or training	☐ 5
Be unemployed and do nothing	☐ 6
Look after the family/home but not have a paid job or be in education or training	☐ 7
Take a break from studying e.g. have a gap year	☐ 8
Other	☐ 9
Don't know	☐ 10

6. Please indicate how much you agree with the following? *Please tick one box on each row.*

	Strongly agree	***Agree***	***Do not agree or disagree***	***Disagree***	***Strongly disagree***	***Don't know***
	1	***2***	***3***	***4***	***5***	***6***
I feel confident in making decisions about my post-16 options	☐	☐	☐	☐	☐	☐
I feel well-informed about how to progress to higher education	☐	☐	☐	☐	☐	☐
I feel well-informed about how to progress to apprenticeships	☐	☐	☐	☐	☐	☐
I feel well informed about science, technology, engineering and technology (STEM)-related careers	☐	☐	☐	☐	☐	☐
Careers-related activities have made me confident in my careers aspirations	☐	☐	☐	☐	☐	☐
Work experience helps to inform decision-making about what career to persue	☐	☐	☐	☐	☐	☐
Knowing a chosen career pathway motivates me to work harder	☐	☐	☐	☐	☐	☐
I enjoy STEM-related subjects	☐	☐	☐	☐	☐	☐
I am aware of the attitudes and skills employers look for when recruiting young people	☐	☐	☐	☐	☐	☐
STEM-related careers are not for me	☐	☐	☐	☐	☐	☐

7. Do you have some idea about what jobs or careers you are interested in?

Yes, I have a firm idea	☐ 1
Yes, I have some idea	☐ 2
I have little/no idea	☐ 3

8. Are you interested in a future career that involves Science, Computer science, Engineering or Maths?

Very interested	☐ 1
Fairly interested	☐ 2
Not very interested	☐ 3
Not at all interested	☐ 4

9. How much do you agree or disagree with the following statements? *Please tick one box on each row.*

	Strongly agree	***Agree***	***Do not agree or disagree***	***Disagree***	***Strongly disagree***
	1	***2***	***3***	***4***	***5***
Careers that use science…..	☐	☐	☐	☐	☐
Are suitable for someone like me	☐	☐	☐	☐	☐
Are difficult to get into	☐	☐	☐	☐	☐
Require high grades	☐	☐	☐	☐	☐
Are boring	☐	☐	☐	☐	☐
Are more suited to men than women	☐	☐	☐	☐	☐
Are open to anyone who has the ability regardless of their background	☐	☐	☐	☐	☐
Make a useful contribution to society	☐	☐	☐	☐	☐

Thank you for your help with this research.

Follow up:

Student Follow-up survey (EFWE)

The National Foundation for Educational Research (NFER) is doing some research to find out about your views of school/college, yourself and your future plans. The questionnaire should not take more than 15 minutes to complete. Please answer the questions honestly. Your opinions are really important to us. You may recall that you completed a questionnaire for us last year. This year we are looking to see the extent of any change in responses.

The survey is being conducted by the National Foundation for Educational Research (NFER) on behalf of the Education Endowment Foundation (EEF) and CSW. You will not be identifiable or named in any reports. The research team at NFER will keep your answers private.

If you do not wish to be included in the research do not complete this questionnaire. You have the right to withdraw from this research at any time.

NFER is responsible for the day-to-day management of this project. If you have any questions about the research or this questionnaire please contact Priscilla Antwi at NFER on 01753 637429 or **workexperience@nfer.ac.uk**. Further information on how we comply with data protection legislation can be found at **https://www.nfer.ac.uk/media/2732/generation_stem_privacy_notice.pdf**. Thank you in advance for your help with this questionnaire.

If you have any questions before you start this survey, please speak to your teacher.

First name:

Last name:

School name:

NFER number:

10. Please indicate how much you agree with the following: *Please tick one box on each row.*

	Strongly agree	***Agree***	***Do not agree or disagree***	***Disagree***	***Strongly disagree***	***Don't know***
	1	***2***	***3***	***4***	***5***	***6***
Most of the time I like being at school/college	☐	☐	☐	☐	☐	☐
I am doing well at school/college	☐	☐	☐	☐	☐	☐
Teachers listen to students	☐	☐	☐	☐	☐	☐
Teachers explain why it is important to have school/college rules	☐	☐	☐	☐	☐	☐
It is important to do my homework/coursework	☐	☐	☐	☐	☐	☐
My teachers tell me what I am doing well	☐	☐	☐	☐	☐	☐
My teachers tell me where I need to improve	☐	☐	☐	☐	☐	☐
It is ok to truant, bunk off, skive or skip school/college if I want to	☐	☐	☐	☐	☐	☐
I feel that school/college is a waste of my time	☐	☐	☐	☐	☐	☐
I think that I am reaching my full potential at school/college	☐	☐	☐	☐	☐	☐
I normally finish tasks I start	☐	☐	☐	☐	☐	☐

11. Please describe yourself at school/college/training: *Please tick one box on each row.*

	Always	***Often***	***Sometimes***	***Rarely***	***Never***	***Don't know***
	1	***2***	***3***	***4***	***5***	***6***
I am well behaved in school/college/training	☐	☐	☐	☐	☐	☐
I am on time for school/lessons/training	☐	☐	☐	☐	☐	☐
I feel confident about speaking in class	☐	☐	☐	☐	☐	☐
I like getting involved in school activities	☐	☐	☐	☐	☐	☐

12. Please indicate how much you agree with the following: *Please tick one box on each row.*

	Strongly agree	***Agree***	***Do not agree or disagree***	***Disagree***	***Strongly disagree***	***Don't know***
	1	***2***	***3***	***4***	***5***	***6***
Other people always do things better than I do	☐	☐	☐	☐	☐	☐
I get on well with my family	☐	☐	☐	☐	☐	☐
Most of the time I enjoy my life	☐	☐	☐	☐	☐	☐
I feel positive about my future	☐	☐	☐	☐	☐	☐
Most of the time I feel happy	☐	☐	☐	☐	☐	☐
Most of the time I feel stressed or anxious	☐	☐	☐	☐	☐	☐
Most of the time I feel positive	☐	☐	☐	☐	☐	☐
Most of the time my family are supportive	☐	☐	☐	☐		

13. Please indicate how much you agree with the following: *Please tick one box on each row.*

	Strongly agree	***Agree***	***Do not agree or disagree***	***Disagree***	***Strongly disagree***	***Don't know***
	1	***2***	***3***	***4***	***5***	***6***
My school/college is giving me skills I need for the future	☐	☐	☐	☐	☐	☐
I find it easy to make decisions about my future	☐	☐	☐	☐	☐	☐
Adults in my school/college help me to plan for my future	☐	☐	☐	☐	☐	☐
I know where to get careers advice	☐	☐	☐	☐	☐	☐
I know what sort of job I want	☐	☐	☐	☐	☐	☐
I'll be able to get the sort of job I want	☐	☐	☐	☐	☐	☐
I want to do more education or training in the future	☐	☐	☐	☐	☐	☐
I feel well-informed about my options after Year 11	☐	☐	☐	☐	☐	☐
There aren't any suitable education and training opportunities for me after Year 11	☐	☐	☐	☐	☐	☐
It is important to get qualifications to get on in life	☐	☐	☐	☐	☐	☐

14. Which of the following are you most likely to do once you no longer have to take part in education or training? (After you have reached age 18) *Please tick one option.*

Stay in full-time education	☐ 1
Do work-based learning e.g. an apprenticeship	☐ 2
Do part-time education or training with a job or volunteering	☐ 3
Do part-time education or training without a job or volunteering	☐ 4
Get a job without education or training	☐ 5
Be unemployed and do nothing	☐ 6
Look after the family/home but not have a paid job or be in education or training	☐ 7
Take a break from studying e.g. have a gap year	☐ 8
Other	☐ 9
Don't know	☐ 10

15. Please indicate how much you agree with the following? *Please tick one box on each row.*

	Strongly agree	***Agree***	***Do not agree or disagree***	***Disagree***	***Strongly disagree***	***Don't know***
	1	***2***	***3***	***4***	***5***	***6***
I feel confident in making decisions about my post-16 options	☐	☐	☐	☐	☐	☐
I feel well-informed about how to progress to higher education	☐	☐	☐	☐	☐	☐
I feel well-informed about how to progress to apprenticeships	☐	☐	☐	☐	☐	☐
I feel well informed about science, technology, engineering and technology (STEM)-related careers	☐	☐	☐	☐	☐	☐
Careers-related activities have made me confident in my careers aspirations	☐	☐	☐	☐	☐	☐
Work experience helps to inform decision-making about what career to persue	☐	☐	☐	☐	☐	☐
Knowing a chosen career pathway motivates me to work harder	☐	☐	☐	☐	☐	☐
I enjoy STEM-related subjects	☐	☐	☐	☐	☐	☐
I am aware of the attitudes and skills employers look for when recruiting young people	☐	☐	☐	☐	☐	☐
STEM-related careers are not for me	☐	☐	☐	☐	☐	☐

16. Do you have some idea about what jobs or careers you are interested in? *Please tick one option.*

Yes, I have a firm idea	☐ 1
Yes, I have some idea	☐ 2
I have little/no idea	☐ 3

17. Are you interested in a future career that involves Science, Computer science, Engineering or Maths? *Please tick one option.*

Very interested	☐ 1
Fairly interested	☐ 2
Not very interested	☐ 3
Not at all interested	☐ 4

18. How much do you agree or disagree with the following statements? *Please tick one box on each row.*

	Strongly agree	***Agree***	***Do not agree or disagree***	***Disagree***	***Strongly disagree***
	1	***2***	***3***	***4***	***5***
Careers that use science…..					
Are suitable for someone like me	☐	☐	☐	☐	☐
Are difficult to get into	☐	☐	☐	☐	☐
Require high grades	☐	☐	☐	☐	☐
Are boring	☐	☐	☐	☐	☐
Are more suited to men than women	☐	☐	☐	☐	☐
Are open to anyone who has the ability regardless of their background	☐	☐	☐	☐	☐
Make a useful contribution to society	☐	☐	☐	☐	☐

19. Have you ever done any work experience? *Please tick one option.*

Yes, with an employer involved in Science, Computer Science, Engineering or Maths (please go to Q11)	☐ 1
Yes, in another area (please go to Q12)	☐ 2
No (please go to Q12)	☐ 3

20. Thinking about your most recent work experience with an employer involved in Science, Computer science, Engineering or Maths, how was this arranged?
Please tick all that apply.

I arranged it myself	☐ 1
I arranged it through my family/friends	☐ 2
It was arranged through my school	☐ 3
Other (please tell us how)	☐ 4

21. Have you ever wanted to do work experience in Science, Computer science, Engineering or Maths, but not been able to do so? *Please tick one option.*

Yes	☐ 1
No	☐ 2

Thank you for your help with this research.

Once completed, please hand back to the teacher who gave you this survey.

Appendix H: Pupil survey factor analysis

We ran Principal axis factor analysis on the baseline survey data (n=1,545) and the factors were rotated using the 'varimax' function in SPSS. When items were inputted in factor analysis, some items were reverse recoded so that high values on all items represented a positive attitude. Factor loadings with a value less than 0.4 were suppressed. Initially, all items were included to investigate clustering. Items that weren't highly correlated with any other items and did not load on to any particular factor were removed.

The resultant factors and items were discussed amongst evaluation team members. (This included colleagues who have an in-depth understanding of work experience policy and practice and have led an extensive portfolio of Education to Employment research work). Some items that did not initially load well, but were of particular research interest, were reconsidered for retaining. Four factors were decided upon. The factors were checked for reliability with and without the additional low loading items. The factors and their items can be seen in the table below. The item descriptions are provided in the following table.

FACTOR	ITEMS	α
1	Q10_2 Q10_3 Q8_8 Q10_4 Q8_3 Q10_1 Q10_5 Q8_4	0.842
	Q8_2 (lower factor loading)	0.851
2	Q12 Q10_8 Q10_10 Q13_1 Q13_4 Q13_7	0.842
3	Q7_5 Q7_7 Q7_3 Q7_6 Q7_4	0.866
4	Q6_1 Q6_2 Q5_2 Q5_11	0.708
	including Q5_1, Q5_5, Q5_8, Q5_9, Q5_10, Q6_4 (lower factor loading)	0.811

As seen in the table above, where these items were added to the factors, the reliability increased. Using the aforementioned items, a final factor analysis was run by forcing four factors to see if the items would load on to the four factors as expected. All items loaded as expected, except Q6_4 (I like getting involved in school activities), which did not load on to any of the four factors. The decision was made to remove this item from Factor 4 and this reduced the reliability marginally from 0.811 to 0.809.

The resulting final four factors are summarised in the table below:

FACTOR	ITEMS	α
1. Well-informed to make future decisions	Q10_3: I feel well-informed about how to progress to apprenticeships Q10_2: I feel well-informed about how to progress to higher education Q8_8: I feel well-informed about my options after Year 11 Q10_1: I feel confident in making decisions about my post-16 options Q10_5: Careers-related activities have made me confident in my careers aspirations Q10_4: I feel well informed about science, technology, engineering and technology (STEM)-related careers Q8_3: Adults in my school/college help me to plan for my future Q8_2: I find it easy to make decisions about my future Q8_4: I know where to get careers advice	0.851
2. Positive attitude to STEM	Q12: Are you interested in a future career that involves Science, Computer science, Engineering or Maths? Q10_8: I enjoy STEM-related subjects Q10_10: STEM-related careers are not for me Q13_1: Are suitable for someone like me Q13_4: Are boring Q13_7: Make a useful contribution to society	0.842
3. Positive attitude to life	Q7_5: Most of the time I feel happy Q7_3: Most of the time I enjoy my life Q7_7: Most of the time I feel positive Q7_4: I feel positive about my future Q7_6: Most of the time I feel stressed or anxious	0.866
4. Positive attitude to school/college	Q6_1: I am well behaved in school/college/training Q5_5: It is important to do my homework/coursework Q5_1: Most of the time I like being at school/college Q5_9: I feel that school/college is a waste of my time Q6_2: I am on time for school/lessons/training Q5_2: I am doing well at school/college Q5_8: It is ok to truant, bunk off, skive or skip school/college if I want to Q5_11: I normally finish tasks I start Q5_10: I think that I am reaching my full potential at school/college	0.809

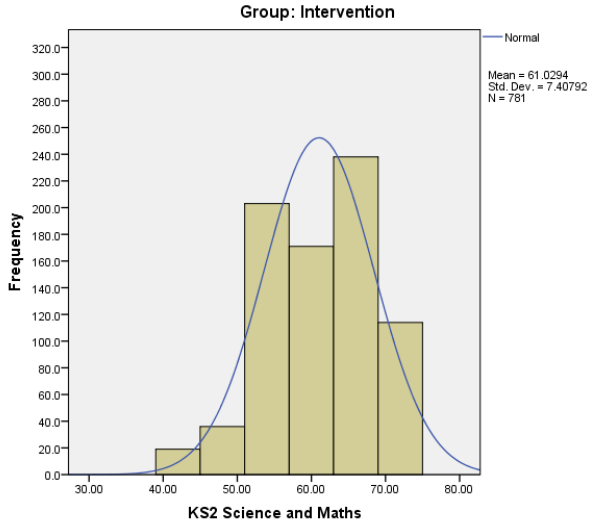
Appendix I: Randomisation code

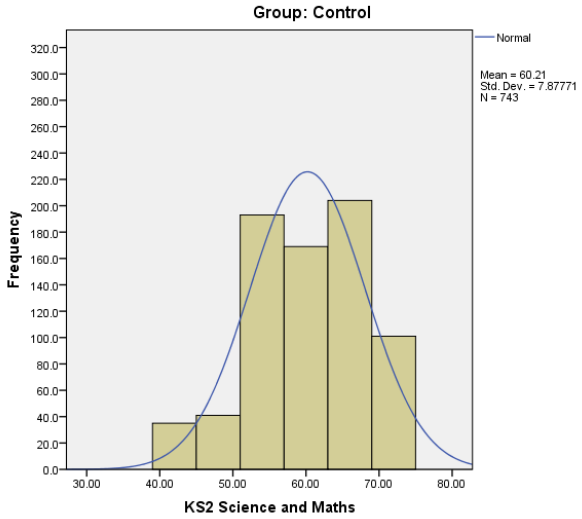
```
GET DATA
  /TYPE=XLSX
  /FILE='K:\EFWE\CfS\Randomisation\School list for randomisation.xlsx'
  /SHEET=name 'Sheet1'
  /CELLRANGE=FULL
  /READNAMES=ON
  /DATATYPEMIN PERCENTAGE=95.0
  /HIDDEN IGNORE=YES.
EXECUTE.
DATASET NAME DataSet1 WINDOW=FRONT.

*Check for duplicates.
sort cases by DfeNumber(a).
match files file=*/first=f/last=l/by DfeNumber.
cross f by l.
delete variable f l.

Freq LEP.

Compute Strata = 0.
Execute.
*Strata are 9 LEPs.
if LEP = 'Cornwall and the Isles of Scilly LEP' strata =1.
if LEP = 'Dorset LEP' strata =2.
if LEP = 'Enterprise M3 LEP' strata =3.
if LEP = 'GFirst LEP' strata =4.
if LEP = 'Heart of the South West LEP' strata =5.
if LEP = 'Oxfordshire LEP' strata =6.
if LEP = 'Swindon and Wiltshire LEP' strata =7.
if LEP = 'The Marches LEP' strata =8.
if LEP = 'West of England LEP' strata =9.
Execute.

value labels Strata  1 'Cornwall and the Isles of Scilly LEP' 2 'Dorset LEP' 3 'Enterprise M3 LEP' 4 'GFirst LEP'
5 'Heart of the South West LEP' 6 'Oxfordshire LEP' 7 'Swindon and Wiltshire LEP'
8 'The Marches LEP' 9 'West of England LEP'.

freq Strata.

sort cases by Strata(a).
dataset copy schools.

***Stratified randomisation of schools.
*I'm going to randomise Strata.
*And within strata I'm going to randomise schools.
*Then I can allocate group in sequence.

aggregate outfile=*/break=Strata/nschools=n(DfeNumber).
list vars=Strata nschools.
set rng=mt, mtindex=20171124.
compute LEPrand=rv.uniform(0,1).
execute.
dataset copy LEPs.

match files file=schools/table=LEPs/in=instrat/by Strata.
execute.
freq instrat.

set rng=mt, mtindex=201711242.
```

```
compute schrand=rv.uniform(0,1).
Execute.

*Randomise.
sort cases by LEPrand schrand.
compute twos=2*trunc(($casenum-1)/2).
compute group=$casenum-twos.
list vars=Strata DfeNumber group.

freq group.
cross Strata by group.

add value labels group 1 'EFWE' 2 'Control'.
sort cases by Strata DfeNumber.
save outfile='K:\EFWE\CfS\Randomisation\Block1.sav'/drop=nschools    LEPrand instrat     schrand  twos.
SAVE TRANSLATE OUTFILE='K:\EFWE\CfS\Randomisation\Randomisation data Block 1_r.xlsx'
  /TYPE=XLS
  /VERSION=12
  /MAP
  /REPLACE
  /FIELDNAMES
  /CELLS=LABELS
  /drop=nschools   LEPrand instrat     schrand  twos.

output save outfile = 'K:\EFWE\CfS\Randomisation\Randomisation data Block 1_r.spv'.
dataset close all.


GET DATA
  /TYPE=XLSX
  /FILE='K:\EFWE\CfS\Randomisation\School list for randomisation - batch 2.xlsx'
  /SHEET=name 'Sheet1'
  /CELLRANGE=FULL
  /READNAMES=ON
  /DATATYPEMIN PERCENTAGE=95.0
  /HIDDEN IGNORE=YES.
EXECUTE.
DATASET NAME DataSet1 WINDOW=FRONT.

*Check for duplicates.
sort cases by DfeNumber(a).
match files file=*/first=f/last=l/by DfeNumber.
cross f by l.
delete variable f l.

Freq LEP.
*12 LEPs as shown in list below.
Compute Strata = 0.
Execute.
*Strata are 9 LEPs.
if LEP = 'Cornwall and the Isles of Scilly LEP' strata =1.
if LEP = 'Dorset LEP' strata =2.
*Only featured in Block 1, not needed for block 2
if LEP = 'Enterprise M3 LEP' strata =3.
if LEP = 'GFirst LEP' strata =4.
if LEP = 'Heart of the South West LEP' strata =5.
if LEP = 'Oxfordshire LEP' strata =6.
if LEP = 'Swindon and Wiltshire LEP' strata =7.
*Only featured in Block 1, not needed for block 2
if LEP = 'The Marches LEP' strata =8.
if LEP = 'West of England LEP' strata =9.
*Block 2 only LEPs.
```

```
if LEP = 'Buckinghamshire Thames Valley LEP' Strata = 10.
if LEP = 'Solent LEP' Strata = 11.
if LEP = 'Thames Valley Berkshire LEP' Strata = 12.
if LEP = 'Worcestershire LEP' Strata = 13.
*This is an overlapping school, make it its own strata.
if LEP = 'Enterprise M3 LEP; Solent LEP' Strata = 14.

Execute.
*Check.
Crosstabs LEP by Strata.
value labels Strata  1 'Cornwall and the Isles of Scilly LEP' 2 'Dorset LEP' 4 'GFirst LEP'
5 'Heart of the South West LEP' 6 'Oxfordshire LEP' 7 'Swindon and Wiltshire LEP'
9 'West of England LEP' 10 'Buckinghamshire Thames Valley LEP' 11 'Solent LEP'
12 'Thames Valley Berkshire LEP' 13 'Worcestershire LEP' 14 'Enterprise M3 LEP; Solent LEP'.

*Check.
Crosstabs LEP by Strata.

sort cases by Strata(a).
dataset copy schools.

***Stratified randomisation of schools.
*I'm going to randomise Strata.
*And within strata I'm going to randomise schools.
*Then I can allocate group in sequence.

aggregate outfile=*/break=Strata/nschools=n(DfeNumber).
list vars=Strata nschools.
set rng=mt, mtindex=20180129.
compute LEPrand=rv.uniform(0,1).
execute.
dataset copy LEPs.
match files file=schools/table=LEPs/in=instrat/by Strata.
execute.
freq instrat.

set rng=mt, mtindex=201801292.
compute schrand=rv.uniform(0,1).
Execute.

*Randomise.
sort cases by LEPrand schrand.
compute twos=2*trunc(($casenum-1)/2).
compute group=$casenum-twos.
list vars=Strata DfeNumber group.

freq group.
cross Strata by group.
add value labels group 1 'EFWE' 2 'Control'.
sort cases by Strata DfeNumber.
save outfile='K:\EFWE\CfS\Randomisation\Block2.sav'/drop=nschools LEPrand instrat schrand twos.
SAVE TRANSLATE OUTFILE='K:\EFWE\CfS\Randomisation\Randomisation data Block 2_r.xlsx'
  /TYPE=XLS
  /VERSION=12
  /MAP
  /REPLACE
  /FIELDNAMES
  /CELLS=LABELS
  /drop=nschools LEPrand instrat schrand twos.

output save outfile = 'K:\EFWE\CfS\Randomisation\Randomisation data Block 2_r.spv'.
dataset close all.
```

Appendix J: Histograms of Key Stage 2 attainment by analysed groups





Appendix K: Levels of compliance by analysed groups

	Full Compliance		Minimum Compliance	
Level of Compliance	Control	Intervention	Control	Intervention
0	743	79	743	157
1	0	79	0	42
2	0	49	0	372
3	0	371	0	12
4	0	40	0	186
5	0	151	N/A	N/A
Missing compliance data	0	12	0	12

This document is available for download at https://educationendowmentfoundation.org.uk

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