Evaluation Summary	
Age range	Year 10 (14-15 year olds) with an interest in STEM
Number of pupils	1950 (15 per school)
Number of schools	130
Design	School randomised
Primary Outcome	KS4 science and maths
Protocol date	23/10/2017
Protocol version	Version 1

Intervention

Generation STEM (Gen Stem) is a work experience (WE) programme developed by CSW Group to provide quality, relevant work experience to students in year 10. The aim is for students with an interest in STEM to get a placement in a job area related to their specific interests and career aspirations and to complete relevant work whilst they are at the placement. The programme has a structured schedule which students follow from beginning to end. The first part is a work preparation day delivered to the whole of year 10 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 interested in STEM who intend to take part in the entire process – see below. During this work preparation day students learn more about the world of work, what's expected of them in a work experience placement, how best to prepare for their work experience, and have chance to think about the local opportunities available for them. Following this, 15 students with an interest in STEM and the placements available are offered an interview with a small panel of local employers and a CSW Group co-ordinator. This interview takes place at the school and is an opportunity for the students to gain experience of an interview situation, and for CSW Group to learn more about the students' particular interests and reasons for wishing to complete a placement. Following this stage, all 15 students are given detailed feedback in a post interview debrief by the CSW Group co-ordinator. Five of these students are chosen to continue on to the bespoke work experience placement. An example of a placement would be a role as a Railway Assistant Engineer working for Great Western Railway. Students on this placement would be engaged as a trainee engineer dealing with servicing and repair of railway rolling stock. The student would shadow engineering staff and gain hands on experience with assembly of parts, cleaning components, and oil sampling. Thus a student with an interest in engineering would gain a relevant work experience. The students are matched to placements based on their interests and aspirations. These students then complete a 5 day work experience placement. Following this they

have a work experience debrief with a CSW Group co-ordinator who has gained detailed feedback from the employer. The ten students who did not gain a place on this particular programme will go through usual school process to find an alternative placement. CSW Group will assist if necessary to ensure these pupils get a placement somewhere.

Gen Stem aims to improve students' life skills such as ability to see the relevance of their school work to their chosen career path, greater motivation to engage in school work, punctuality, confidence, and maturity. Students then are more ready and able to focus on their studies and potentially their attainment in STEM subjects improves.

Significance

In 2011 the coalition government made an important change to the policy regarding work experience in secondary schools. The decision was made that it was no longer mandatory for 14-16 year olds to undertake work experience in schools. Since then the number of teenagers who have experience in the workplace has rapidly fallen (Hughes *et. al*.2016). Now the responsibility lies with the schools themselves to decide which companies to work with, 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 10s and 12s and some offering none at all.

As with any intervention it is important to deterime what works, what doesn't work, and what sort of outcomes might be improved.
Previous research into the likely outcomes of WE programmes highlight their potential to impact on 'life skills', and on preparation for or decisions about transitions into further education or work. A recent survey of school-staff, carried out as part of DfE research into WE in schools (DfE, 2017) suggests it can lead to positive impacts on pupils' communication and interpersonal skills, confidence, understandings of the world of work/industries, employability, maturity, team working skills, independence, time management, clarity over career aspirations, greater motivation to engage in education, and understanding of educational career pathways. 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) highlights how WE can impact on employability skills (e.g. communication, teamwork, and interpersonal skills) and can help young people to be more work-ready through developed understandings of employers' expectations and of what is required in the workplace in terms of time management, dress code and behaviour. As it stands, and as far as we are aware, there is no evidence from RCTs showing that this increase in life skills spills over to directly affect attainment. This gap in the literature needs to be addressed and so we set out to test the theory that greater engagement in school work following work experience leads to higher attainment in related academic subjects.

Methods

Research questions:

- The **primary research question** is: What is the impact of Gen Stem on attainment in science and maths measured by KS4 outcomes?

- The **secondary research question** is: What is the impact of Gen Stem on attitudes to learning, and engagement in studies, - measured by the NFER survey.

- **Further research questions include**:
- What is the Impact of Gen Stem on subject choices? (using destination data)
- What is the impact of Gen Stem on school attendance data?

- **Process questions include:**
- How is the programme delivered? How do staff and pupils engage with it?
- What is the impact of any alterations to the intended programme?
- How much does it cost to run the programme?

Design

The trial is a school randomised efficacy trial, with two arms: intervention and control. Schools will be recruited into the trial by CSW Group with assistance from NFER to draft recruitment materials. CSW Group will recruit schools by first sending out a letter at the end of the summer term introducing the intervention and trial, to which schools can express interest. In the autumn term, CSW Group will send out an information sheet and Memorandum of Understanding (MOU) to the schools setting out what the trial involves and how to get involved. This will be followed up by phone calls to the schools to assess and encourage interest and to answer any questions the schools might have. Schools who wish to take part fill out the consent form on the MOU and post it back to CSW Group. CSW Group provide weekly updates to NFER on the schools who have signed up. Once they have signed up, schools then invite 15 students who are interested in STEM and available for work experience placements to put themselves forward. Teachers will specifically target some disadvantaged pupils (everFSM) and will aim to have 5 of the 15 students fall into the everFSM category. Following this, opt-out consent will be obtained from the parents for the pupils to be part of the trial, i.e. potentially complete the work experience intervention or otherwise be in the control group, and for NFER to collect their pupil data and later match it to NPD. The schools submit these pupil names, DOBs and UPNs to NFER through a secure portal. Pupils will then complete a baseline survey administered by NFER and then NFER will randomise the schools. The intervention group goes on to receive the work experience intervention and the control schools continue with business as usual which may or may not include work experience placements. When the intervention is complete, the pupils from both the intervention and control schools will complete a follow-up survey administered by NFER. Control schools will be paid £1000 each to complete this.

The trial needs to recruit 130 schools. 80 schools need to be recruited and ready to randomise by October half term otherwise CSW will have to expand into more regions to reach sufficient schools in time.

Randomisation

Randomisation will take place in two stages. The first stage at October half term 2017, and the second at the end of December 2017. This allows CSW Group to start to find employers and set up

work prep days during the latter half of the autumn term for the schools that are randomised in October, whilst keeping the recruitment window open until the end of this term to allow the best possible chance of recruiting sufficient numbers of schools. Randomisation will be carried out by NFER and will be stratified by local enterprise partnership (LEP): 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, South Gloucestershire) and Gloucestershire. Nine schools receiving the intervention must be in Cornwall because of CSW Group's funding agreements with Careers Enterprise Company (CEC).

Participants

Maintained secondary schools in the 6 LEP regions of 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, South Gloucestershire) and Gloucestershire, will be eligible. Eligibility may be expanded beyond these regions if recruitment targets are not met in October.

Any year 10 pupils from the above schools with an interest in STEM and the work experience opportunities in their local area are eligible. The identification process will involve a mixture of self - selection and teacher input to encourage disadvantaged pupils to apply – see the design section for more detail.

Sample size calculations

In this trial design 15 students are selected in each school to be the target students in that school. These 15 students in the intervention schools all attend the work preparation day and interview process but only 5 go on to attend the work experience placement. Thus we have a dilution effect where 10 of the 15 in the intervention group will not receive a Gen Stem placement. Education trials often have small effect sizes and given the added dilution we will power for detection of an effect size of 0.15.

Detecting an effect size of 0.15 on attainment with 80% power will require 130 schools (65 intervention and 65 control) based on the following assumptions:

- ICC with covariates of 0.1 (Teacher Observation trial with GCSE maths outcome and KS2 maths baseline had ICC = 0.087)
- Correlation between KS2 and GCSE of 0.65 (Teacher Observation trial with GCSE maths outcome and KS2 maths baseline had 0.68)
- Number of eligible Year 10s per school: 15.

Powering the trial for attainment means that the trial is very likely to be powered for life skills outcomes too assuming:

- ICC with covariates of 0.05
- Correlation between baseline and follow-up of 0.60.

Sample size calculations were not done to determine the number of disadvantaged students who should take part because of the small number of students in total participating from each school. Instead it was decided that schools could reasonably aim to include 5 disadvantaged students within

the 15. With 5 students in each of 130 schools at 80% power and maintaining all the assumptions above the MDES will be 0.2.

Outcome Measures

The primary outcome measure for this trial will be its impact on GCSE attainment in 2019, obtained via the National Pupil database (NPD). As the WE placements will be STEM, we will use an amalgamation of science and mathematics performance. It is not yet clear whether the new 9-1 grades will be supplemented with any additional information on NPD. A weighted sum which ensures equal treatment of dual-award science versus triple science would seem appropriate.

We will also collect attendance data from the NPD and compare the attendance of the control and intervention groups in year 11. This will be a secondary outcome.

As we will be obtaining UPNs of selected Year 10 pupils prior to randomisation, it will be possible to track the majority of these pupils into Year 12 using the NPD. As much of the useful information on these datasets arrives when qualifications are taken, we will use the Post-16 Learning Aims (PLAMS) survey available within the NPD that should be available in February 2020 for this cohort. This will allow us to test whether the proportion of pupils taking A-level physics, for example, differs between intervention and control groups. This will be a secondary outcome

A further secondary outcome measure will be the NFER Gen Stem Survey. This will be administered at baseline and end point and will measure 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.

Analysis plan

The main analysis will be intention-to-treat. The primary outcome will be a weighted sum of maths and science scores at GCSE[1]; giving the two subjects equal weight. This is a cluster randomised design, so analysis will use a multilevel model with two levels: school and student. Comparisons will be made between the intervention and control groups at follow up controlling for prior attainment by including baseline performance as a covariate. For the primary outcome, baseline will be an appropriate measure of maths /science[2] achievement at Key Stage 2. The cohort taking their GCSEs in summer 2019 completed their Key Stage 2 assessments in 2014 i.e. the old style tests. The baseline will be a weighted sum of the total mark in the maths tests (KS2_MATTOTMRK) and the science teacher assessment level (KS2_SCILEVTA); giving the two subjects equal weight. We will also include LEP as a covariate as this will be a stratifier in the randomisation. Any effects of the intervention on everFSM-eligible pupils, will be carried out through the use of interaction terms in the model. This will be done for the primary outcome only.

[1] GCSEs underwent major change for 2017 onwards. The way to calculate the primary outcome will be specified in the SAP once the availability of new GCSE variables on NPD is made public.
[2] This is teacher-assessed at Key Stage 2 but as this is a baseline measure, no bias is introduced.

The primary outcome analysis will be done on all 15 students that were selected for the trial before randomisation. As it is the intention that only 5 of these go forward to complete the WE programme, any effect of the programme will be diluted amongst the 15 intervention students within each school. It will therefore be necessary to complement the primary analysis with a quasi-experimental analysis similar to that used in the FAST trial[3]. Like FAST, this trial has the advantage of containing 5 students within the 15 selected in each control school that would have received the WE programme, should they have been randomised to the intervention. This improves the likelihood of selecting an unbiased comparison group.

For the attendance data we will use absence data for their year 11 from the NPD and use an intention to treat model for the 15 students with the year 9 absence data as a covariate.

For the destination data the destination models will be multilevel logistic models exploring whether taking part in work experience affects the uptake of STEM related subjects. These include A Levels in Science and Maths.

For the survey a factor analysis will be run on the items to produce an overall score / key subscores for each section. An iterative process will be used to establish reliable factors to form further secondary outcomes of relevance to the trial. We will class factors as reliable if they have a cronbach's alpha of 0.7 or above. Factor scores can then be entered into a multilevel regression analysis exploring the differences between control and intervention groups at follow up using their scores at baseline as a covariate. Frequencies by group of individual items will also be produced where relevant. If we don't find any reliable factors then we will simply produce frequencies for each group (control v intervention).

A further approach to the problem of dilution identified above will be to carry out a Complier Average Causal Effect (CACE) analysis on the basis of the extent of WE programme experienced by every participant in the experiment. Compliance in this study is defined as:

Student compliance

From a student's perspective, we expect the full Generation STEM experience would be:

- take part in the Work Preparation Day
- complete an application for a placement
- take an interview for a placement on the Interview Day
- successfully complete all 5 days of their work experience placement
- receive feedback/debrief following placement

Allowing for student illness/absence, as an absolute minimum, compliant student need to have at least:

- completed an application for a placement
- taken an interview for a placement

[3] https://educationendowmentfoundation.org.uk/our-work/projects/families-and-schools-together-fast/

- successfully completed at least 3 days of their work experience placement
- received feedback/debrief following placement

Further detail on the analysis will be supplied in the SAP.

Process evaluation:

The implementation and process evaluation (IPE) will complement the impact evaluation and gather information to validate the logic model. It will investigate:

- How the WE is 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.
- The quality of the intervention (including the pre- and post- support and reflections on lessons learned, as well as the WE itself), and its ability to engage pupils.
- The nature of and reasons behind any variations or adaptations that are made to the programme, at provider-, school- employer-or pupil level.
- 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 pupils or employer e.g. Urban/rural
- Usual practice for control and intervention schools, whether it changed in the trial context, and the distinctiveness of the programme.
- The typical costs for schools, including direct, marginal costs, and investment of staff time.
- Suggestions for improvements or advice for good practice for any subsequent effectiveness trial.

We propose to use a mixed-methods approach drawing on engagement with the provider, an observation of 3 work preparation days, and qualitative interview data with young people, school senior leadership teams and/or work experience coordinators, and employers, which will take the form of 45 telephone interviews each lasting 30-45 minutes (15 with young people, 15 with employers and 15 with school staff). We will also do pre- and post-intervention surveys of the 15 pupils**.**

Intervention Delivery and Evaluation Analysis (IDEA) workshop

Following the set-up meetings, we will host an IDEA workshop with the programme delivery team. This will allow us to explore the programme in more depth, to discuss its delivery history and confirm our understanding of the new, expanded, delivery model. We will use the meeting to co-construct and agree the EEF-adapted Template for Intervention Description and Replication (TIDieR), and to develop and agree the logic model. We will also focus discussions on the application form and process that will be used to identify eligible pupils prior to randomisation, and ask for details of any routine monitoring and evaluation with a view to streamlining, maximising and/or integrating evaluation activities.

Strategic and provider interviews

Following the IDEA workshop we will engage in two telephone interviews with a key personnel from the delivery team and with an independent expert on work experience. As well as informing the

development of the process evaluation research instruments, these will allow 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

To further immerse the research team in the programme, we will attend three of the work preparation days. This will provide valuable contextual data for the process evaluation and help to assure the quality and appropriateness of our research instruments.

Follow-up pupil life skills surveys

In the follow-up survey, we will add an extra set of questions to ask pupils what careers- related activities they have engaged in since completing the baseline measure (e.g. WE, careers talks, fairs, employer visits or taster days). We will request further details about any WE they participate in (be they part of the programme under investigation, or through other means), including their nature, length, and the extent of any preparatory and follow-up materials or support. This will measure business as usual for the comparison pupils, and show what other careers-related activity that both the intervention and comparison pupils may have engaged in. We will also explore the quality of any WE that pupils have experienced, and the influence of any careers-related activities on their confidence about their career aspirations, their ability to make post-16 decisions, on their confidence in communicating with others and with adults, or in team work and problem- solving skills. We will compare responses between the intervention and comparison group pupils. Asking pupils to report on their engagement in any careers-related activities means that we do not need to issue comparison group schools with a pupil-level business-as-usual log. This reduces the administrative burden on schools, and the overall evaluation budget.

Interviews with pupils

Towards the end of the WE placements we will carry out telephone interviews with 15 of the intervention pupils. Given the time constraints of securing interviews following WE placements and before the summer holidays, CSW Group have agreed to include the potential interview with us as part of the conditions of WE for participants. The interviews will explore:

- pupils' experience of moving through the programme, from the work preparation day, through the application and interview process, the supporting preparatory resources and into the WE placement and any subsequent support
- detail on any early impacts from the programme, including impacts on career intentions, improved confidence over 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
- any suggested improvements.

Interviews with school-based staff

In July 2018 we will also carry out telephone interviews with one member of staff in a sample of 15 schools (15 interviews in total). These will cover:

- 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, marginal costs, as well as 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
- any additional careers-related activity the intervention pupils have participated in, and how this programme compares.

Interviews with employers

In July 2018 we will also interview 15 employers over the telephone. These will cover:

- key elements of the STEM placement and preceding interviews/debriefs
- young people's attendance; punctuality; perceived attitudes
- perceived impacts of the placement/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
- usual work experience practice and how the STEM placements differs

Cost effectiveness analysis

Following the EEF principles of cost evaluation[4], we will engage with the programme providers and school staff to arrive at a cost per pupil for engaging in the intervention.
In summer 2018 we will speak with the programme providers to understand the costs involved in providing a pupil with the WE and support package, including the administration costs and associated liaison with schools and employers. We will explore the costs for schools through telephone interviews with a sample of 15 schools. The interviews will gather information on direct, marginal costs (such as purchasing or photocopying any resources or materials, and any travel, subsistence or supply costs associated with the intervention), as well as the amount of staff time required of the intervention (such as time spent liaising with the programme providers, supporting pupils, or communicating with parents and staff). We will use this to provide a representative assessment of the costs to the wider group of schools. We are confident that by talking to school-staff we can ascertain accurate measures of costs. We will prime each interviewee to expect some questions about staff time and the cost of any additional resources, and use a carefully constructed cost assessment tool to guide the conversations. If the interviewee cannot answer the question at the time of interview, we can email the cost assessment tool to them for self-completion.

[4] https://educationendowmentfoundation.org.uk/public/files/Evaluation/Setting_up_an_Evaluation/EEF_guidance_to_evaluators_on_cost_evaluation_2016_revision_FINAL.pdf

Ethics and registration

The trial will be designed, conducted and reported to CONSORT standards (http://www.consort-statement.org/consort.statement/) and registered on http://www.controlled-trials.com/. The evaluation will be conducted in accordance with and approved by NFER's Code of Practice. NFER's data protection policy is available at: http://www.nfer.ac.uk/nfer/about-nfer/code-of-practice/nfercop.pdf. Fieldwork will be conducted in accordance with NFER's Code of Practice. NFER, and CSW will work together to ensure each organisations' policies can be applied in practice.
In setting out the roles and responsibilities for this trial, the three parties (CSW, NFER and EEF) will draw up a Memorandum of Understanding (MoU). This will include a description of the nature of the data being collected and how it will be passed to NFER.
In addition, CSW will provide MoUs to schools, explaining the nature of the data being requested of schools, families and children, how it will be collected, and how it will be passed to and shared with NFER. Headteachers provide consent for schools to take part in the trial. Opt-out consent will be obtained from the 15 pupils and their parents who wish to go forward and take part in the intervention. This will cover taking part in the work experience intervention and access to NPD data.

Registration details to be added when registration is complete.

Personnel

Dr Ben Styles will be the Project Director, leading the NFER team and taking responsibility for project delivery. Ben is head of NFER's Education Trials Unit and has led or directed 13 evaluations for the EEF. The trial manager will be Dr Susie Bamford, a quantitative researcher in our Centre for Statistics. Susie is an active member of NFER's Trials Unit and has substantial trials experience spanning the last 15 years. Building on trials at the universities of Bangor and Southampton, at NFER she has led a recent RCT of Code Club and has been involved in both the process and impact side of the FAST trial.
Tami McCrone, a Senior Research Manager in NFER's Centre for Evidence and Consultancy, will lead the process evaluation, and David Sims will assist. Tami and David have an in-depth understanding of work experience (WE) policy and practice and lead NFER's extensive Education to Employment research portfolio. They have a strong history of close working on careers-related evaluations and bring a wealth of evaluation and subject expertise to the team.
Kathryn Hurd, Head of Survey Operations, will support the programme providers with school recruitment and will lead the administration of the life skills survey. Kathryn works closely with the Research Department to manage RCTs and quantitative work. She is currently overseeing the surveys and 'business as usual' logs for the EEF's Catch Up® Literacy Trial. Kathryn also oversaw the recruitment of 200 primary schools for the EEF Philosophy for Children Trial where schools were required to complete pupil-level surveys and provide pupil data pre-randomisation.

Risks

Risk	Assessment	Countermeasures and contingencies
Insufficient schools recruited to the study	**Likelihood: moderate** **Impact: high**	NFER could help with recruitment for an additional fee if expansion to a larger sample is possible if this becomes problematic.
School or pupil attrition	**Likelihood: moderate** **Impact: moderate**	Clear information/initial meeting with schools explaining the principles of the trial and expectations.
Insufficient everFSM pupils apply for the WE	**Likelihood: moderate** **Impact: high**	A percentage everFSM eligibility criterion will be applied at student recruitment.
Low response rate to the follow-up survey	**Likelihood: moderate** **Impact: high**	Control schools will receive an incentive payment when pupils have responded to the follow-up survey. The provider will build survey completion into the conditions of being offered a placement. We can increase our targeted reminder activities (currently a combination of emails, post and phone calls) to boost response rates, if required, for additional cost.
Researchers lost to project due to sickness, absence or staff turnover	**Likelihood: moderate, especially over 3 years** **Impact: moderate**	NFER has a large research department with numerous researchers experienced in evaluation and careers education, who could be redeployed.

Timeline

Date	Activity
Month	**Activity**
Summer term 2017	Project inception and set up meetings
	IDEA workshop
	Research instruments and recruitment materials developed
	Protocol written
	Trial registration
Autumn term 2017	Provider recruits schools - NFER steps in if targets are not met and CSW can expand to other regions
	Schools identify students
	NFER requests the UPNS of eligible pupils from schools, and distributes the baseline survey of life skills to all eligible pupils
	NFER randomises schools in 2 waves - October and December
Spring term 2018	Strategic and provider interviews
	Statistical analysis plan
	Basic analysis check of baseline survey
	Research team observe WE preparation day(s)
	Eligible pupils are invited for interview, and names and DOBs provided to NFER
	Provider interviews pupils in intervention schools
Summer term 2018	Provider completes interview debrief for all interviewed pupils
	Provider matches successful pupils to employers for placements
	Pupils complete WE
	NFER interviews with school based staff and employers
Autumn term 2018	Follow-up survey
	NFER Interviews with pupils
	Survey data analysis
	Interview data analysis
	Internal emerging findings meeting
Summer term 2019	Year 10 pupils take GCSEs
	NFER makes NPD request
Spring term 2020	Attainment and progression data comes available
	Data analysis
	Reporting (draft report due end of April 2020)