

**Trial Evaluation Protocol**  
**ASCENTS 121 Support for Science**  
NatCen Social Research  
Principal investigator: Arnaud Vaganay



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| <b>PROJECT TITLE</b>                 | ASCENTS 121 Support for Science  |
| <b>DEVELOPER (INSTITUTION)</b>       | University of Lincoln  |
| <b>EVALUATOR (INSTITUTION)</b>       | NatCen Social Research   |
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| <b>TRIAL DESIGN</b>                  | Multi-site trial with randomisation at the individual level                                    |
| <b>PUPIL AGE RANGE AND KEY STAGE</b> | KS4  |
| <b>NUMBER OF SCHOOLS</b>             | 35   |
| <b>NUMBER OF PUPILS</b>              | 770  |
| <b>PRIMARY OUTCOME</b>               | Science GCSE attainment  |
| <b>SECONDARY OUTCOMES</b>            | Maths GCSE attainment<br>English GCSE attainment<br>Progression to Science A- or AS- level     |
| <b>ISRCTN number</b>                 | ISRCTN28630907   |

## Protocol version history

| VERSION | DATE       | REASON FOR REVISION |
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## Contents

|   |    |
|---|----|
| 1. Intervention .....                                       | 4  |
| 2. Evaluation overview .....                                | 8  |
| 3. Background .....   | 9  |
| 4. Impact evaluation.....                                   | 13 |
| 5. Implementation and Process Evaluation.....               | 20 |
| 6. Follow-up study on mentors' study and career paths ..... | 27 |
| 7. Ethics and registration .....                            | 29 |
| 8. Data protection .....                                    | 30 |
| 9. Personnel .....  | 31 |
| 10. Risks .....   | 32 |
| 11. Timeline.....   | 34 |
| 12. References.....   | 35 |

# 1. Intervention

## 1.1. Overview and definition

ASCENTS 121 Support for Science (hereafter 'ASCENTS') trains STEM<sup>1</sup> undergraduates to provide one-to-one science support to disadvantaged Year 11 pupils in local schools. STEM undergraduates from five different universities will be trained to deliver mentoring sessions. The programme will run in 35 schools from September 2019 to May 2020.

For the purpose of this study, mentoring is defined as the provision of intensive, individualised and subject-specific support by a teacher, teaching assistant or other adult, to a pupil. It is important to note that this definition usually refers to the activity of *tutoring* rather than mentoring<sup>2</sup>. As ASCENTS was *also* developed with a view to build confidence and resilience among pupils, it was felt by the developers that the term tutoring was too restrictive. Throughout this protocol, the terms 'mentoring' and 'tutoring' will be taken to have broadly the same meaning.

## 1.2. Why

The effect of tutoring on learning outcomes is well documented (see section 3.2 for a short review of the literature). Overall, the evidence suggests that one-to-one tuition is an effective way to improve attainment and may also increase subject enjoyment and interest.

However, the high costs associated with one-to-one tuition may result in reduced access for disadvantaged pupils. Furthermore, schools may find it difficult to fund tutoring programmes, as it is a rather expensive type of support. Therefore, interventions like ASCENTS, which include one-to-one tuition targeted at disadvantaged pupils, could expand access for disadvantaged pupils and reduce the attainment gap.

## 1.3. Who

ASCENTS was developed by the University of Lincoln. The programme will be delivered by the University of Lincoln in collaboration with the University of Leeds, University of Liverpool, UCL Institute of Education, and University of York. Each university will co-ordinate intervention activities with mentors and local schools.

ASCENTS will be delivered by undergraduate students (mentors) to Year 11 pupils (mentees).

In order to be eligible to take part, mentors must meet the following criteria:

- be in their 2nd or 3rd year of study during the academic year of mentoring sessions (i.e. 2019/2020)
- studying for a degree in a science related subject that confers a BSc degree or integrated master's degree;
- minimum of a C grade in GCSE English, Maths and Science; and

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<sup>1</sup> Science, Technology, Engineering, and Mathematics

<sup>2</sup> According to the EEF, "mentoring involves pairing young people with an older peer or volunteer, who acts as a positive role model. In general, mentoring aims to build confidence, develop resilience and character, or raise aspirations, rather than to develop specific academic skills or knowledge". See: <https://educationendowmentfoundation.org.uk/evidence-summaries/teaching-learning-toolkit/mentoring/>

- minimum of one A-level in either Biology, Chemistry, Physics or Psychology at grade C or higher.

In order to be eligible to take part, schools must meet the following criteria:

- State, mixed-sex schools.
- Schools within the vicinity of the university partners in Lincoln, London, Leeds, Liverpool and York.

In order to be eligible to take part, mentees must meet the following criteria:

- be in Year 11 during the academic year of mentoring sessions (i.e. 2019/20);
- eligible for pupil premium;
- predicted a grade 3 to 5 in GCSE science; and
- studying combined double award science (foundation or higher).

The intervention will be evaluated by NatCen Social Research.

The project is jointly funded by EEF and the Wellcome Trust.

## 1.4. What

The ASCENTS programme involves the following key activities.

### 1.4.1. Recruitment of mentors, schools and mentees

Each university participating in the programme will be responsible for recruiting mentors from the cohort of undergraduate students attending the university. Universities will invite students to take part in the programme via an invitation letter sent to all STEM undergraduates in their first or second year of study. Information about the programme will also be communicated through advertisements on the university website as well as through announcements during lectures and seminars. Undergraduates will be able to apply to take part in the programme by emailing the ASCENTS university lead or applying through the student job shop. Places on the programme will be allocated to eligible mentors on a first-come first-served basis. Once recruited into the programme, the university will verify that the eligibility criteria are met and undertake DBS clearance check.

The University of Lincoln and partner universities will also identify and recruit eligible schools through university outreach departments, and school-centred initial teacher training departments (SCITT). Techniques to recruit include utilising school contacts, conducting local marketing campaigns (through emails and social media) and face-to-face visits with headteachers. NatCen will provide guidance on eligibility criteria and requirements for research participation. Schools will apply to take part in the programme by contacting the ASCENTS university lead.

Once participating schools have been recruited, they will be required to identify eligible pupils and send out a letter to them and their parents to inform them of the programme and invite them to take part.

Universities will be responsible for pairing undergraduate students with Year 11 pupils. Undergraduate timetabling will determine which mentors are made available to schools, and then mentors will be randomly allocated to pupils. Once the pairings have been completed, universities will inform mentors of their allocated schools and the details of their first mentoring session.

### 1.4.2. Mentor training and support

Mentors will be required to attend two days of training held at their university in advance of the mentoring sessions. The first day of training will be delivered by the University of Lincoln. The purpose of this day is to cover procedural aspects of the intervention, including an introduction to the ASCENTS project alongside DBS and paperwork checks. The second day will be delivered by a trained university programme manager and provides mentoring and safeguarding training. The mentors will be given the opportunity to ask questions at the end of each training day.

Mentors will be required to attend an additional school specific procedural training session in their allocated school prior to the first mentoring session, delivered by the ASCENTS contact at each school.

#### *1.4.3. Delivery of 23 mentoring sessions*

Mentees will receive 23 weekly one-hour face-to-face ASCENTS sessions throughout Year 11. The topic of each session will be decided by the Year 11 pupil, with an opportunity for teachers to suggest work to be covered. The topics chosen must be part of the GCSE science curriculum. All sessions are desk based and there will be no practical component. Mentors will be paid for their time.

#### *1.4.4. Revision day for mentees*

After the 23 mentoring sessions have been delivered, mentees will be invited to a six-hour revision session held at their partner university in the weeks before their GCSE examinations. The session will be delivered by the pupils' mentors and includes one-hour tutoring for Biology, Chemistry and Physics. Schools may decide that they do not want to visit the university, or cannot cover the transportation costs, in which case, the revision session can be delivered in school.

#### *1.4.5. Travel fund*

ASCENTS includes a discretionary travel fund, managed by the developers, to cover mentors' travel expenses.

### **1.5. How much**

As mentioned above, mentees will receive 23 weekly one-hour face-to-face ASCENTS sessions throughout Year 11. This dosage is both high and intensive. Of the eight other tutoring programmes funded by the EEF:

- Only two provided more contact time than ASCENTS;
- None had more frequent meetings than ASCENTS;
- None seemed to have longer sessions than ASCENTS (although the duration of sessions was not always reported);
- Several were partly or wholly delivered through group interventions.

### **1.6. Where**

The sessions will be held at the mentees' school under the supervision of a qualified teacher. Developers do not have specific requirements with regards to the type of space needed for mentoring sessions.

### **1.7. When**

Schools will have some flexibility with regards to the timing of the mentoring sessions. Developers recommend to plan (i) a unique mentoring session per week; and (ii) sessions outside of the school timetable, such as before or after school, but not during breaktimes.

## 2. Evaluation overview

This efficacy evaluation has three components: an impact evaluation, an implementation and process (IPE) evaluation and a follow-up study.

The impact evaluation is outlined in **section 4**. Its aim is to assess:

- The impact of ASCENTS on the Science attainment of disadvantaged Year 11 pupils in England;
- The impact of ASCENTS on the Maths and English attainment of disadvantaged Year 11 pupils in England;
- The impact of ASCENTS on enrolment in Science A- and AS-levels; and
- Whether the impact of ASCENTS may differ by prior levels of attainment.

The IPE is outlined in **section 5**. Its aim is to explore:

- Whether/how ASCENTS differs from the usual practice;
- The level of implementation fidelity;
- The level of responsiveness from mentors;
- The level of responsiveness from mentees;
- Wider outcomes for non-participating students, teachers and universities;
- The cost and affordability of the programme.

The follow-up study is outlined in **section 6**. Its aim is to explore:

- Whether mentors have developed an interest in becoming teachers after their participation in ASCENTS, and what background, attitudinal or experiential variables are correlated with interest;
- What proportion of mentors have enrolled in Initial Teacher Training, and what background, attitudinal or experiential variables are correlated with enrolment;
- What proportion of mentors have become science teachers, and what background, attitudinal or experiential variables are correlated with becoming a science teacher;
- What proportion of mentors have become any kind of teachers, and what background, attitudinal or experiential variables are correlated with becoming a teacher; and
- What proportion of those who rated high on interest in becoming a teacher but later decided not to enrol on training or become a teacher, and what background, attitudinal or experiential variables are correlated with this change in intentions.

## 3. Background

This section briefly summarises what is known about the impact, pathways to impact and long-term effect of mentoring/tutoring programmes in educational settings – and where additional research is needed.

### 3.1. Expected impact

#### 3.1.1. Expected impact of tutoring on attainment

There are few studies examining mentoring programmes specifically tailored to pair undergraduate science pupils with Year 11 pupils from more disadvantaged backgrounds who are taking science at GCSE. As ASCENTS was first introduced as a small-scale pupil-randomised efficacy trial in Lincolnshire, the evaluation of this trial (Sharpe, Abrahams and Fotou, 2018) is the study that this evaluation most closely intends to replicate. The authors did find evidence of a positive impact. The findings showed that mentored pupils achieved better attainment in science in both mock and actual GCSE examinations, with an effect size of 0.3 standard deviations.

To find more relevant studies, one needs to broaden the search to evaluations of *peer tutoring* and *mentoring* interventions targeting wider or different groups. There is a sizeable body of evidence for both types of intervention.

Evidence from meta-analyses show that *peer tutoring* is effective, resulting in moderate effects on pupil attainment across a range of outcomes and ages (e.g. Kunsch, Jitendra and Sood, 2007; Jun, Ramirez and Cumming, 2010). There is also evidence to suggest that tutoring is particularly effective for more at-risk pupils, including low-income, younger, urban and minority pupils (e.g. Rohrbeck, Fantuzzo, Ginsburg-Block and Miller, 2003; Leung, 2014). It should be noted, however, that evidence from recent single studies is more mixed. Evidence from two effectiveness trials show that peer tutoring may not necessarily lead to improvements in attainment in all instances (e.g. Lloyd et al., 2015a, Lloyd et al., 2015b). As these studies were effectiveness trials as opposed to efficacy trials, it is possible that a lack of effect may be due to greater heterogeneity in, for example, how consistently the trial is delivered, how it is received by pupils, or due to other extraneous sources of influence at the pupil, tutor and school level (DuBois, Holloway, Valentine and Cooper, 2002).

On average, *mentoring* appears to have a small positive impact on academic outcomes. For instance, a meta-analysis of 55 evaluations found that there was a modest or small benefit of programme participation on academic performance, although slightly stronger effects were found for those from disadvantaged backgrounds (DuBois, Holloway, Valentine & Cooper, 2002). However, other meta-analyses find no effect on academic performance (e.g. Wood and Mayo-Wilson, 2012). Evidence from single studies also find little evidence for positive effects on academic performance, including those that look at science, maths and English attainment (Bernstein, Rappaport, Olsho, Hunt and Levin, 2009; McQuillin, Smith and Strait, 2011; McQuillin, Strait, Smith and Ingram, 2015).

#### 3.1.2. Moderating effect of prior attainment

Tutoring has been shown to have larger effects on those with low prior attainment in literacy and numeracy. A meta-review of 17 studies on numeracy tutoring interventions including guided practice and frequent feedback found a moderate effect size of 0.84 for those with low prior attainment compared to 0.49 for those with average prior attainment (Burns, 2010). Similarly, a meta-review of 30 studies on literacy interventions found a moderate effect size of 0.56 for those performing below standards compared to 0.10 for those not at risk (Kidron, 2014). There is sparse evidence testing the moderating effect of prior attainment on

outcomes of mentoring interventions, perhaps due to the very small, or lack of, effect typically found for these types of interventions.

### *3.1.3. Impact of tutoring/mentoring on study choices*

There is a scarcity of evidence analysing the effect of tutoring/mentoring on study choices. A small-scale pilot study found beneficial effects when school pupils, who were about to choose their GCSE options, were paired with university students reading Modern Foreign Languages (MFL). Just over half of pupils who partook in the mentoring scheme opted to enrol in MFL GCSE courses as a result of mentoring by undergraduates, and the greatest impact was noted in schools where uptake for GCSE MFL courses was lowest prior to its implementation (DfE, in press). The ASCENTS evaluation will contribute to the literature by examining whether any effects of the intervention persist in the longer-term by following pupils to KS5 to determine whether they are enrolled in A- or AS- level Science subjects.

## **3.2. Expected pathways to impact**

The ASCENTS IPE will identify the main factors driving or hindering implementation and assess whether these factors were the same as in previous programmes. For example, the reoccurrence of a previously identified obstacle to implementation could suggest that the lessons from previous programmes were not properly understood, shared or addressed.

### *3.2.1. Differentiation*

NatCen reviewed the evaluations of two similar EEF-funded interventions (ThinkForward and Paired Reading) to identify the main risks to implementation fidelity (Demack, McCaig et al., 2016; Lloyd, Edovald et al., 2015a). In both cases, the evaluators reported that the availability of alternative sources of support had made it difficult to understand the innovativeness of the intervention and to detect an impact.

### *3.2.2. Implementation fidelity*

The following issues were encountered by developers in the two above-mentioned EEF programmes (Demack, McCaig et al., 2016; Lloyd, Edovald et al., 2015a):

- Timetabling constraints, resulting in inconsistent dosage between schools (shorter sessions in some schools, longer sessions in others); and
- Space constraints, resulting in the use of crowded/noisy rooms.

### *3.2.3. Mentees' responsiveness*

Meta-analyses of peer assisted learning across a range of age groups and subjects have found the following components, of relevance to ASCENTS, to be related to higher levels of mentee engagement:

- Initial and ongoing training for mentors (DuBois et al. 2002; Leung 2015).
- Higher student autonomy, for example through students being responsible for setting goals (Rohrbeck et al. 2003; Ginsburg-Block et al. 2006).
- Individualized evaluation, based on improvement, progress and mastery of material (Rohrbeck et al. 2003; Ginsburg-Block et al. 2006).
- Structured activities for mentors and mentees, such as question frameworks (DuBois et al. 2002; DuBois and Rhodes 2006; Ginsburg-Block et al. 2006; Leung 2015).
- Expectations for frequency of contact (DuBois et al. 2002).
- Same-gender dyads (Ginsburg-Block et al. 2006).

Other factors related to intervention design which have been identified by existing studies of peer-assisted learning are: the amount and type of information and training received by the

teachers delivering the programme in schools; the amount and type of information and support received by mentors; and intervention duration and dosage (DuBois et al. 2002; DuBois and Rhodes 2006; Lloyd et al. 2015a; 2015b). No systematic investigation of the effects of the first two components has been so far conducted, and findings on the effects of this latter component are mixed. While evidence on tutoring suggests intensive blocks of tutoring over short time periods are more effective than longer programmes (Leung 2015; EEF 2018), the opposite has been found for mentoring (DuBois and Rhodes 2006).

Literature also indicates one-to-one support may have a positive effect on several pupil attitudinal outcomes. In their evaluation of cross-age paired mentoring, Sharpe et al. (2018) found the intervention to have a significant positive impact on pupils' attitudes to science. The programme appeared to improve pupils' attitudes to 'learning science in school', 'science outside school', and 'pursuing further a scientific education and scientific career', and to help them retain their level of 'self-concept in science'. In their meta-analysis of peer assisted learning, Ginsburg-Block et al. (2006) find this to result in positive, small-to-moderate effects on social, self-concept, and behavioural outcomes, and both social and self-concept outcomes to be significantly positively correlated with academic outcomes. The relation between attitudinal outcomes and attainment is however complex and its direction unclear. The authors also find same-gender groupings to result in significantly greater social and self-concept outcomes. Archer et al.'s (2010) analysis of children's science aspirations draws attention to the gendered nature of their constructions of science and identity, and of their consequent perception of a science-related career as being for them or not for them.

Importantly, research conducted in other countries also alerts us to possible unintended negative consequences of tutoring, such as higher levels of study-related stress and lower levels of overall well-being and self-esteem (Lee 2013; Song et al. 2018). Song et al. (2018) suggest this is likely to be due to the negative effects of being identified as low-achieving and in need of support. Qualitative research on mentoring carried out in the UK also highlights the importance of mentees' understanding of why they have been selected to take part in the programme in informing engagement and indicates being selected may generate self-doubt (Russell 2007).

#### *3.2.4. Mentors' responsiveness*

Mentor views and outcomes have been so far much less explored. Recent effectiveness trials of tutoring programmes conducted in the UK report a null to small negative effect on the achievement of pupils who acted as tutors (Lloyd et al. 2015a; 2015b). Yet, these interventions differed substantially from ASCENTS as tutors and tutees attended the same Key Stage. The process evaluation will contribute to understanding mentor outcomes by looking at self-reported impact of mentoring on science-specific and broader academic achievement, and at eventual diversions of time and resources. Sharpe et al. (2018) also found that mentors in their programme were more likely to go on to teaching than the national average. However, their evaluation did not assess changes in career aspirations resulting from taking part in mentoring. Through the analysis of pre- and post-intervention mentor survey data, and of national data on progression into teaching, NatCen will be able to investigate these processes in more depth.

#### *3.2.5. Wider outcomes*

The ASCENTS IPE will also explore the possible effects of mentoring on two groups of people, namely peers (i.e. pupils in the same class as the mentee but not taking part in ASCENTS) and science teachers. Whilst there is no evidence of that mentoring has a spill-over effect on peers, there is some literature showing that effective teachers not only impact their own students, but also individuals who later share a class with them. For example, a recent US study shows that an increase in the average quality of a student's peers' previous teachers affects their test scores by around 40% as much as an increase in their own

teacher's quality (Opper, 2019). Interestingly, the same study shows that the estimated spill-overs occur within gender groups and ethnic groups, as opposed to within the entire school community. This illustrates the crucial importance of social networks in disseminating the effect and suggests that much of the spill-overs are due to peer-to-peer interactions, rather than the entire effect being mediated by changes to the classroom dynamics at the middle school (Opper, 2019).

NatCen did not find studies analysing whether mentoring had effects on teachers' workload and classroom management. This suggests a possible contribution of the ASCENTS evaluation to the literature.

### *3.2.6. Cost and affordability*

Ultimately, the per-pupil cost of ASCENTS will be compared with the average per-pupil cost of previous tutoring/mentoring programmes funded by the EEF (bearing in mind the difference in dosage and delivery mode)<sup>3</sup>. EEF expects this cost to be high<sup>4</sup>. A typical effective programme might involve 30 minutes tuition, five times a week, for 12 weeks. This would require about four full days of a teacher's time, which is estimated to cost approximately £700 per pupil.

## **3.3. Expected long-term outcomes**

The follow-up study will analyse whether ASCENTS had any discernible effect on mentors' interest in becoming a teacher and on study/career paths. These results will be discussed in the context of a few relevant studies.

### *3.3.1. Effect of interest in becoming a teacher*

NatCen identified a few studies analysing the effect of tutoring on tutors' intention to continue teaching. Many of them come from evaluations of 'near-peer' teaching programmes in medical schools. One such study found that 91% of tutors who took part in a scheme agreed that being a tutor made them consider pursuing teaching in the future (Khalid, Shahid et al., 2018). Others found that among participants who already were considering making teaching part of their future career path, there was a feeling that tutoring gave them practice of many of the skills that they would need (Rodrigues, Sengupta, et al., 2009). Similarly, another study found an increased interest in teaching among tutors as they felt that taking part in the programme had improved their confidence and communication skills (Buckley, Zamora, 2007). However, it is also worth noting that literature does not present a wholly uniform picture on this question – one study of a near-peer tutoring programme found that tutors did not report an increased interest in teaching, in part because they felt that the intervention did nothing to improve their CV in this regard (Liew, Sow et al, 2015).

### *3.3.2. Effect of behaviours*

NatCen did not find studies analysing whether mentors/tutors were likely to study to become teachers or to become teachers following their participation to a mentoring/tutoring programme. This suggests a possible contribution of the ASCENTS evaluation to the literature.

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<sup>3</sup> A direct comparison will not be undertaken as part of this evaluation

<sup>4</sup> See: <https://educationendowmentfoundation.org.uk/evidence-summaries/teaching-learning-toolkit/one-to-one-tuition>

## 4. Impact evaluation

### 4.1. Research questions

The aims of the efficacy trial of ASCENTS are to answer the following research questions:

1. What is the impact of ASCENTS on the Science attainment of disadvantaged Year 11 pupils in England?
2. What is the impact of ASCENTS on the Maths attainment of disadvantaged Year 11 pupils in England?
3. What is the impact of ASCENTS on the English attainment of disadvantaged Year 11 pupils in England?
4. What is the impact of ASCENTS on enrolment in Science A- and AS-levels?
5. How does the impact of ASCENTS differ by prior levels of attainment?

### 4.2. Design

The evaluation will be conducted as a multi-site efficacy trial evaluating the impact of ASCENTS for disadvantaged Year 11 pupils in England meeting the eligibility criteria defined in section 1.3.

The primary outcome of interest is Science GCSE attainment, using GCSE grades from the National Pupil Database (NPD). Secondary outcomes of interest will be NPD-derived measures of Maths and English GCSE attainment, as well as progression to Science A- or AS- level.

This efficacy trial will randomise at the pupil level, with pupils either randomised to a treatment group receiving ASCENTS or a control group receiving 'business-as-usual' teaching and support. A randomised control trial (RCT) uses randomisation to assess the causal impact of an intervention. A multi-site individual-level randomised trial provides greater power to detect an effect of the intervention whilst minimising trial costs. Individual-level treatment allocation can also help ensure sufficient numbers of pupils and mentors are recruited in order to meet the requirements of the programme compared to treatment allocation at class or school level. However, individual-level treatment allocation may also increase the potential for spill-over effects whereby the intervention impacts non-eligible pupils in the same class, year or school<sup>5</sup>. NatCen will explore the potential for transfer effects via the IPE through teacher interviews and a school survey.

Seven hundred and seventy pupils will be recruited from 35 schools to participate in the trial (22 pupils per school); schools will be recruited by five universities, each recruiting approximately seven schools. Of the 770 pupils eligible for the trial, 385 pupils will be allocated to the treatment arm and the same number to the control group. Pupils will be randomised within schools, with 11 pupils allocated to the treatment group and 11 pupils to the control group per school; the allocation of pupils to treatment and control will be communicated to schools by NatCen. Pupils assigned to the control condition will receive a business-as-usual approach to learning science. Seventy-seven mentors will be recruited from each of five universities giving a total of 385 mentors. Undergraduate timetabling will determine which mentors are made available to schools, and then mentors will be randomly allocated to pupils.

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<sup>5</sup> Note also that due to the targeted selection of intervention participants, there is potential for transfer effects (i.e. the intervention affecting non-eligible pupils) and that the proposed evaluation design is not able to estimate the size of these. NatCen will explore this via the process evaluation.

Schools will be required to provide background information for all Year 11 pupils including the Unique Pupil Number (UPN), date of birth, first name, surname and FSM eligibility. Schools will also need to identify those pupils eligible and interested in receiving mentoring. This background information will be collected in an Excel spreadsheet template and uploaded by schools using a secure NatCen website upload platform. A unique identifier will be assigned to children and mentors which will be used for all research purposes; pseudonymisation of children and mentors as unique identifiers enhances privacy.

|   |   |
|---|---|
| <b>Trial type and number of arms</b>  | Multi-site trial with randomisation at the individual level   |
| <b>Unit of randomisation</b>  | Individual  |
| <b>Stratification variables (if applicable)</b>                                 | School  |
| <b>Primary outcome</b><br>variable<br>measure<br>(instrument, scale)            | Science GCSE attainment<br>Grade achieved in Full GCSE Double Award Science (NPD derived)   |
| <b>Secondary outcome(s)</b><br>variable(s)<br>measure(s)<br>(instrument, scale) | Progression to Science A- or AS- level <sup>6 7</sup> ; Maths and English GCSE attainment<br>Grade achieved for A- level or AS- level Biology, Chemistry or Physics; grade or level achieved in Full GCSE English and Maths (NPD derived) |

### 4.3. Randomisation

Pupils will be allocated to either the treatment or control group using stratified randomisation by school. Stratified randomisation is designed to promote balance across trial arms at setting level and across strata after randomisation. It also helps to control for any variation in school characteristics and in how the programme is implemented across schools, thereby improving the accuracy of the impact estimator.

The allocation ratio between treatment and control will be determined by the number of pupils participating in the trial at the time of randomisation. For a sample size up to 770 pupils, NatCen will use a 50:50 ratio between treatment and control arms to give 385 pupils in each group. If more or fewer than the expected 22 pupils are available per school, randomisation will be designed to ensure that each mentor has a pupil randomly allocated to them, with the remainder randomly allocated to the control condition.

Stata will be used to undertake randomisation and the steps recorded using *do* and *log* files. Analysts will be blinded to the identity of pupils at the time of randomisation, and identifiers will subsequently be merged with group allocation data.

### 4.4. Participants

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<sup>6</sup> NatCen will use an NPD outcome indicating grade achieved at A- or AS- level Science as a means to create a binary indicator of whether pupils sat an exam or not; this will act as a proxy for progression to Science A- or AS- level.

<sup>7</sup> AS-levels are currently available on the curriculum but are 'decoupled' from A-levels so do not count towards overall A-level grades.

NatCen will define the trial population as all pupils meeting the intervention eligibility criteria and who express interest in, and have permission to, participate in the programme, and have not been withdrawn from data processing. Pupils will be deemed eligible to take part in the trial if they meet the following criteria:

1. Pupils in Year 11 who are eligible for Pupil premium.
2. Pupils enrolled in GCSE combined double award science (foundation or higher) and predicted a grade 3 to 5.

Schools will be deemed eligible to participate in the trial if they meet the following criteria:

1. State, mixed-sex schools that follow a Science Double-Award curriculum.
2. Schools within the vicinity of the university partners in Lincoln, London, Leeds, Liverpool and York.

Schools will be asked to sign a Memorandum of Understanding (MOU) in order to confirm their participation. Once MOUs have been signed, universities will then share the following with schools for them to share with parents and pupils: a letter to parents asking for their permission for their child to participate in the ASCENTS programme; a pupil letter informing them about the ASCENTS programme; and a privacy notice. Pupils will be informed that they can choose to withdraw consent for collection and processing of their data.

Schools will then be asked to share student details (name, surname, UPN, DOB and form group) via secure upload for all students whose parents have given them permission to participate in ASCENTS, ready for randomisation.

#### **4.5. Sample size calculations**

The table below details the intention-to-treat minimum detectable effects size (MDES) for the available sample for a multi-site randomised efficacy trial with random assignment at individual level. It gives the MDES estimates for a sample made up of 22 pupils per school, for a total of 35 participating schools (seven schools linked to each of the five university delivery partners). The numbers of schools and pupils have been determined in part by logistical considerations such as the capacity of universities to recruit schools and recruit and train mentors.

The calculations were undertaken using PowerUp! and indicate that the study is able to detect an effect of 0.18 standard deviations or greater with the proposed sample of 35 schools (with seven schools per delivery partner) and 22 pupils per school. These calculations do not account for attrition over the course of the trial.

|   |                  | OVERALL           |
|---|------------------|-------------------|
| <b>MDES</b>                             |                  | 0.16              |
| <b>Pre-test/ post-test correlations</b> | level 1 (pupil)  | 0.4 <sup>8</sup>  |
|   | level 2 (class)  | n/a               |
|   | level 3 (school) | n/a               |
| <b>Intracluster correlations (ICCs)</b> | level 2 (class)  | n/a               |
|   | level 3 (school) | n/a               |
| <b>Alpha</b>                            |                  | 0.05              |
| <b>Power</b>                            |                  | 0.8               |
| <b>One-sided or two-sided?</b>          |                  | Two-sided         |
| <b>Average cluster size</b>             |                  | 22 <sup>9</sup>   |
| <b>Number of schools</b>                | Intervention     | n/a <sup>10</sup> |
|   | Control          | n/a <sup>4</sup>  |
|   | <b>Total</b>     | 35                |
| <b>Number of pupils</b>                 | Intervention     | 385               |
|   | Control          | 385               |
|   | <b>Total</b>     | 770               |

N.B. No power calculation is provided for analysis of Free School Meal (FSM) pupils as the trial's recruitment criteria require that all pupils be eligible for FSM.

## 4.6. Key variables

### 4.6.1. Outcome variables<sup>11</sup>

For Research Question 1, NatCen will use NPD-derived GCSE double Science attainment grades<sup>12</sup> as the measure of interest, taken post-treatment from the NPD. GCSE Double-Award Science students receive two grades between 1/1 and 9/9. They may also be entered for either the foundation paper (which allows a pupil to achieve grades 1/1 through 5/5) or the higher paper (which allows a pupil to achieve grades 4/4 through 9/9). The grades represent the pupils' performance across the three Science subjects, Biology, Chemistry and

<sup>8</sup> The baseline measure of attainment will be confirmed in the Statistical Analysis Plan. It is likely to be (1) science attainment at KS2, or (2) maths attainment at KS2, or (3) English attainment at KS2. We will choose the measure explaining the most variance in science attainment at GCSE.

<sup>9</sup> NatCen anticipate that schools will recruit 22 students (11 to treatment and 11 to control) and 11 mentors will be allocated to each school.

<sup>10</sup> Randomisation is at the pupil-level so the number of schools is not applicable.

<sup>11</sup> GCSE and A level assessments will have changed from grades to levels (1-9) by the time NatCen accesses the NPD, but we present the current available outcomes which use grades.

<sup>12</sup> Current NPD variable is GCSE - KS4\_APDSCI\_PTQ\_EE [Null=no entry, \*\*=A\*A\*, A\*, AA, AB, BB, BC, CC, CD, DD, DesE, EE, EF, FF, FG, GG, U=Ungraded]. However, it should be noted that the grade system at KS4 has changed from letters to a 1-9 scale and this will likely be the format of the variable used in the final analysis.

Physics. NatCen will take the highest grade achieved (as opposed to the average grade achieved) by a student.

For Research Question 2, the outcome variable will be a NPD-derived measure of GCSE Maths attainment. NatCen intends to use the NPD variable that records the highest grade achieved in full GCSE Maths<sup>13</sup>.

For Research Question 3, NatCen will analyse NPD-derived measures of GCSE English attainment. NatCen intends to use the NPD variable that records the highest grade achieved in full GCSE English<sup>14</sup>.

For Research Question 4, NatCen will collect information on whether pupils progress to A- or AS- level science (Biology, Chemistry or Physics) two years after collection of GCSE attainment data in 2022. NatCen will create a binary variable to indicate whether pupils sat an A- or AS-level science exam, which will act as a proxy for whether pupils go on to study science at A-level. This will be based on NPD-derived A- or AS-level attainment grades in any of the three aforementioned science subjects<sup>15</sup>. Any science outcome indicating a pupil was graded or ungraded (A-E and N, Q, U, or X); will be classified as 'progression to A- or AS-level science', while not enrolling for AS-or A-level science will be classified as 'did not progress to A- or AS- level science'.

For Research Question 5, NatCen will use the same outcome variables as for Research Questions 1-4.

#### 4.6.2. Treatment variable

A binary variable will be created to indicate whether pupils were in the treatment or control group.

#### 4.6.3. Covariates

All models will include baseline data on prior attainment for all sampled Year 11 pupils. For Research Question 1, prior attainment will be measured using NPD-derived teacher-assessed science attainment at Key Stage (KS) 2<sup>16</sup>. For Research Questions 2 and 3, models will include baseline measures of outcomes for KS2 maths and KS2 English (reading and writing) respectively. Those are recorded as the score achieved<sup>17</sup>.

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<sup>13</sup> GCSE - KS4\_HGMATH\_PTQ\_EE [Null=no entry, \*=A\*, A, B, C, D, E, F, G, U=Ungraded at GCSE].

<sup>14</sup> GCSE - KS4\_APENG\_PTQ\_EE [Graded 1-9/ Null=no entry].

<sup>15</sup> A level: KS5\_GA\_BIOLOGY, KS5\_GA\_CHEMISTRY, KS5\_GA\_PHYSICS [A-E and N, Q, U, X where A-E denotes that either a grade A, B, C, D or E were awarded. N denotes a near grade pass, meaning candidates just missed achieving a grade E. U denotes unclassified, meaning the standard required for a grade E was not achieved. X denotes that a result has not been issued. Q denotes that results are pending or are currently unavailable.].

AS Level: KS5\_GAS\_BIOLOGY, KS5\_GAS\_CHEMISTRY, KS5\_GAS\_PHYSICS [A-E and N, Q, U, X]

<sup>16</sup> KS2\_SCITAOUTCOME [1-6 national curriculum level achieved, A=Absence or not enough information available to calculate TA, W=Working towards Level 1, D=Disapplied from national curriculum, L=if a pupil has left the school, M=Missing (used where school records are unavailable), F=If pupil has not taken the test but will be taking it in the future, P=If pupil has not taken the test but took it in the past, Z=Not a TA result: pupil who incorrectly registered].

<sup>17</sup> KS2\_KS2MATSCORE; KS2\_READSCORE [both continuous scale]

#### 4.6.4. Procedure

Data on outcomes will be collected for both treatment and control group individuals from the appropriate NPD dataset at the first follow-up point in autumn 2020, after pupils have sat their GCSEs. All variables discussed here are listed in the 2018 NPD data tables (NPD, June 2018)<sup>18</sup>.

### 4.7. Analysis plan

This two-arm trial will compare outcomes for the ASCENTS intervention (treatment group) with those from a group receiving business-as-usual Science education (control group).

#### 4.7.1. Research Question 1

The primary analysis will estimate the intervention's impact on science attainment, as measured by NPD-derived science GCSEs, using an intention-to-treat approach. The analysis will use KS4 science GCSE attainment raw scores, in line with EEF guidance<sup>14</sup>. The analysis will use a single-level fixed effects model. The model will contain baseline measures of science at KS2. The impact of the intervention resulting from a change in attainment from KS2 to KS4 will be expressed as a standardised effect size using Hedge's *g* with 95% confidence intervals.

A sensitivity analysis will include an adjusted model, including a range of prognostic covariates to increase power. Covariates will include pupil prior attainment (as in the primary analysis model), gender and age. All covariate data will be obtained from the NPD or publicly available data.

If differential loss to follow-up creates an imbalance between trial groups or if attrition is high (if missing data exceeds five per cent<sup>19</sup>), and providing a covariate can predict loss to follow-up, the sensitivity of the estimated effect will be assessed by approximating missing outcomes using multiple imputation.

#### 4.7.2. Research Questions 2-4

Analysis of secondary outcomes (Maths GCSE, English GCSE, progression to A- or AS-Level science) will follow the same format as that for the primary outcomes, with a single-level fixed-effects model.

#### 4.7.3. Research Question 5

An interaction between treatment and the relevant measure of prior attainment will be performed for all measures of attainment (Science GCSE, Maths GCSE, English GCSE) and progression to A-level Science. This will help inform how the programme should be targeted in the future.

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<sup>14</sup> Statistical Analysis Guidance for EEF trials (2018). Available at [https://educationendowmentfoundation.org.uk/public/files/Evaluation/Writing\\_a\\_Protocol\\_or\\_SAP/EEF\\_statistical\\_analysis\\_guidance\\_2018.pdf](https://educationendowmentfoundation.org.uk/public/files/Evaluation/Writing_a_Protocol_or_SAP/EEF_statistical_analysis_guidance_2018.pdf)

<sup>18</sup> National Pupil Database (2018), Department for Education, UK.

<sup>19</sup> In line with EEF Analysis Guidance, 2018

Subgroup analyses by FSM will not be performed as all pupils in the trial will be eligible for free school meals.

#### 4.8. Compliance

The intention to treat analysis outlined above may underestimate the effect of an intervention if some individuals, in either trial arm, do not adhere to their assigned treatment. As a result, an additional analysis will be conducted to take account of any non-compliance among those who received the intervention.

A measure of compliance will be constructed according to pupil attendance at mentoring sessions and at the University Revision Day. This data will then be used to conduct analyses in the presence of non-compliance and thus give an indication of the treatment effects amongst those who participate in the intervention. ASCENTS includes 23 mentoring sessions and a University Revision Day. The University Revision Days include a visit to the university where mentors are studying, a chance to see the university first hand and to understand what it is like to study Science as an undergraduate.

Attendance at mentoring sessions will be captured via a register designed by NatCen and completed by the teacher supervising the mentoring sessions in each school. Attendance at the University Open Day will be captured via a register designed by NatCen and completed by University staff.

A measure of compliance will be constructed as follows:

- Pupils will be given one point for each mentoring session attended, up to a total of 23.
- Students will be awarded three points if they attend the University Revision Day.

The total score will then be summed to produce a scale of compliance with a possible range of  $0 \leq Comply_A \leq 26$ .

This compliance score will also be used in the IPE (see section 5) and the follow-up study (see section 6).

## 5. Implementation and Process Evaluation

### 5.1. IPE dimensions

In line with the literature reviewed in section 3.2 and EEF guidance, the IPE will cover the following dimensions:

- **Differentiation**, i.e. the extent to which ASCENTS differs from the usual practice in terms of activities and dosage.
- **Implementation fidelity**, i.e. the extent to which the programme was delivered as intended by both universities and schools. More specifically, the IPE will explore:
  - Behaviours (steps taken to recruit mentors, mentees and schools, number of training sessions organised, support provided to mentors, etc.); and
  - Perceived drivers and obstacles to implementation.
- **Mentors' responsiveness**, i.e. the extent to which mentors were actively involved in delivering the intervention (as defined by Reeve, Jang, Carrell, et al., 2004). The IPE will explore:
  - Behaviours (how much time spent preparing for the activity, delivering the activity, communicating with mentees, absenteeism, etc.);
  - Cognitive mechanisms (perceived costs and benefits of tutoring);
  - Emotions (professional and personal identification, enjoyment, perceived quality of the interaction with mentees); and
  - Factors moderating mentor engagement.
- **Mentees' responsiveness**, i.e. the extent to which mentees were actively involved in the intervention. The IPE will explore:
  - Behaviours (how much time spent preparing for the activity, regularity of attendance and punctuality, communications with mentors, absenteeism, etc.);
  - Cognitive mechanisms (perceived costs and benefits of tutoring);
  - Emotions (self-confidence, enjoyment, perceived quality of the interaction with mentors); and
  - Factors moderating mentee engagement.
- **Wider outcomes**, i.e. the extent to which, and the ways in which, the intervention affected non-participating pupils in participating schools, science teachers and universities. The IPE will explore the perceived benefits of the intervention on:
  - Classroom learning dynamics. These could be positive, due to a faster pace of learning or due do mentees sharing tips and/or documents with non-participating students. However, these could also be negative, due to discouragement/ perceived unfairness among non-participating pupils (some of them might have applied to participate in the programme).
  - Teachers' workload and class management; and
  - Universities' outcomes (to be defined).
- **Affordability**, i.e. the per-pupil cost of the intervention, as defined by EEF.

## 5.2. Research questions

| IPE dimension                  | Research Question  | Data collection instrument   |
|--------------------------------|--|--|
| <b>Differentiation</b>         | What is business as usual? To what extent does ASCENTS differ from BAU?  | Post-intervention teacher interviews<br>Pre-intervention teacher survey  |
| <b>Implementation fidelity</b> | Was ASCENTS implemented as planned by both universities and schools?<br><br>What were the drivers and obstacles to implementation?   | Pre-intervention programme managers interviews<br>Post-intervention programme managers interviews<br>Mentors training observations |
| <b>Mentors' responsiveness</b> | How engaged were mentors in preparations, delivery and follow up?<br><br>What were the perceived costs and benefits of being an ASCENTS mentor? What did mentors learn?<br><br>How did mentors feel about mentoring?<br><br>What were the drivers/obstacles to mentors' engagement? <sup>20</sup>              | Pre-intervention mentor survey<br>Post-intervention mentor survey<br>Mentors training observations<br>Mentoring observations       |
| <b>Mentees' responsiveness</b> | How engaged were mentees in preparing for, attending and following up on mentoring sessions?<br><br>What were the perceived costs and benefits of participating in ASCENTS?<br><br>How did mentees feel about mentoring sessions?<br><br>What were the drivers/obstacles to mentees' engagement? <sup>21</sup> | Pre-intervention mentee survey<br>Post-intervention mentee survey<br>Mentees focus groups<br>Mentoring observations                |
| <b>Wider outcomes</b>          | What is the perceived effect of ASCENTS on classroom learning dynamics (as defined above)?<br><br>What is the perceived effect of ASCENTS on schools and teachers? <sup>22</sup>   | Post-intervention teacher interviews<br>Pre-intervention teacher survey  |

<sup>20</sup> For example: prior attainment of mentors, gender pairing, distance between mentors' home and school, age of the mentor, etc.

<sup>21</sup> For example: gender pairing, prior attainment of mentees, whether attended final revision day

<sup>22</sup> For example: effect of teachers' workload and class management, etc.

|                      |  |   |
|----------------------|--|---|
|                      | What are the drivers/obstacles to positive outcomes? <sup>23</sup> | Post-intervention teacher survey  |
|                      | Is ASCENTS attractive for universities to take up and deliver?     | Pre-intervention programme managers interviews<br>Post-intervention programme managers interviews |
| <b>Affordability</b> | How affordable is ASCENTS, in terms of per-pupil cost?             | Post-intervention programme managers interviews   |

### 5.3. Data collection plan

The IPE will synthesize the data collected from 12 research instruments.

#### Research with mentors

##### 5.3.1. Pre-intervention mentor survey

The **aim** of this survey is to collect data on mentors' profile and background, mentoring experience, career aspirations, motivation to take part in ASCENTS, experience of ASCENTS so far (application, training) and expectations about ASCENTS and mentoring. The indicative **timing** of this survey is May 2019 (during the mentor training). The **mode** of this survey is online. The expected **completion time** is 15 minutes.

##### 5.3.2. Post-intervention mentor survey

The **aim** of this survey is to collect data on mentors' experience of ASCENTS (delivery of the mentoring sessions, interactions with students, teachers, and programme managers, etc.), study plans and career aspirations. The indicative **timing** of this survey is June 2020. The **mode** of this survey is online. The expected **completion time** is 15 minutes.

#### Research with mentees

##### 5.3.3. Pre-intervention mentee survey

The **aim** of this survey is to provide a baseline of pupils' intermediate outcomes, such as motivation, attitudes to science, confidence in relation to their science GCSEs and career aspirations. It will also gather contextual information on science-related extracurricular activities (including private tutoring) that students have been involved in or are intending to take part in during the intervention period. The indicative **timing** of this survey is September 2019 (as part of the first mentoring session). **Mode:** This survey will be paper-based. The expected **completion time** is 15 minutes.

##### 5.3.4. Post-intervention mentee survey

The **aim** of this survey is to twofold. The first part of the survey will capture any change in pupils' motivation, confidence and attitude to science by repeating relevant questions in the pre-intervention survey. The second part will collect data on pupils' experience of the

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<sup>23</sup> For example: Ofsted rating, timing of mentoring sessions whether additional programmes are taking place, etc.

programme and relationship with mentors. The indicative **timing** of this survey is May-June 2020 (either during the final mentoring session or the university day). **Mode**: this survey will be paper-based. The expected **completion time** is 15 minutes.

#### *5.3.5. Mentees focus groups*

Six to eight focus groups will be organised with mentees. The **aim** of these focus groups is to capture (i) how mentees feel about the mentoring sessions, (ii) the perceived pros and cons of mentoring, and (iii) whether they discussed the support they received with, or took on opportunities to tutor or mentor friends and peers. The indicative **timing** of these focus groups is May 2020. The expected **duration** is 60 minutes.

### Research with teachers (school project leads)

#### *5.3.6. Pre-intervention teacher survey*

A survey of school leads in participating schools will be conducted. The **aim** of this survey is to gather contextual information on the school, such as the types of additional science activities or extra help that are available to students, and their arrangement to facilitate mentoring sessions, to understand usual practice. The indicative **timing** of this survey is September 2019. The **mode** of this survey is online. The expected **completion time** is 10 minutes.

#### *5.3.7. Post-intervention teacher survey*

Whereas the pre-intervention survey will be conducted among school leads only, the post-intervention survey will include all science teachers. The **aim** of this survey is to collect up-to-date contextual information on (i) the types of additional science support provided to students and level of take-up; and (ii) the control condition. It will gather information on how the mentoring sessions were delivered in school, intervention dosage and any perceived benefits or challenges for the school, whole class and individual students. Questions will also be asked about how randomisation was perceived by pupils and whether assignment to the control condition created any resentment/compensatory behaviour. The indicative **timing** of this survey is June 2020. The **mode** of this survey is online. The expected **completion time** is 15 minutes.

#### *5.3.8. Post-intervention teacher interviews*

ASCENTS leads in sampled schools will be interviewed. The **aim** of these light-touch interviews is to explore: teachers' perceptions of the wider outcomes of the project, including classroom learning dynamics (pace of teaching/learning, student engagement with the teachers and the teaching materials, students' attitudes and interest in science and progress made by non-participating students), teachers' workload and class management; and business as usual. The indicative **timing** of these interviews is July 2020. The **mode** of these interviews is online. The expected **duration** is 20 minutes.

### Research with programme managers

#### *5.3.9. Pre-intervention programme managers interviews*

The **aim** of these interviews is to gather information on (i) delivery partners' motivation to take part in ASCENTS, (ii) their approach to mentor recruitment and school recruitment, (iii) the allocation of mentors to mentees, (iv) the support that will be provided over the course of the school year, and (v) the support received from the programme lead (Lincoln) and other universities (if any), as well as the usefulness of information received. The indicative **timing**

of these interviews is June 2019. The **mode** of these interviews is online (phone). The expected **duration** is 45 minutes.

#### 5.3.10. Post-intervention programme managers interviews

The **aim** of these interviews is to gather monitoring information about the implementation of the programme (number of mentors recruited and retained, number of mentees recruited and retained, number of ASCENTS sessions held, etc.), the time spent delivering ASCENTS (with a view to estimating the true cost of the programme) and the drivers and obstacles to the optimal delivery of ASCENTS. The indicative **timing** of these interviews is July 2019. The **mode** of these interviews is online (phone). The expected **duration** is 45 minutes. Programme managers will be provided with a pro forma to share monitoring information in a consistent way.

### Observations

#### 5.3.11. Mentor training observations

The second day of training will be observed in two settings. The **aim** of these observations is to understand (i) how the delivery team framed the benefits of ASCENTS for mentors, (ii) what support the team offered mentors to overcome potential obstacles, (iii) how detailed was the advice the team gave to mentors, (iv) whether key risks were identified and discussed, and (v) the level of engagement of mentors. The indicative **timing** of these observations is May 2019. The expected **duration** of each observation is one day.

#### 5.3.12. Mentoring observations

The **aim** of these observations is to analyse the quality of mentor-mentee interactions, including: the punctuality of sessions, the structure of the session, the number of questions, the type of questions (substantive questions vs. more 'pastoral' questions), references to previous sessions and the quality of the rapport between mentor and mentee. The indicative **timeframe** for these observations is January-April 2020. The expected **duration** of each observation is 60 minutes.

## 5.4. Sampling plan

| Unit of analysis     | Number | Sampled | Points in time | Justification  |
|----------------------|--------|---------|----------------|--|
| <b>Organisations</b> |        |         |                |  |
| Universities         | 5      | 5       | N/A            | All universities will be included in the evaluation.   |
| Schools              | 35     | 10      | N/A            | Two schools per university will be sampled and used as case studies. These two schools will purposively be selected to provide range and variation with regard to size, Ofsted rating, and GCSE results. |
| <b>People</b>        |        |         |                |  |
| Programme managers   | 5      | 5       | 2              | All programme managers will be interviewed at two points in time: pre-intervention and post-intervention   |

|                          |          |          |   |   |
|--------------------------|----------|----------|---|---|
| Mentors                  | 385      | 385      | 2 | All mentors will be surveyed at two points in time: pre-intervention and post-intervention.   |
| Mentees                  | 385      | 385      | 2 | All mentees will be surveyed at two points in time: pre-intervention and post-intervention.   |
|                          | 385      | 25-30    | 1 | Five or six students will be interviewed in five of the sampled schools. The schools will be purposively selected, based on access and convenience.   |
| Teachers                 | Un-known | Un-known | 2 | All teachers will be surveyed at two points in time: pre-intervention and post-intervention.  |
|                          | Un-known | 10       | 1 | One teacher per sampled school will be interviewed at one point in time. The teacher is likely to be the contact person at the school or a deputy.  |
| <b>Events</b>            |          |          |   |   |
| Mentoring sessions       | 8,855    | 6-8      | 1 | One mentoring session will be observed in six to eight sampled schools. Insofar as possible, all sessions will be at a similar stage of the intervention. Although the selection of the sessions is likely to be dictated by convenience, NatCen will seek to maximise variation in terms of mentor experience. |
| Mentor training sessions | 15-20    | 2        | 1 | The second day of training will be observed in two different universities. These two sessions will be selected by convenience.  |

### 5.5. Analysis plan

Raw, qualitative data will be analysed thematically, using the Framework approach. This will allow us to analyse the data by dimension and by profile. For example, responsiveness will be analysed among all mentors, identifying similarities and differences by level of experience or career aspirations.

Raw, quantitative data will be analysed by means of frequencies and cross tabulations, using SPSS.

### 5.6. Cost evaluation

Costs will be evaluated in accordance with EEF guidelines. Cost data will be collected from all participating universities and schools. Relevant costs include:

- Direct, marginal costs;
- Relevant pre-requisites;
- School staff time.

A per-pupil, per-year cost will be estimated, including:

- Fees for services (e.g. mentoring sessions, ongoing support and monitoring provided by programme leads and school leads).
- Purchasing (or printing/photocopying) resources, materials and equipment. This might include textbooks, handouts, or digital technology.
- Travel/subsistence.

## 6. Follow-up study on mentors' study and career paths

### 6.1. Research questions

The follow-up study will answer five research questions:

1. Have mentors developed an interest in becoming teachers after their participation in ASCENTS? What are the background, attitudinal or experiential variables correlated with interest?
2. What proportion of mentors have enrolled in Initial Teacher Training? What are the background, attitudinal or experiential variables correlated with enrolment?
3. What proportion of mentors have become science teachers? What are the background, attitudinal or experiential variables correlated with becoming a teacher?
4. What proportion of mentors have become teachers? What are the background, attitudinal or experiential variables correlated with becoming a teacher?
5. Of those who rated high on interest in becoming a teacher, what proportion of mentors didn't enrol on training or become a teacher? What are the background, attitudinal or experiential variables correlated with this behaviour?

### 6.2. Data collection plan

#### 6.2.1. Follow-up mentor survey

The **aim** of this survey is to collect data on mentors' study/career progression, whether they entered teacher training or the teaching profession and, for those who did, their reasons for making such a decision. The indicative **timing** of this survey is one year after mentors' graduation, which means that it will be conducted in November 2021, November 2022 and November 2023 with the relevant mentors. The **mode** of this survey is online. The expected **duration** is 15 minutes.

#### 6.2.2. Follow-up mentee analysis

NatCen will attempt to obtain data from the Initial Teacher Training Performance Profiles (ITTPP)<sup>24</sup> and the School Workforce Census (SWC)<sup>25</sup>. The **aim** of these data requests is to explore whether some of the ASCENTS mentors have decided to enrol in teacher training or become teachers even after they have completed the follow-up survey. The indicative **timing** of this data requests is Summer 2024 (which is when data from 2023 will be published).

#### 6.2.3. Data linkage

ITTPP and SWC will be matched using Teacher Reference Numbers (TRN), a unique identifier used throughout a teacher's career. TRN is well-populated and reliable in both

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<sup>24</sup> The ITTPP includes information on age, gender, declared disability status, declared ethnicity, subject, degree class, and route onto ITT. The most recently published statistics (in July 2018) were for final year trainees in the 2016-2017 academic year.

<sup>25</sup> The School Workforce Census (SWC) is collected annually in November. It identifies all teachers working in state-funded schools in England. The SWC provides information about the individual's work status, type of school employed in, full or part-time status, contract, roles and responsibilities, subject taught salary, sickness absence and qualifications. It also provides data on 'teacher leavers' (ex-teachers who have left the profession).

datasets<sup>26</sup>. TRN can be used to match on data at later time periods, creating a longitudinal data set for the purposes of analysis. The linked dataset could potentially be used to assess how many undergraduate mentors were awarded Qualified Teacher Status (QTS), how many found employment in a state-funded teaching role, and their retention rates. ITT PP and SWC can be matched using Teacher Reference Numbers (TRN), a unique identifier used throughout a teacher's career. TRN is well-populated and reliable in both datasets<sup>27</sup>. TRN can be used to match on data at later time periods, creating a longitudinal data set for the purposes of analysis. The linked dataset could potentially be used to assess how many undergraduate mentors were awarded Qualified Teacher Status (QTS), how many found employment in a state-funded teaching role, and their retention rates.

Data collected from the ITTPP/SWC will be linked with the survey data (follow-up mentor survey, pre-intervention survey and post-intervention survey) using the forename, surname, UCAS number and date of birth, along with length of course and course year at time of ASCENTS for all ASCENTS mentors.

NatCen will attempt to link survey and attainment data.

### **6.3. Sampling plan**

The follow-up analysis will include all mentors with a compliance score of 1 or more (i.e. who have delivered a minimum of one mentoring session).

### **6.4. Key outcome variables**

For Research Question 1, the outcome variable will be a measure of mentors' interest in becoming teachers. This variable is likely to be measured on a 1-10 point scale.

For Research Questions 2-5, the outcome variable will be dichotomous (1=observed, 0=not observed).

### **6.5. Analysis plan**

For Research Question 1, NatCen will model the strength of mentors' interest given a number of background, experiential and attitudinal variables using linear regression.

For Research Questions 2-5, NatCen will model the odds of observing the relevant behaviour vs. not, given a number of background, experiential and attitudinal variables using binary logistic regression.

This approach does not allow for a causal estimate of the difference the ASCENTS programme made to mentor outcomes.

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<sup>26</sup> Previous research suggests matching 86% of individuals on ITTPP data could be matched to the SWC Census using the TRN ([https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/682892/SFR11\\_2018\\_Main\\_Text.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/682892/SFR11_2018_Main_Text.pdf))

<sup>27</sup> Previous research suggests matching 86% of individuals on ITTPP data could be matched to the SWC Census using the TRN ([https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/682892/SFR11\\_2018\\_Main\\_Text.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/682892/SFR11_2018_Main_Text.pdf))

## 7. Ethics and registration

### 7.1. Ethics

NatCen's Research Ethics Committee (REC) reviewed and approved the research proposal for this project on 11 January 2019. The committee consists primarily of senior NatCen staff. The guidance and recommendations provided by the REC have been incorporated in this study plan.

### 7.2. Procedures for obtaining agreement to participate in the trial

#### 7.2.1. Mentor recruitment

Delivery partners identified and recruited mentors, with NatCen communicating the requirements for research participation. Mentors were sent an information letter including a link to the NatCen project webpage, and were asked to sign a Memorandum of Understanding where they express consent to take part in the evaluation. Details of participating mentors were transferred to NatCen securely via FTP.

#### 7.2.2. School recruitment

Delivery partners identified and recruited eligible schools, with NatCen advising on eligibility criteria and communicating the requirements for research participation. Schools were sent an information letter including a link to the NatCen project webpage, and were asked to sign a Memorandum of Understanding where they express consent to take part in the evaluation. Details of participating schools' project leads were transferred to NatCen securely via FTP.

#### 7.2.3. Pupil recruitment

Schools were responsible for recruiting eligible pupils. Schools were provided with two information letters: one for eligible pupils and one for their parents. These letters detailed the various aspects of the intervention and evaluation, the voluntary nature of participation and the management of confidentiality and anonymity. They were also be provided with a link to the NatCen project webpage should they require further information. Relevant details of pupils whose parents gave permission for them to take part in the intervention were transferred to NatCen securely via a secure website.

Pupils (or their parents if under 16) will have the possibility to object to their data being processed as part of the evaluation at any point after data collection and until a draft report is submitted to the EEF. They will also have the right to raise any concerns with the Information Commissioner's Office (ICO).

### 7.3. Registration

The trial's registration number is: ISRCTN28630907

More details are available on the ISRCTN website:

<https://doi.org/10.1186/ISRCTN28630907>

## 8. Data protection

The Education Endowment Foundation (EEF) and Wellcome Trust have funded the National Centre for Social Research (NatCen) to carry out the independent evaluation of ASCENTS.

NatCen is the data controller and data processor for this project. In order for the use of personal data to be lawful, one (or more) conditions must be met, as set out in Article 6(1) of the General Data Protection Regulation (GDPR).

### 8.1 Personal data

The legal basis for processing personal data is covered by GDPR Article 6 (1) (f):

*Legitimate interests: the processing is necessary for your (or a third party's) legitimate interests unless there is a good reason to protect the individual's personal data which overrides those legitimate interests.*

NatCen's assessment is that the evaluation fulfils one of its core business purposes (undertaking research, evaluation and information activities) and is therefore in its legitimate interest, that processing personal information is necessary for addressing the research questions in this study. NatCen has considered and balanced any potential impact on the data subjects' rights and find that its activities will not do the data subject any unwarranted harm.

### 8.2. Data processing

NatCen will provide a Memorandum of Understanding to participating schools and mentors, explaining the nature of the data being requested, how it will be collected, and how it will be passed to and shared.

Procedures for ensuring data quality, anonymity and confidentiality can be found in the privacy notice<sup>28</sup>.

The evaluation will necessitate the use of NPD data for baseline and endline measures of the outcomes of interest. At time of writing, new GDPR compliant procedures and processes are being implemented by NPD and the Department of Education. NatCen anticipates accessing and analysing NPD data either in the NPD Data Lab or via NPD secure, remote access. Analysis will be undertaken in Stata with steps recorded using *do* and *log* files. Current practice is for final datasets to be archived in the EEF archive managed by FFT Education. By the time of archiving it is likely that the EEF archive will be hosted within the ONS SRS.

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<sup>28</sup> <http://www.natcen.ac.uk/taking-part/studies-in-field/evaluation-of-ascents-121-support-for-science/privacy-notice/>

## 9. Personnel

### 9.1. Delivery team

Ian Abrahams (University of Lincoln);  
Ruth Amos (University College London, Institute of Education);  
Lynda Dunlop (University of York);  
Leanne Mason (University of York);  
Michael Inglis (University of Leeds);  
Michael Reiss (University College London, Institute of Education);  
Rachael Sharpe (University of Lincoln);  
Helen Vaughan (University of Liverpool).

### 9.2. Evaluation team<sup>29</sup>

|                              |                        |
|------------------------------|------------------------|
| Conceptualisation            | LM; DP                 |
| Data curation                | BS; RS; TB; HB         |
| Analysis                     | BS; RS; TB; HB; DP; AV |
| Funding acquisition          | LM; DP                 |
| Investigation                | BS; RS; TB; HB         |
| Methodology                  | LM; DP; AV             |
| Project administration       | AV; DP; BS             |
| Resources                    | NatCen Social Research |
| Software                     | RS                     |
| Supervision                  | AV; DP                 |
| Validation                   | FH; MV                 |
| Visualisation                | RS; TB; HB             |
| Writing – original draft     | BS; RS; TB; HB; AV; DP |
| Writing – review and editing | AV; DP                 |

AV: Arnaud Vaganay  
BS: Berenice Scandone  
DP: Daniel Philips  
FH: Fatima Husain  
HB: Helen Burridge  
LM: Lydia Marshall  
MV: Martina Vojtkova  
RS: Rukmen Sehmi  
TB: Tom Bristow

All evaluators are affiliated with NatCen Social Research.

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<sup>29</sup> Based on the CRediT taxonomy of research roles: <https://casrai.org/credit/>

## 10. Risks

| Risk   | Likelihood/<br>Impact                           | Mitigation/Contingency   |
|--|---|--|
| <b>School leads do not engage with the evaluation activities at the beginning of the project</b> | <b>Likelihood:</b> Low<br><b>Impact:</b> High   | NatCen will ensure that the Memorandum of Understanding (MoU) includes details about the requirements of the evaluation. Schools will be asked to share securely with NatCen the list of pupils whose parents have given permission for them to take part in ASCENTS, as a key requirement for taking part in the programme. NatCen will work closely with Lincoln and partner universities so that school leads are aware of the evaluation timetable and requirements. |
| <b>School staff do not complete the survey</b>   | <b>Likelihood:</b> Low<br><b>Impact:</b> Medium | As per other EEF studies, NatCen proposes an on-line approach. The survey fieldwork period will be sufficiently long to allow staff to complete the survey at a time suitable to them. NatCen will also ensure the survey is no longer than 10-15 minutes. Reminders will be sent through the key contact in each school.  |
| <b>Mentors do not complete the survey</b>  | <b>Likelihood:</b> Low<br><b>Impact:</b> Medium | To maximise the response rate, NatCen proposes that the 1 <sup>st</sup> wave of the mentor survey is administered online during mentor training at each of the partner universities. Should mentors wish to complete it in their own time, the survey will be live for a sufficiently long period for them to do so. The survey will be no longer than 10-15 minutes.  |
| <b>Pupils do not complete the survey</b>   | <b>Likelihood:</b> Low<br><b>Impact:</b> Medium | NatCen proposes that the survey will be administered in hard-copy and completed during school time. The survey will be short.  |
| <b>Difficulty scheduling school visits within the required timescale</b>                         | <b>Likelihood:</b> Low<br><b>Impact:</b> Medium | The initial recruitment materials will set out clearly the data collection points and details about the study so that schools are making an informed decision about whether to participate. Sufficient resource allocated to arranging visits and large team means NatCen has flexibility.   |
| <b>Lack of success in gaining access to school staff</b>   | <b>Likelihood:</b> Low<br><b>Impact:</b> High   | NatCen will seek to identify a key contact in each school to support the research and facilitate access to school staff. NatCen will work in close collaboration with Lincoln and partner universities and seek their support if NatCen struggles to engage school staff.  |
| <b>Mentor drop-out or attrition</b>  | <b>Likelihood:</b> Low<br><b>Impact:</b> Low    | NatCen will work closely with Lincoln and partner universities to address any concerns about burden on mentors. Universities have been asked to recruit additional mentors in case mentors drop out before the programme starts. If mentors drop-out after programme start, pupils will be offered mentoring by another mentor.  |

|   |  |   |
|---|--|---|
| <b>Pupil information collection is delayed</b>  | <b>Likelihood:</b> Low<br><b>Impact:</b> Medium  | NatCen will work closely with Lincoln and partner universities so that they are aware of exactly what information is required and when. NatCen will detail this as part of the MOU in the 'information requirements' sheet supplied by NatCen. NatCen will also proactively collect data, engage project leads in information requirements as part of the initial interviews, and use project administrator time to contact and support colleges through this process.  |
| <b>Pupil-level attrition</b>  | <b>Likelihood:</b> Low<br><b>Impact:</b> Medium  | Recruitment has been planned to allow for some attrition of pupils.   |
| <b>Differential pupil attrition from control and intervention groups</b>                | <b>Likelihood:</b> Low<br><b>Impact:</b> Low     | The trial is well-designed and NatCen would expect some attrition, but with this sample size this should be evenly matched across trial arms.   |
| <b>School level attrition</b>   | <b>Likelihood:</b> Low<br><b>Impact:</b> High    | The requirements of the trial will be clearly communicated in the MOU and settings will be provided with clear instructions at the start of the project on what needs to be done and when.  |
| <b>Access to NPD data</b>   | <b>Likelihood:</b> Low<br><b>Impact:</b> Low     | NatCen will need to access NPD data for outcomes and baseline measures of student attainment. The new GDPR compliant procedures and processes that are being implemented by NPD and the Department of Education may result in a delay in obtaining an NPD data extract for conducting. The implications of this have been accounted for in the reporting milestones set out in the timetable below.   |
| <b>Staffing issues: staff leaving/unavailable over extended duration of the project</b> | <b>Likelihood:</b> Medium<br><b>Impact:</b> High | Succession planning has been built into team roles. Large teams can absorb problems in the short-term. Sufficient numbers of experienced staff in senior roles are available to cover others in the team.   |
| <b>Data may not be protected</b>  | <b>Likelihood:</b> Low<br><b>Impact:</b> High    | NatCen has a range of policies and practices in place to ensure secure data handling. NatCen will categorise all data and files to 5 different levels, dictating how they are stored, handled and transmitted. NatCen will use an encrypted data drive using PGP Whole Disk Encryption by Symantec. If a laptop is lost or stolen, the data on the hard drive is inaccessible. The encryption used by PGP is certified to FIPS 140-2 standards, and NatCen also use encrypted digital recorders for qualitative interviews. |
| <b>Staffing issues: staff leaving/unavailable over extended duration of the project</b> | <b>Likelihood:</b> Medium<br><b>Impact:</b> High | Succession planning has been built into team roles. Large teams can absorb problems in the short-term. Sufficient numbers of experienced staff in senior roles are available to cover others in the team.   |

## 11. Timeline

| Dates              | Activity   | Staff responsible/<br>leading |
|--------------------|--|-------------------------------|
| May 2019           | Mentor training observations<br>Pre-intervention mentor survey   |                               |
| June 2019          | Randomisation of pupils<br>Pre-intervention programme managers interviews  |                               |
| September 2019     | Pre-intervention mentee survey<br>Pre-intervention teacher survey  |                               |
| January-April 2020 | Mentoring observations   |                               |
| May 2020           | Mentees focus groups   |                               |
| June 2020          | Post-intervention mentor survey<br>Post-intervention mentee survey<br>Post-intervention teacher survey   |                               |
| July 2020          | Post-intervention programme managers interviews  |                               |
| March 2021         | Submission of draft report to EEF  |                               |
| June 2021          | Protocol revision (mentor follow-up)<br>Ethical approval   |                               |
| September 2021     | Submission of updated report to EEF<br>Submission of data to EEF archive<br>Updating of ISRCTN registry with results                                       |                               |
| November 2021      | Follow-up mentor survey  |                               |
| September 2022     | Submission of updated evaluation report to EEF (including pupil follow-up); submission of data to EEF archive and updating of ISRCTN registry with results |                               |
| November 2022      | Follow-up mentor survey  |                               |
| November 2023      | Follow-up mentor survey  |                               |
| June 2024          | Data requests ITT PP and SWC   |                               |
| February 2025      | Submission of final evaluation report to EEF   |                               |

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