



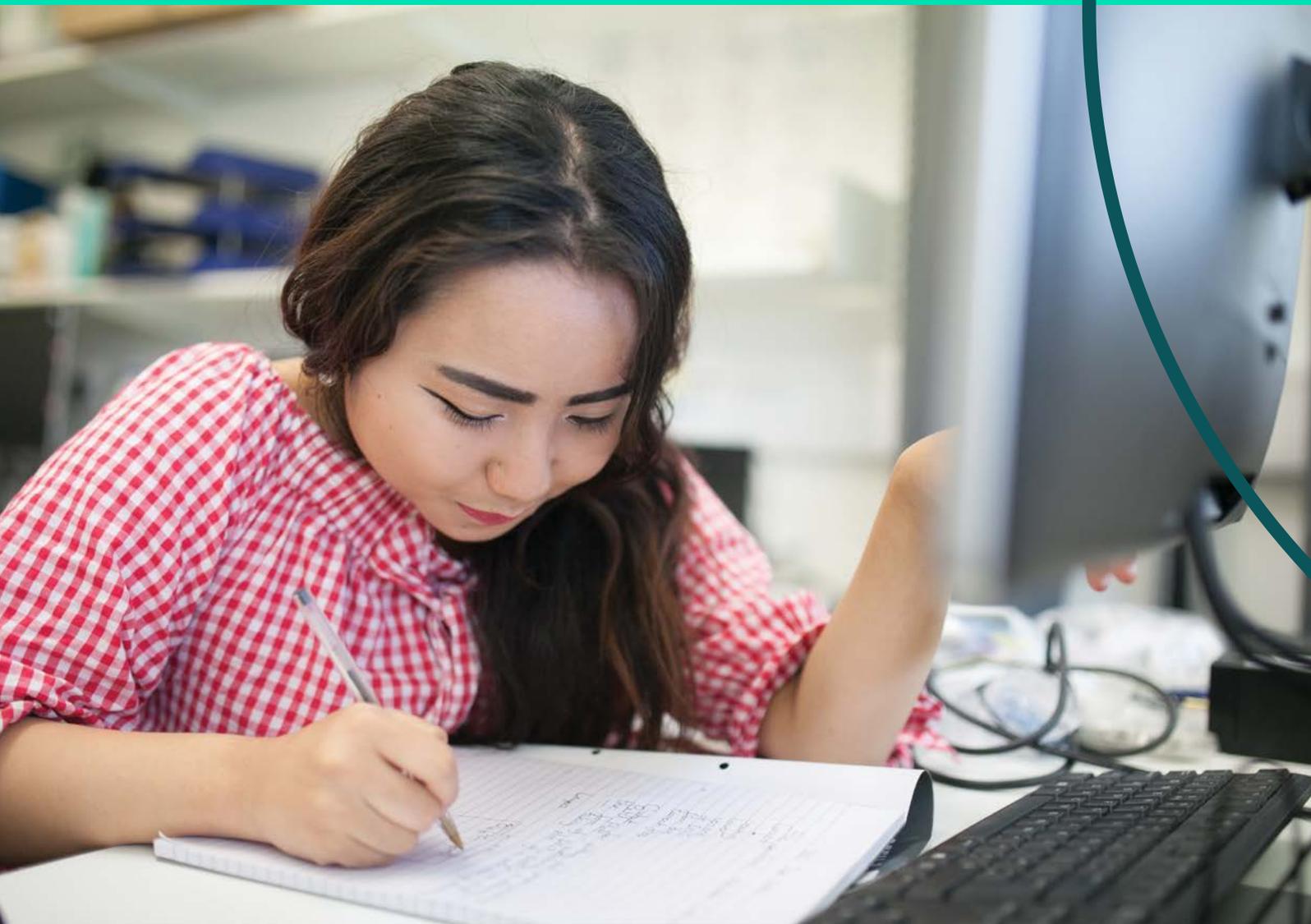
Report focus

Interim report from an independent evaluation of the impact of Nuffield Research Placements on the education and career outcomes of students.

Authors

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Evaluation of Nuffield Research Placements: interim report



About the Nuffield Foundation

The Nuffield Foundation is an independent charitable trust with a mission to advance social well-being. Our aim is to improve people's lives, and their ability to participate in society, by understanding the social and economic factors that affect their chances in life.

We fund research that informs social policy, primarily in Education, Welfare, and Justice. We also fund student programmes – Nuffield Research Placements and Q-Step – to enable young people to develop skills and confidence in quantitative and scientific methods.

We have established the Ada Lovelace Institute, an independent research and deliberative body with a mission to ensure data and AI work for people and society, and we are the founder and co-funder of the Nuffield Council on Bioethics.

The Nuffield Foundation has commissioned Frontier Economics to evaluate Nuffield Research Placements, but the views expressed are the those of the authors and not necessarily of the Foundation.

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Foreword

Nuffield Research Placements give talented post-16 students across the UK the opportunity to undertake a high quality research project through a 4-6 week placement with a local employer in their summer holidays. Most placements are at universities, research institutes and in industry. In the past five years we have increasingly focused on providing placements for young people from disadvantaged backgrounds, whether from low income households, families with no history of higher education or those in care.

In providing this opportunity to over 1,000 students each year, our aim is to develop their skills and confidence in quantitative and scientific methods – skills that are central to the Foundation's mission to advance educational opportunity and social well-being. In the 20-year period leading up to the evaluation (1996 - 2016), 16,000 students have participated.

As an organisation committed to robust research, evaluation and programme design it is important for us to assess the impact of Nuffield Research Placements on student experience and outcomes. In 2016, we commissioned an independent evaluation of the programme, led by Dr Gillian Paull at Frontier Economics. The six year evaluation is tracking the education and career destinations of three cohorts in comparison to similar students that have not undertaken a placement. In addition to providing a robust assessment of impact, the evaluation makes recommendations for how the programme might be improved.

This interim report from the evaluation summarises findings to date and provides some early indications of positive impact on student outcomes. It shows that students who undertake a placement are more likely to go on to study a science, technology, engineering or maths (STEM) course at a Russell Group university than comparable students. This is impressive because these students have already met the programme's high attainment eligibility criteria, but enhance their prospects even further through the placement. Students themselves perceive their participation as important in developing many of the transferable skills valued in the world of work.

The report also highlights the programme's achievements in encouraging a diverse range of students to apply for and undertake placements and identifies ways we might build on these successes. The findings suggest that we may wish to expand the provision and diversity of placements for female students, who already represent just over half of participants.

There are many programmes that – like Nuffield Research Placements – are aimed at enriching young people's education or supporting those that are disadvantaged. However, they are rarely evaluated in this rigorous way. We hope that sharing details of the evaluation and its initial findings will help strengthen approaches to designing and evaluating programmes and encourage equivalent studies.

We are grateful to all those who work with us to deliver Nuffield Research Placements, including our co-funders Wellcome and UKRI who have contributed to the evaluation, our network of regional programme co-ordinators, the teachers and employers who provide support and placements, and of course the students themselves. We look forward to sharing further findings from the evaluation in due course.



Josh Hillman
Director of Education, Nuffield Foundation

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Executive Summary

The Nuffield Foundation provides post-16 students the opportunity to undertake science, technology, engineering and mathematics (STEM) research placements through the Nuffield Research Placements (NRPs) programme. The programme aims to deepen students' understanding of STEM subjects and research, and to encourage them to pursue further studies and careers in STEM by arranging a four- to six-week STEM research placement for students between Years 12 and 13 (or equivalent). The programme began in 1996 and in the 20-year period to 2016, an estimated 16,000 students have participated.

In 2016, the Nuffield Foundation commissioned Frontier Economics and CFE Research to evaluate the impact of NRPs on the education and career outcomes of students and to identify areas where the programme might be improved. This interim report summarises the findings to date and preliminary estimates of impacts for the 2014 cohort.

The key findings are:

- **NRPs increase the likelihood of enrolling in a STEM course at a Russell Group higher education institution (HEI)**, with similar sized impacts for all pupils and for more disadvantaged (free school meals (FSM)) pupils. Undertaking a placement is associated with a higher enrolment rate in a STEM course of 8 percentage points and higher enrolment in a Russell Group HEI also of 8 percentage points, both for all pupils and for more disadvantaged pupils. There is no discernible impact on enrolment in higher education (HE) per se, possibly because most students were planning to attend HE prior to application for an NRP.
- **The placement experience is perceived to enhance transferable skills**, including study motivation, overall confidence in abilities and specific skills in presenting, writing and time management. These skills are beneficial both for employment within STEM and for their transferability to employment in other areas.
- **Students report that placements improve their understanding of what STEM researchers do** on a day-to-day basis but do not appear to influence their attitudes on how interesting a STEM career is or how much they enjoy the study of STEM subjects. Placements also do not appear to influence students' aspirations and plans, mainly because most placement students aspired to study for a STEM degree even prior to application for an NRP.
- **NRPs increase the number and quality of STEM A Levels achieved**, which may support the impacts on HE enrolment. Undertaking a placement is associated with a higher average number of STEM A Levels of 0.2 for all pupils and 0.3 for FSM pupils, and a higher average point score for STEM A Levels of 7 for all pupils and of 11 for FSM pupils (which roughly corresponds to one grade for one A Level).
- **The programme is successfully targeting disadvantaged pupils**. However, while 56 percent of placement students were female in 2016, the proportion of female pupils applying to the programme should be higher relative to male pupils given their prior educational attainment, and female NRP students are more likely than males to have placements in biology and chemistry related subjects than in physics, computing or engineering related subjects.

Later work will extend the impact analysis to all three 2014-to-2016 cohorts and include the impacts on post-HE study and employment.

Chapter 1: The Evaluation of Nuffield Research Placements

Why is there a need for STEM placements?

There is a shortage of skills in STEM (science, technology, engineering and mathematics) subjects in the UK (House of Commons, 2018). Over a third of employers report difficulties recruiting STEM skilled staff and one in four employers report that applicants for STEM roles do not have adequate practical experience or laboratory skills for work (CBI, 2015). Businesses continue to regard a focus on STEM subjects as their top priority area for action in secondary schools, and hands-on application of STEM knowledge is seen as key to helping foster greater appreciation of its importance (CBI, 2018). A recent National Audit Office report concluded that the existing evidence indicates that there is a STEM skills mismatch rather than a simple shortage, including particular shortages of STEM skills at technician level, but an oversupply in other areas, such as biological science graduates. There is also evidence to suggest that, at graduate level and above, the problem is sometimes one of quality rather than quantity, with people not having all of the employability or practical skills they need to enter the workforce (National Audit Office, 2018).

Students from disadvantaged backgrounds are particularly under-represented in STEM. For example, Gorard and See (2009) showed a clear disparity in numbers of students choosing to study STEM subjects post 16 by free school meals (FSM) status, only part of which was explained by lower attainment among students eligible for FSM. In addition to reducing diversity and economic potential, low STEM participation among disadvantaged groups limits individual opportunities for social mobility: those who study STEM subjects at A Level and degree level typically earn higher salaries later in life (Dolton & Vignoles, 2002; Greenwood et al., 2011), although substantial proportions of the differences are explained by other differences in individual characteristics (Belfield et al., 2018).

What are Nuffield Research Placements?

The Nuffield Foundation provides post-16 students the opportunity to undertake STEM research placements through the Nuffield Research Placements (NRPs) programme. The programme aims to deepen students' understanding of STEM subjects and research, and to encourage them to pursue further studies and careers in STEM by arranging a four- to six-week STEM research placement for students between Years 12 and 13 (or equivalent). The programme began in 1996 and in the 20-year period to 2016, an estimated 16,000 students have participated.

Placements are delivered across the UK, managed by co-ordinators representing 13 English regions, Scotland, Wales and Northern Ireland. Beginning in September each year, the programme recruits and supports a range of organisations, including universities, research institutes and private sector firms, to offer placements in STEM, while also working with schools and colleges to raise awareness of the programme and encourage students to apply. Applicants are then screened and matched to the available placements.

To be eligible for a placement, students must be studying for at least one A Level (or equivalent) in a STEM subject and have five GCSEs (or equivalent) at grade B or above, including maths, English and a science. Applicants are also expected to have an interest in studying STEM at university. All students who meet the academic eligibility criteria are able to apply, although the Nuffield Foundation has focused in recent years on reaching students from more disadvantaged backgrounds. In the allocation of places, each region has an

allotted number of places based on the number of Year 12 students. The regional coordinators select students on a range of criteria, including prioritising those with particular disadvantages beyond the FSM measure such as those with low science capital or those who lack other opportunities. However, as the matching process takes into account a number of different elements, including availability of places in a student's preferred subject area, this means that the exact process varies across regions.

Students undertake the placements over a four- to six-week period in July and August, followed by the submission of a placement report and a 'celebration event' for students to share their experiences with other students, parents, placement supervisors, and school and college staff. All students taking part in the scheme have their travel expenses reimbursed. Additional financial support is given to bursary students who must meet one of the following criteria: be eligible for FSM, or have been in the last six years; have a total household income below £30,000; or be living in local authority care. In 2016, 50 percent of Nuffield students were eligible for a bursary.

What are the objectives of the NRP programme?

The current theory of change for NRPs is structured around a set of short-term outcomes (up to 18 months after the placement) and long-term outcomes (18 months to five years after the placements) for young people, providers and schools and colleges:

- For young people, the short-term outcomes include improved confidence, independent working, science capital/networks and informed decision-making, as well as enhancing opportunities for Gold CREST awards and success in National Schools Employability Challenge competitions. In addition, the placement experience aims to support higher education institution (HEI)/job interviews, more successful UCAS applications and attendance at research-intensive and 'top' 30 HEIs. The long-term outcomes include greater completion of higher education (HE) study in a STEM subject, further study (MSc, PhD) in STEM and employment in research.
- For placement providers/supervisors, the short-term outcomes include greater understanding of STEM education in schools and of the challenges faced by less well-represented groups in STEM; the development of management and supervision skills; and opportunities to engage the public in research. The long-term outcomes include offering more placement opportunities (particularly in industry); top 30 HEIs focusing on authentic research placements with independent study work (not just NRPs); and early career researchers establishing links to local schools and colleges.
- For schools and colleges, the short-term outcomes include more students from target schools and colleges applying and more FSM-eligible students applying. The long-term outcomes include sustainable relationships between schools and colleges and the Nuffield Foundation and more informed key stage 4/Scottish Highers (or equivalent) subject choices by other students.

More broadly, the programme aims to achieve the following impacts:

- More diverse profile of students enrolled in STEM courses at HE (gender, disadvantaged backgrounds), contributing to greater social mobility via STEM.
- Improved capacity in STEM research.

- More organisations offering authentic placements as part of a widening participation agenda, and more schools and colleges supporting students to undertake authentic STEM research projects.

How are NRPs being evaluated?

In 2016, the Nuffield Foundation commissioned Frontier Economics and CFE Research to evaluate the impact of NRPs on the education and career outcomes of students, and to identify areas where the programme might be improved. The evaluation is being undertaken over seven years until 2022 and comprises a qualitative element (led by CFE Research) and a quantitative element (undertaken by Frontier Economics).

In terms of providing evidence on the theory of change, the study is focused on the short-term and long-term outcomes for young people. A key aim is to understand the impact on the propensity of students, particularly those from disadvantaged backgrounds, to undertake post-18 study in STEM subjects and subsequent employment in STEM research careers. As part of this, the analysis considers the impacts on A Level achievement as a means to inform on whether placements have a direct effect on post-18 outcomes or whether impacts occur via changes in A Level outcomes. Outcomes for placement providers and for schools and colleges are only considered in terms of broad perceptions reported from the qualitative element of the work.

It should be noted that the evaluation does not cover the following areas:

- Evidence on the impacts in the theory of change (more diverse profile of students enrolled in STEM HE courses, improved capacity in STEM or greater opportunities for students to undertake authentic placements).
- Financial valuation of the impacts (such as higher earnings for students), analysis of delivery cost or value for money assessment.
- Comparisons with other programmes.

What has the qualitative element of the evaluation involved?

The qualitative element undertook an in-depth exploration of the perceptions and experiences of placement providers, schools, colleges and students participating in 2016 in order to help with understanding how well the programme works for each group. In particular, it sought to address three overarching research questions:

- What are the experiences of teachers, schools and colleges?
- What are the experiences of placement providers?
- How does participation in the placement influence student decision-making, aspirations and views about STEM subjects and career plans.

In addressing these questions, the research explored the progress being made towards the achievement of key outcomes for NRPs, assessing the extent to which the programme is perceived to:

- Influence students' aspirations, improve their confidence and ability to work independently, and enhance their science capital and networks.

- Equip placement providers with a greater understanding of STEM education and the challenges faced by less well-represented groups in STEM.
- Provide opportunities for early career researchers to develop management and supervision skills.
- Support the development of sustainable relationships between schools and colleges and placement providers.
- Provide opportunities to engage the public in research.

Evidence to answer these questions was collected through a series of qualitative interviews and focus groups with key participants and through a longitudinal online survey of the 2016 applicant cohort:

- Qualitative interviews and focus groups were conducted with successful and unsuccessful applicants, school and college staff, placement providers and the regional co-ordinators across the UK. The sample was purposively selected to ensure it reflected the range of geographical regions, placement subjects, and school, college and placement provider types involved in the programme, with a particular focus on schools and colleges with a high proportion of FSM pupils. Evidence was collected from a total of 62 applicants, 24 teachers, 20 placement providers and 9 co-ordinators.
- The longitudinal survey consisted of four waves for successful applicants (one pre-placement in July 2016¹ and three post placement in September/October 2016, February/March 2017 and March/April 2018). Comparison surveys were also undertaken with *unsuccessful* applicants at the same time as the three post-placement surveys (with comparative pre-placement information also collected at the first of these).² The first post-placement survey (wave 2) captured changes in students' plans, STEM knowledge and skills, and attributes since prior to the placement, while the latter surveys continued to map these changes and record details on their further education and career plans.

Detailed analysis and the findings from waves 1 to 3 of the longitudinal survey can be found in a report published alongside this one (Bowes et al., 2017) and a summary of these findings is presented in chapters 3 and 4 below. In later stages of the evaluation, analysis of the final wave of the survey will be presented with the quantitative analysis for the 2016 cohort.

How is the programme being evaluated quantitatively?

The quantitative element of the evaluation is using linked administrative datasets to:

- Identify which types of students are likely to apply for NRPs and to be successful in their application.
- Assess the impacts that placements have on choices about post-school study and career paths in STEM.

¹ The pre-placement survey was administered by the Nuffield Foundation, while the remaining three waves were administered by CFE Research.

² Of the 1,182 successful applicants in 2016, 820, 1,141, 883 and 750 took part in waves 1 to 4 of the survey. Of the 1,982 unsuccessful applicants, 806, 463 and 284 took part in waves 2 to 4 of the survey.

Linked National Pupil Database (NPD) data for three cohorts of applicants in 2014, 2015 and 2016 was used to identify which types of students are likely to apply and to be successful in their application, and to model the selection process from the population of AS Level pupils in England. The detailed analysis and findings can be found in a technical report published alongside this summary report (Paull & Xu, 2017) and a summary of the findings is presented in chapter 2 below.

The analysis of impacts will again use the linked NPD data for the three NRP cohorts, combined with further data linking to Higher Education Statistics Agency (HESA) data on key stage 5 (A Level) results and HE outcomes and to Destination of Leavers of Higher Education data on post HE and employment. Preliminary analysis of the HESA data for the 2014 cohort is presented in chapter 4 and the accompanying technical report provides the regression results for this preliminary analysis.

What are the next steps for the evaluation?

The next steps for the evaluation are a report in spring 2020 which will extend the preliminary impact analysis and provide:

- Analysis of the impacts of the placements on key stage 5 (A Level) results and HE outcomes using HESA data for three cohorts of placement students (2014, 2015 and 2016), building on the preliminary analysis for 2014 presented in chapter 4.
- Analysis of the impacts of the placements on key stage 5 (A Level) results and HE outcomes using combined HESA data and all four waves of the student survey data for the 2016 cohort of placement students.

A further report in spring 2023 will include an analysis of the impacts of the placements on post-HE study and employment using the graduate outcomes survey for all three cohorts.

Outline of this report

The remainder of this report is structured in the following way:

- Chapter 2 provides a description of placement students and the extent to which the programme is reaching disadvantaged students.
- Chapter 3 reports on the perceptions of the benefits of the placements, using the views of students, schools and colleges, and placement providers from 2016.
- Chapter 4 presents the findings from preliminary analysis of the impacts on students' A Level results and HE outcomes using administrative data for placement students and AS Level students in 2014.

Chapter 2: Access to Placements

This chapter presents a profile of those participating in NRPs and considers the types of pupils most likely to apply for a placement and most likely to succeed in their application. The first section describes the demographic characteristics of those participating in NRPs. The second section outlines the student selection process, while the following three sections explore the selection experience for different types of pupils (by disadvantage, by gender and ethnicity, and across regions). The penultimate section describes the types of placements undertaken, while the final section summarises the findings.

This chapter uses data from the NPD for the three cohorts of NRP applicants in 2014 to 2016, including 7,802 applicants and around 800,000 AS Level students (of which around 350,000 would be eligible to make an NRP application). The analysis is restricted to pupils in maintained schools in England because of the limited coverage of the NPD data. The complete analysis can be found in the composition report published alongside this report (Paull & Xu, 2017).

Who are NRP students?

The key demographic characteristics of those undertaking NRPs are:

- Just over half (54 percent) of participants are female.
- A substantial proportion of participants are from ethnic minority groups (7 percent are black, 26 percent Asian and 8 percent of other or mixed ethnicity).
- Just under a quarter (22 percent) of participants are currently eligible for FSM or have been eligible in the previous six years.
- Participants are drawn fairly evenly from across the distribution of neighbourhood deprivation as measured in the IDACI (Income Deprivation Affecting Children Index) score.

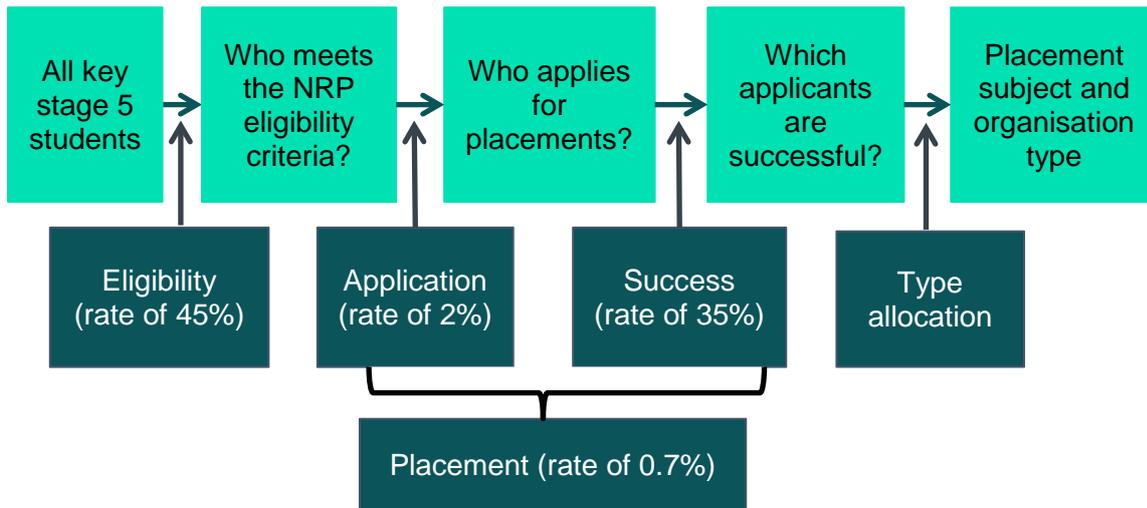
In terms of prior academic attainment, most participants (82 percent) are from the top 20 percent of academic achievers at GCSE, which is unsurprising given the GCSE requirement for NRP application.

What are the steps to attaining a placement?

Over half of schools in England who have AS Level students and record data for the NPD had at least one applicant to the NRP programme during the three years from 2014 to 2016. Indeed, placement students are drawn from a broad range of schools and very few achieve multiple placements year on year.

Figure 1 summarises the steps to attaining a placement which were analysed in assessing the reach of the programme. Of all key stage 5 (AS Level in 2014 to 2016) students, it is estimated that 45 percent are eligible to apply for an NRP. From this eligible pool, around 2 percent of pupils apply to the programme and 35 percent will be successful in their application. This means that 0.7 percent of all eligible pupils will successfully go through the application process and attain a placement.

Figure 1: Steps to attaining a placement



Are placements reaching disadvantaged students?

A key objective of the NRP programme is to provide opportunities for experience in STEM to pupils from more disadvantaged backgrounds. This was explored using eligibility for FSM in the previous six years as the measure of disadvantage, providing strong evidence that recruitment for placements is successfully targeting those from more disadvantaged backgrounds:

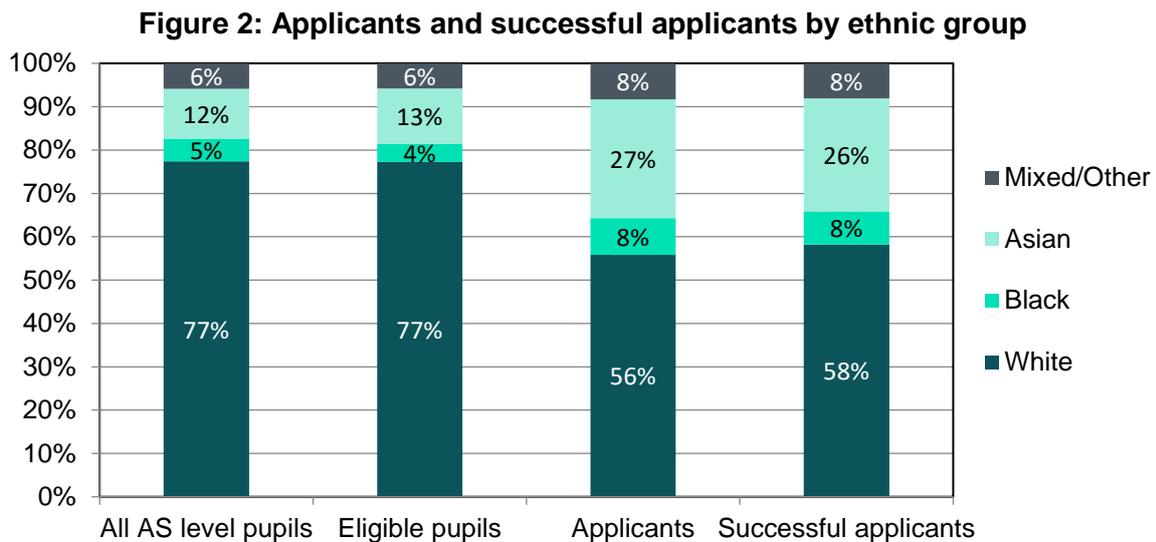
- Among those eligible, FSM pupils are more likely to apply and, among applicants, are more likely to be successful. While FSM pupils constitute 11 percent of all eligible pupils, they account for 19 percent of applicants and 22 percent of those offered placements. Even allowing for other individual characteristics (including ethnicity and academic achievement), FSM pupils are more likely to apply and to be offered a placement.
- Within schools, current or recent eligibility for FSM is associated with an average higher probability of application of around 1 percentage point over other students in the same school. Given the average application rate of 1.9 percent, this is a sizeable difference.
- Across schools, there is a positive relationship between application and success (and overall placement rate) and the proportion of pupils eligible for FSM within the school. This indicates that being from a school with a higher proportion of FSM pupils increases the likelihood of application and success regardless of whether the student is or has been eligible for FSM themselves.

Are placements reaching female and ethnic minority students?

Just over half of all AS Level students are female and very similar proportions are eligible to apply for NRP placements, do apply and are successful in securing a placement. These simple proportions suggest that gender is not an important influence in the selection process for placements. However, when differences in prior academic attainment are taken into consideration, female pupils are less likely to apply than male pupils. In other words, given

their level of academic attainment, female pupils would be expected to be more likely to apply than male pupils.

The ethnic mix of eligible pupils is very similar to that for all AS Level students, but those in non-white groups, particularly those in the Asian group, are much more likely to apply than those in the white group (figure 2). Conditional on applying, the proportion of white pupils who are successful is slightly higher than those for the other ethnic groups, although the proportions of the ethnic minority groups undertaking placements are still notably higher than in the eligible student population.



Note: Columns may not sum to 100 percent due to rounding.

Taking into consideration other pupil and school characteristics (including the FSM measure of disadvantage), regression analysis shows that:

- Black and Asian pupils are more likely to apply than those of mixed or other ethnicity, who in turn are more likely to apply than white students.
- While the raw differences in the success rates indicate that black and Asian pupils are more likely to be successful than white pupils, controlling for school background indicates that white pupils are more likely to be successful than Asian ones (indicating that the reason for the Asian and black pupils' higher success rate was due to the types of schools they attend).
- The much greater difference in the application rates dominates the final outcome that eligible pupils from ethnic minority groups are more likely to secure a placement than their white counterparts.

What kinds of placements do NRP students undertake?

An examination of the types of placements undertaken in 2015 and 2016 showed that:

- The most common placement subject area is biology, biomedical and environmental sciences, with 40 percent of placements in this field. Other placement subjects

included astronomy and physics (13 percent), chemistry, biochemistry and forensics (15 percent), computing, engineering and manufacturing (23 percent), and maths, statistics and data science (9 percent).

- The vast majority of placements (73 percent) are undertaken at universities. Much smaller proportions are undertaken in the private sector (16 percent), research institutes (4 percent) and other types of organisations (7 percent).

There are no strong patterns in the placement subject and organisation type, with similar spreads of subject for all organisation types.

There is no evidence that disadvantage (FSM status) has a direct influence on the type of placement undertaken, but gender and ethnicity are associated with particular placement types:

- Female NRP students are more likely than males to have placements in biology and chemistry related subjects than in physics, computing or engineering related subjects. They are also more likely to have placements in universities than in the private sector.
- White NRP students are more likely than ethnic minority students to have placements in physics and chemistry related subjects than in biology related subjects.

Summary

A key aim of the NRP programme is to offer pupils from disadvantaged backgrounds the opportunity to obtain research experience in STEM subjects. There is substantial evidence that the programme is successfully targeting disadvantaged pupils in several ways:

- Pupils from disadvantaged backgrounds (measured by FSM eligibility) are more likely to apply for and undertake a placement than other pupils.
- Pupils in schools with higher proportions of FSM pupils and lower average academic attainment are more likely to apply and to be successful in their application.
- Pupils eligible for FSM are more likely to apply than non-FSM pupils in all 13 of the English NRP regions and are more likely to undertake a placement in all regions.
- Pupils eligible for FSM are considerably more likely to apply than other pupils in their school.

In addition, pupils from ethnic minorities also appear to benefit disproportionately from the programme and are more likely to apply for and undertake placements than other pupils. Indeed, ethnicity appears to have an influence over and beyond any association with disadvantage. On the other hand, there is evidence that female pupils should be applying at a higher rate given their background characteristics, and female NRP students are more likely than males to have placements in biology and chemistry related subjects than in physics, computing or engineering related subjects. However, the fact that more than half of placements are undertaken by female students may be deemed a success given the historically low representation of women in STEM.

Chapter 3: Perceptions of Benefits

This chapter reports on the perceptions of the benefits of the placements, using the views of programme participants in 2016. The first section presents findings from an examination of the NRP programme design, drawing out the elements that work well and providing potentially useful insights for other similar programmes.³ The second section provides a broad overview of programme benefits, while the remaining three sections focus on students' perceptions of how placements influence their aspirations and plans; their decision-making process; and the development of their skills. The final section summarises the findings.

The first two sections draw on evidence from the qualitative interviews and focus groups with applicants, school and college staff, placement providers and programme co-ordinators who participated in 2016 across the UK. The sample was purposively selected to ensure it reflected the range of geographical regions, placement subjects, and school, college and placement provider types involved in the programme, with a particular focus on schools and colleges with a high proportion of FSM-eligible pupils. In total, 62 applicants, along with 24 teachers, 20 placement providers and 9 co-ordinators were consulted through a series of focus group discussions and individual interviews.

The remaining sections present findings from the first three waves of the longitudinal survey with students, undertaken prior to placement for successful applicants (July 2016), post placement for placement students and post summer for unsuccessful applicants (September to October 2016) and a follow-up for both sets of applicants following the period of HE application (February to March 2017). Of the 1,182 successful applicants in 2016, 820, 1,141, 883 and 750 took part in waves 1 to 4 of the survey. Of the 1,982 unsuccessful applicants, 806, 463 and 284 took part in waves 2 to 4 of the survey. The complete findings are available in a report published alongside this one (Bowes et al., 2017).

What works well in the NRP programme?

Several specific elements of the programme were found to work most effectively in the pre-placement stage:

- Tailored communications and promotional activities and testimonials from teachers, providers and alumni are an effective way to engage new schools, colleges and providers. Presentations by students who have participated in the past are particularly effective for engaging schools and colleges. Providing evidence of the impact of the programme (such as widening participation or research outputs) is particularly effective for engaging providers, especially HEIs. Working with Royal Societies and other sector bodies is also helpful for attracting placement providers. Disseminating information about NRPs at meetings of pre-existing groups is more effective in raising awareness of the programme than specially convened meetings and information sessions for schools, colleges and providers.

³ Other formative findings from this element of the evaluation are being used by the Foundation to develop the NRP programme going forward.

- Support with administration and the application process helps to secure and maintain co-operation with schools and colleges, as well as any 'guarantees' regarding the number and type of placements available to students. Similarly, a simple and straightforward process for placement providers to register project details is helpful, together with additional support from co-ordinators when needed. Email is an effective channel for maintaining existing relationships with schools, colleges and providers as long as the key contact or gatekeeper remains in post.
- Promotional material that reflects students' motivations for applying to NRPs acts as an effective hook in promoting NRPs to students, including highlighting the opportunities to undertake research in a real-life setting; to develop new skills; to gain experience which strengthens their UCAS application and CV; and to produce evidence for awards such as Gold CREST.
- A simple and straightforward application process is effective in encouraging students to apply. To target disadvantaged students, opportunities to learn about NRPs from other students 'like them' is often more effective than a presentation from a teacher or a co-ordinator, while this group particularly appreciate help from teachers to develop their personal statement and apply for the bursary if appropriate.
- Matching between placements and students works best when co-ordinators are clear about the providers' requirements and can allocate placements to the most suitable students. Requiring students to express why they are interested in a placement as part of the selection process further helps to ensure a good match and that realistic expectations of the placement are established at the outset.

The best placements enable students to complete an authentic research project, or a discrete part of a larger or longer-term project, within the four- to six-week period and gain genuine insights into a career in the field. The opportunity to contribute to a live research project and gain practical research experience working alongside skilled practitioners is highly valued by students and is what is perceived to set the programme apart from other enrichment activities. Placements were found to work most effectively and benefit both the students and providers when:

- They are well planned and well structured, and provide students with the opportunity to engage in an authentic 'live' project.
- A comprehensive induction is in place which ensures students understand the aims and objectives of the project and their role with the team.
- Regular supervision and ongoing support are in place for the duration of the placement, including opportunities for peer support.
- Students have the opportunity to engage in a variety of tasks and to contribute their own ideas.
- Students are afforded a degree of autonomy to complete tasks and take decisions, with guidance from their supervisor or team members as required.

Two elements worked particularly well in the post-placement stage:

- The placement report is an effective way to capture research findings in a format that can be used to apply for awards such as Gold CREST. The process of producing the report works best when the placement supervisor is available to assist the student, particularly with how to structure an argument, reference source material and present data.
- The celebration event is an effective mechanism for disseminating research findings and the learning from the placement experience. The impact of the event is maximised when a broad audience, including school and college staff, parents and prospective applicants, have the opportunity to attend along with providers.

Who benefits and how?

Figure 3 summarises the evidence on how placements can benefit programme participants during the placement (immediately), post-placement and in the longer term. As well as the benefits for students, it highlights wider organisational benefits for schools, colleges and placement providers.

For students, the insights gained into STEM research and other STEM-related roles from the placement can help them make more informed decisions in the post-placement period. The experience of the placement can help develop their STEM knowledge and skills, while also enhancing their confidence in their abilities and developing transferable skills. Placements can also help develop professional networks within STEM. Following the experience, placements can enhance students' UCAS applications for HE and, particularly for students from more disadvantaged backgrounds, can influence aspirations and support applications to research-intensive and 'top 30' institutions. In the longer term, placements can enhance students' CVs, raising future employment prospects both within STEM and more broadly across all types of employment through the development of skills which are transferable to other types of work.

For schools and colleges, there may be some immediate benefits from participation, from adding value to their enrichment programmes (particularly for those with higher proportions of FSM students or with limited resources for these activities) and from the association with placement providers and the Nuffield Foundation. But most benefits occur post placement: enhancing placement students' STEM knowledge and study motivation can improve academic attainment, while involvement in the programme can also raise the profile of STEM subjects across the school or college and boost the numbers of students considering studying STEM subjects. Together, these benefits can lead to a higher rate of progression to HE, particularly among students from more disadvantaged backgrounds. In the longer term, these benefits can enhance the reputation of schools and colleges, strengthening their ability to attract and recruit higher-calibre students.

Although offering placements may have some costs for the providers, there are also substantial potential immediate benefits. The additional resources from the students can make some research projects possible or allow others to progress more rapidly. Oversight of placement students can also help existing staff, particularly early career researchers, to develop their management and supervisory skills (benefiting both them as individuals and the firm more broadly). In the longer term, placement providers can benefit from the development of their future workforce and pipeline of skilled staff, most specifically in the form of the retention or later return of placement students. Involvement with the programme may also support organisational strategic objectives such as widening participation targets.

Figure 3: Perceived benefits for students, schools/colleges and placement providers

Immediate	Post- placement	Longer term
NRP students		
<ul style="list-style-type: none"> Gain insights into research and other STEM sector roles Apply STEM knowledge and develop new technical and research skills Grow in confidence from the support and autonomy afforded by placement supervisors Develop transferable skills: communication and listening, problem-solving, critical thinking and independent working Develop STEM professional networks 	<ul style="list-style-type: none"> More informed decision-making Influence aspirations and support progression to research-intensive 'top 30' HEIs (especially for disadvantaged students) Enhance UCAS application 	<ul style="list-style-type: none"> Enhance CV and future employability
Schools and colleges		
<ul style="list-style-type: none"> Add value to enrichment programmes (particularly for those with more disadvantaged students or limited resources) Association with placement providers and Nuffield Foundation 	<ul style="list-style-type: none"> Improve attainment by enhancing students' STEM knowledge and study motivation Raise profile of STEM subjects and boost numbers studying STEM subjects Increase progression to HE (particularly among disadvantaged students) 	<ul style="list-style-type: none"> Enhance reputation and recruitment of students
Placement providers		
<ul style="list-style-type: none"> Provide resources for research projects Develop management and supervisory skills of existing staff, including early years career researchers 	<ul style="list-style-type: none"> Develop future talent pipeline, including through retention of placement alumni Support organisational strategic objectives such as widening participation targets 	

Do placements influence aspirations and plans?

According to the student survey, even before applying to the programme, most placement students knew what they wanted to do after their current study. Just 4 percent were undecided and most (87 percent) aspired to progress into HE and study for a STEM degree. The majority (90 percent) had not changed their plans as a result of their placement experience, but the placement was perceived to have helped to confirm their prior choices. Among the minority who changed their plans, half subsequently planned to study for a STEM degree.

Following the period of HE applications (in wave three of the survey), a small minority of placement students (7 percent) had changed their plans. The main reasons for change were that students were clearer about the options available to them, where their skills and interests lay and/or what they needed to do to achieve their future career ambitions. For others, the change was forced upon them because of poorer than expected examination results and/or failure to secure a place at their preferred HEI.

However, these patterns for placement students were not substantially different from those for unsuccessful applicants to the programme. Most unsuccessful applicants (83 percent) reported that they intended to study for a STEM degree (in the post-summer survey) and 5 percent reported that they had changed their plans following the period of HE applications of the survey. In addition, regression analysis of the drivers of HE choices (including application to a 'top' institution) did not provide any evidence that placements had influenced these choices.

Evidence collected in wave 3 of the survey showed that most placement students (85 percent) anticipated that they would be working or studying in STEM in five years' time, with 47 percent anticipating further study in STEM and 38 percent anticipating paid STEM employment. There were very similar patterns for unsuccessful applicants, with 83 percent anticipating working or studying in STEM, including 48 percent in STEM study and 35 percent in STEM paid employment.

What role do placements play in decision-making?

Evidence from the survey indicates that placements may have some impacts on students' knowledge of and attitudes to STEM. Placement students' perception that they know what STEM researchers do on a day-to-day basis was higher following the placement: the average score on a 7-point scale (where 1 is strongly disagree and 7 is strongly agree) increased from 3.9 to 5.7. It was also higher than that for unsuccessful applicants to the programme (4.7) in the post-placement/summer survey. Using the same type of scale, placement, students' level of agreement that STEM industries offer many interesting job opportunities increased from an average score of 5.9 to 6.4 over the same period and the level of agreement that they enjoy STEM subjects also rose slightly from an average score of 6.1 to 6.4. In both cases, the post-summer score for unsuccessful applicants to the programme was very similar (6.5 and 6.4 respectively). Among placement students who reported a change in their knowledge or attitudes, large proportions felt that the placement had influenced the change a great deal (70 percent for understanding what researchers do, 55 percent for believing that STEM industries offer many interesting opportunities and 49 percent for enjoying STEM subjects).

There is no evidence that the NRP experience influences the sources of information, advice and guidance that students use to support their education, and career decisions. Irrespective of whether a student has undertaken a placement or was an unsuccessful applicant, the most commonly used sources in the post-placement/summer survey (wave 2) were parents (62 percent), university visits (60 percent), class teachers (56 percent) and university websites (53 percent). By the time of the following survey, the most commonly used sources for both groups were university visits (79 percent), university websites (72 percent), parents (69 percent) and school or college teachers (63 percent).

Do placements help to develop skills?

Placement students reported an increase in their study motivation, confidence in their abilities and a range of skills following the placement.⁴ Almost all students who reported an increase in motivation, confidence or skills attributed the change either 'somewhat' or 'a great deal' to the experience of the placement (the remaining option being 'not at all'). In the post-placement/summer survey, placement students reported higher levels of agreement with statements about their skills and abilities than unsuccessful applicants. Regression analysis including controls for other individual characteristics showed that a higher proportion of placement students than unsuccessful applicants agreed with the statements 'I am motivated by my school work', 'I am confident in my own abilities', 'I am a confident presenter', 'I am good at writing reports' and 'I manage my time well', indicating higher levels of study motivation, overall confidence in their abilities and perception of their skills in presenting, writing reports and time management. This suggests that placements are important for the development of skills which are beneficial both for employment within STEM and for their transferability to employment in other areas.

Summary

In summary, this evidence suggests:

- There are a broad range of organisational benefits from programme participation for schools and colleges and for placement providers beyond those accruing directly to placement students. Schools and colleges may benefit from enhancement of broader interest in STEM and improvement in academic attainment. Placement providers may benefit from the additional resources and opportunity to develop staff supervisory skills as well as longer-term development of the future talent pipeline.
- Placements do not appear to influence students' aspirations and plans, mainly because most placement students aspired to study for a STEM degree even prior to application.
- Placements improve students' understanding of what STEM researchers do on a day-to-day basis but do not appear to influence their attitudes on how interesting a STEM career is or how much they enjoy the study of STEM subjects.
- Placements do not appear to influence the sources of information, advice and guidance that students use in their education and career decisions.
- The placement experience enhances transferable skills including study motivation, overall confidence in abilities and specific skills in presenting, writing and time management. These skills are beneficial both for employment within STEM and for their transferability to employment in other areas.

⁴ These skills included problem-solving, writing reports, giving presentations, time management, team-working and ability to work independently. See sections 5.2 and 5.3 in Bowes et al. (2017).

Chapter 4: Impacts on A Level Results and Higher Education Choices

This chapter presents preliminary findings for the impacts of the placements on A Level results and HE choices for the students undertaking placements in 2014. The first section summarises how the impacts are estimated, while the second and third sections present the findings for A Level results and HE choices respectively. The final section summarises the findings.

Further details of the analysis are presented in the technical report (Cilauro & Paull, 2019). Later work in the evaluation will repeat this analysis for three cohorts of placement students in 2014, 2015 and 2016, with findings expected to be published in spring 2020.

How are impacts estimated?

This preliminary analysis considered the impacts on two sets of outcomes: A Level choice and achievement and HE enrolment in 2015/16. A Level choices are not specific programme objectives, but may be a step towards achieving the aims of encouraging or enabling students to pursue further study and careers in STEM, and are considered to provide insight on whether NRPs impact future choices via the effects on A Level study.⁵ Because the programme aims to specifically support pupils from disadvantaged backgrounds, the impacts were estimated for all NRP participants and separately for participants from disadvantaged backgrounds, specifically those who were eligible for FSM.

Data on A Level achievement for maintained schools in England was obtained from the NPD data and on HE enrolment in the UK from HESA for all pupils in the NRP cohort year, with individual matching for NRP applicants (both successful and unsuccessful). For each outcome, NRP participants were compared to two different comparison groups:

1. Unsuccessful applicants: all unsuccessful applicants to the programme in 2014.
2. All eligible students: all pupils in the NPD data eligible to apply for an NRP in 2014.⁶

As neither of these comparison groups will be an exact match for NRP participants, impacts were estimated as the differences in outcomes from regression models which control for differences in other observed characteristics which may drive the outcomes, including individual, school and local area characteristics.

⁵ Analysis of the HE outcomes conditional on A Level results indicated that the total impact on enrolment in STEM courses and in Russell Group institutions is partly direct (for example, by influencing aspirations) and partly indirect via improved A Level results. For simplicity, this interim report presents only the total impact on HE enrolment and the later analysis will consider the breakdown into direct and indirect impacts.

⁶ This excluded those whose only STEM subject at A Level was psychology because very few NRP participants studied psychology at AS Level and because psychology is not included in the Higher Education Funding Council for England (HEFCE) definition, which is the definition used to define STEM subjects in HE (even though it is included as STEM for the NRP programme).

The following caveats should be noted with respect to the impact analysis:

- The analysis is restricted to pupils in maintained schools in England because of the limited coverage of the NPD data.
- The impact on enrolment in HE only covers the year following A Level completion and does not include enrolment following a gap year. The later analysis will explore HE entry following a gap year.
- While using unsuccessful applicants as a comparison group has the advantage that they are likely to closely match NRP participants in other characteristics which could drive outcomes, there are two drawbacks to using this comparison group. First, the sample size is relatively small. Second, successful applicants may differ from unsuccessful ones due to the NRP selection process, which varies due to such factors as the availability of places in particular subject areas and the ways in which co-ordinators may give preference to students who they think will benefit the most and could introduce an unknown bias in the differences with the unsuccessful applicant comparison group.
- While using all eligible pupils as a comparison group has the advantage of an extremely large size (which substantially raises the likelihood of identifying any programme impacts), applicants to the programme may differ from the broader pool of all eligible pupils in having greater unmeasured motivation to study and pursue careers in STEM subjects. This would suggest a potential upward bias in the estimates of the impact of the NRPs using the all eligible pupils comparison group. However, the comparison group will contain many students who have not applied to the NRP programme for reasons unrelated to motivation (for example, they may not have been aware of the programme), suggesting that any bias may be limited.

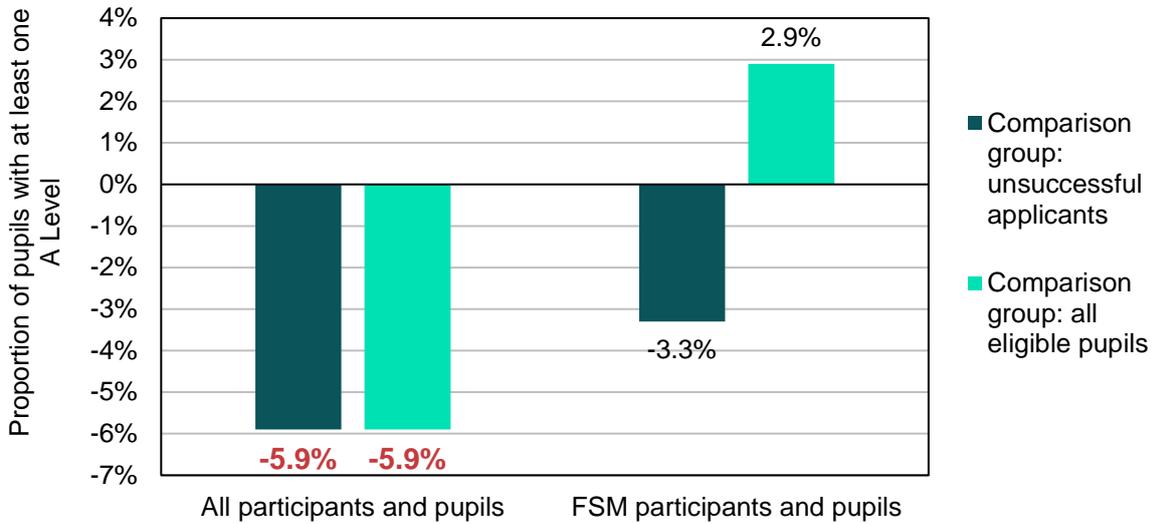
On balance, the preferred comparison group is all eligible pupils, but findings are also presented for unsuccessful applicants for completeness.

Do placements improve STEM A Level results?

Some 82 percent of all NRP students go on to achieve at least one STEM A Level in the following year. But undertaking a placement is associated with a lower likelihood (5.9 percentage points lower) of achieving this for both comparison groups (figure 4). For FSM students, 80 percent of NRP participants go on to achieve at least one A Level in STEM, but there are no statistically significant differences in the likelihood of achieving at least one A Level with either comparison group. The lower achievement rate in comparison to unsuccessful candidates may reflect the programme selection process favouring pupils in greater need of support.

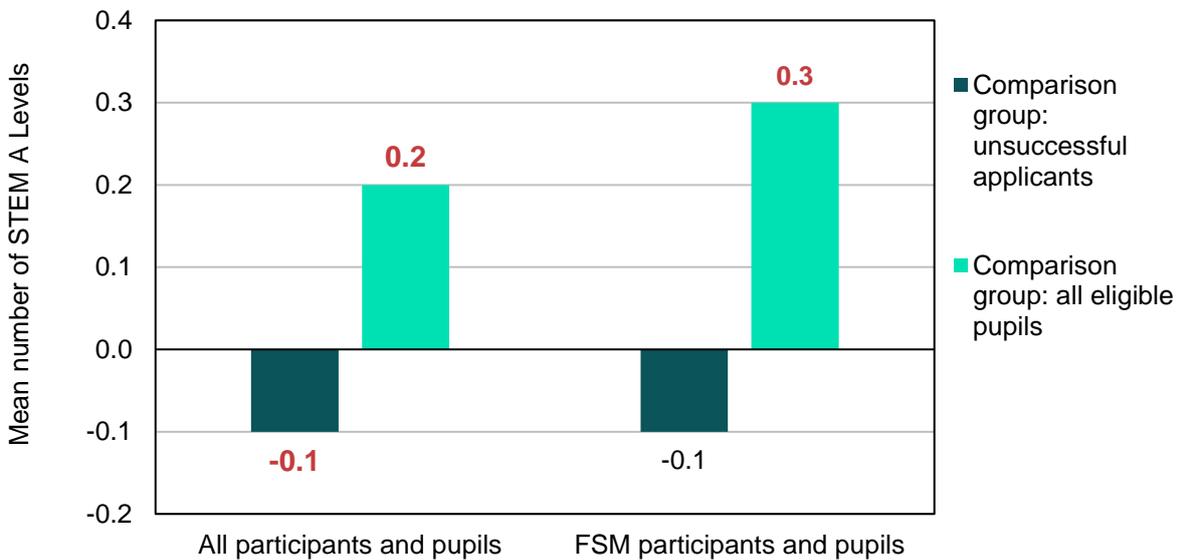
NRP students go on to achieve an average of 2.4 STEM A Levels. Undertaking a placement is associated with a lower mean number of STEM A Levels (0.1 lower) than unsuccessful applicants but a higher mean number (0.2 higher) than all eligible pupils (figure 5). For FSM students, those undertaking a placement go on to achieve an average of 2.2 STEM A Levels. There is no statistically significant difference with unsuccessful applicants, but undertaking a placement is associated with a higher mean number of STEM A Levels (0.3 higher) than for all eligible FSM pupils.

Figure 4: Estimated impacts on proportion achieving at least one STEM A Level



Notes: Numbers in bold red indicate statistically significant differences at the 95 percent level. Sample sizes are 1,691 and 88,947 for all participants and pupils and 343 and 10,007 for FSM participants and pupils.

Figure 5: Estimated impacts on number of STEM A Levels achieved

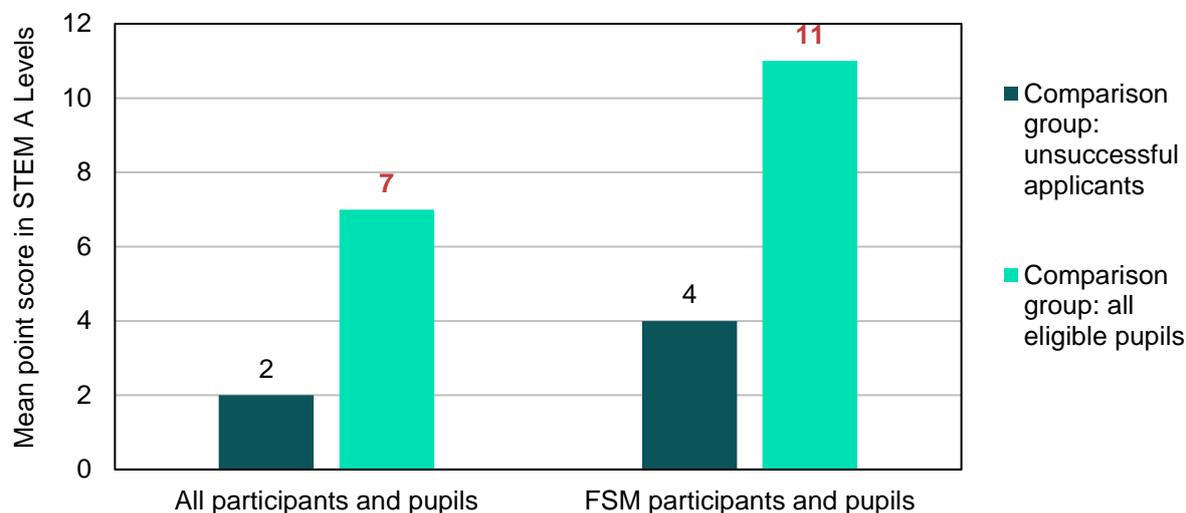


Notes: Numbers in bold red indicate statistically significant differences at the 95 percent level. Sample sizes are 1,691 and 88,947 for all participants and pupils and 359 and 10,007 for FSM participants and pupils.

NRPs also have benefits for the average point score in STEM A Levels among those achieving at least one STEM A Level (figure 6). All NRP students achieve an average score of 248, while FSM NRP students achieve an average score of 238, and undertaking a placement is associated with a higher mean score (7 points higher) for all eligible pupils and a higher mean score (11 points higher) for FSM-eligible pupils (with no statistically significant

differences with unsuccessful applicants). As 10 points corresponds to one higher grade on one A Level, this difference roughly indicates, for example, that placement students achieve an average AAB set of grades for three A Levels rather than ABB or that they achieve an average ABC rather than BBC.

Figure 6: Estimated impacts on average point score in STEM A Levels



Notes: Numbers in bold red indicate statistically significant differences at the 95 percent level. Sample sizes are 1,443 and 70,128 for all participants and pupils and 290 and 7,132 for FSM participants and pupils.

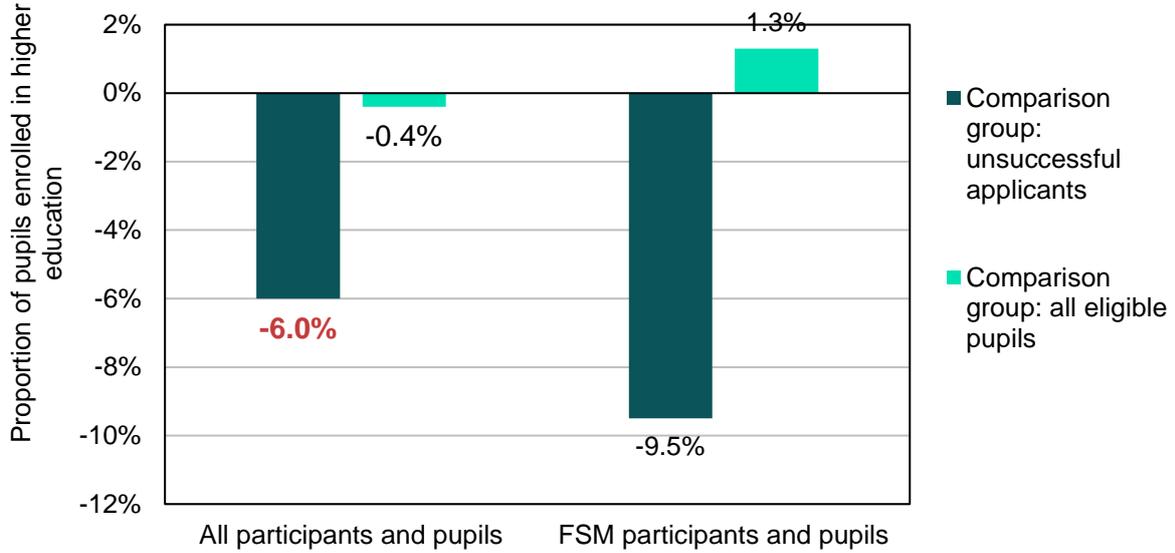
Do placements improve access to STEM higher education?

Just over two-thirds (67 percent) of NRP students (and 60 percent of FSM participants) enrol in HE in the following year. However, there is no evidence that placements are associated with a higher proportion than that for either comparison group (figure 7). Indeed, undertaking a placement is associated with a lower probability of enrolment (6 percentage points lower) than for unsuccessful applicants, but this may reflect programme selection towards pupils requiring more support or the possibility that those undertaking NRPs may be more likely to take a gap year before enrolling in HE. The more robust comparison group (all eligible pupils) does not indicate any difference in enrolment rates.

Just under half (47 percent) of NRP participants (and 43 percent of FSM participants) enrol in a STEM course in HE in the following year. While there are no statistically significant differences in this proportion with unsuccessful applicants, this proportion is substantially higher than for the all eligible pupils comparison group (figure 8). Indeed, participating in the programme is associated with a higher enrolment rate of 8 percentage points for all pupils and for FSM pupils.

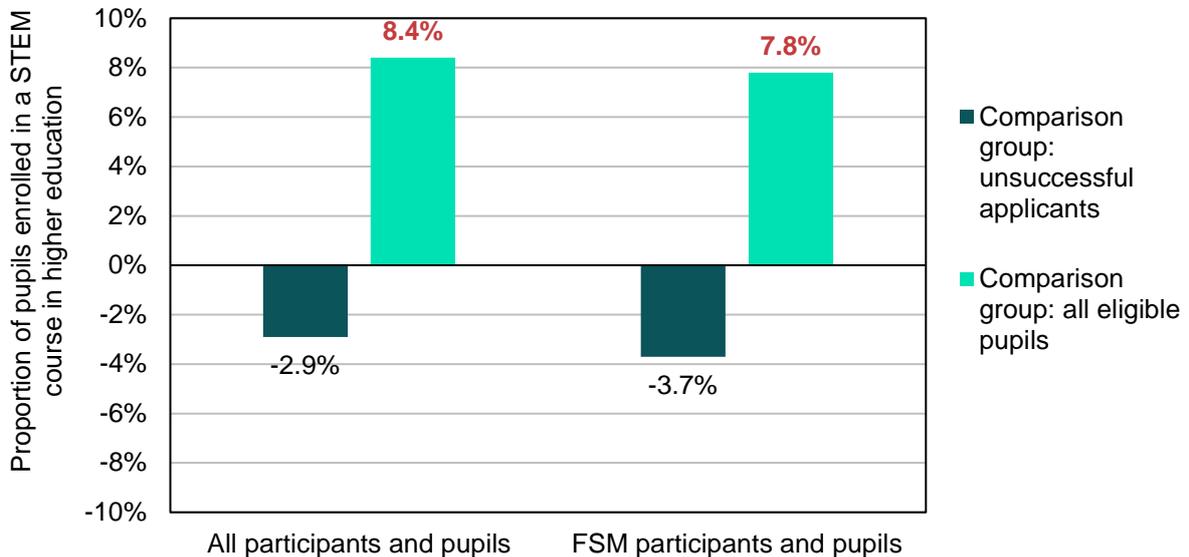
Almost a half (45 percent) of NRP students will enrol in a Russell Group HEI in the following year, although the proportion is somewhat lower (36 percent) for FSM participants. However, the differences with the comparison groups follow the same pattern as for STEM courses: there are no statistically significant differences with unsuccessful applicants, but the proportions are substantially higher than for all eligible pupils with, again, placements being associated with a higher enrolment rate of 8 percentage points for all pupils and for FSM pupils (figure 9).

Figure 7: Estimated impacts on proportion enrolled in higher education



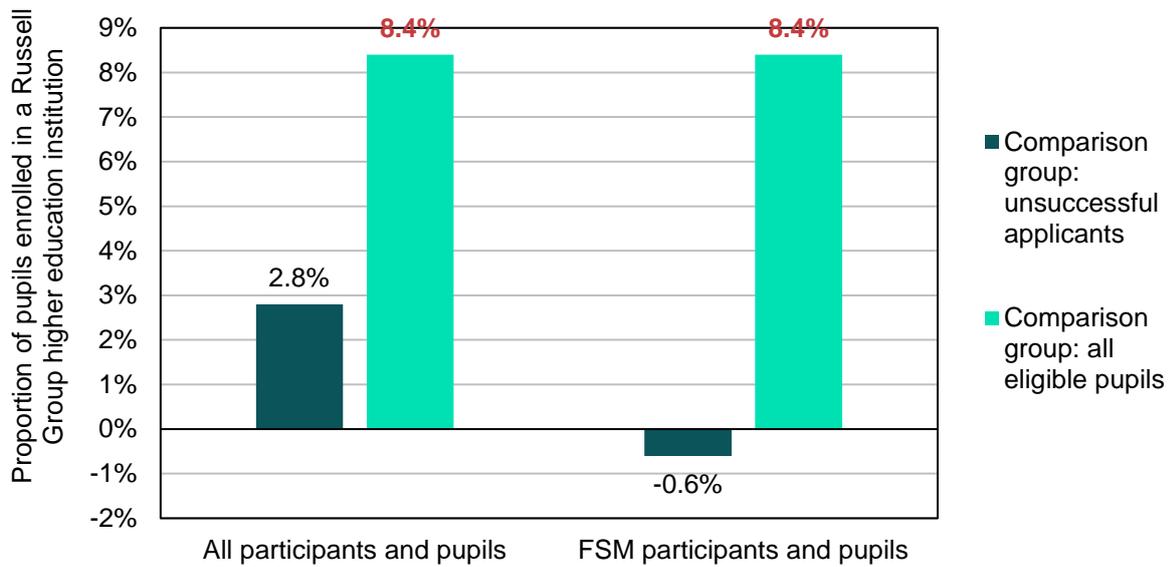
Notes: Numbers in bold red indicate statistically significant differences at the 95 percent level. Sample sizes are 1,691 and 88,947 for all participants and pupils and 356 and 10,007 for FSM participants and pupils.

Figure 8: Estimated impacts on proportion enrolled in a STEM course in higher education



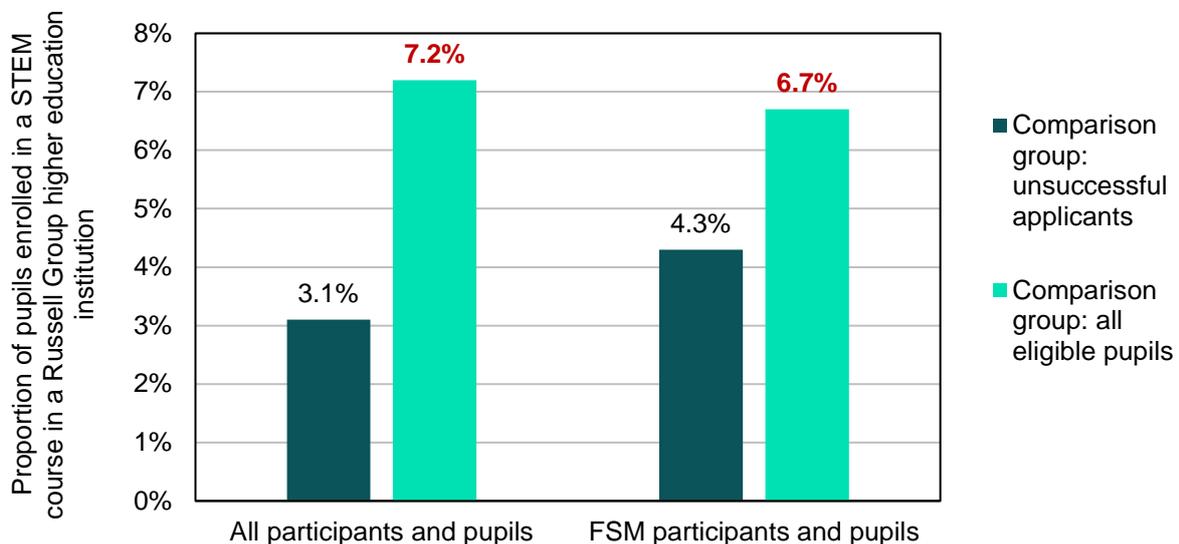
Notes: Numbers in bold red indicate statistically significant differences at the 95 percent level. Sample sizes are 1,691 and 88,947 for all participants and pupils and 356 and 10,007 for FSM participants and pupils.

Figure 9: Estimated impacts on proportion enrolled in a Russell Group higher education institution



Notes: Numbers in bold red indicate statistically significant differences at the 95 percent level. Sample sizes are 1,691 and 88,947 for all participants and pupils and 356 and 10,007 for FSM participants and pupils.

Figure 10: Estimated impacts on proportion enrolled in a STEM course in a Russell Group higher education institution



Notes: Numbers in bold red indicate statistically significant differences at the 95 percent level. Sample sizes are 1,691 and 88,947 for all participants and pupils and 340 and 10,007 for FSM participants and pupils.

Finally, just under a third (32 percent) of all NRP students enrol in a STEM course in a Russell Group institution in the following year, while just over a quarter (27 percent) of FSM NRP participants enrol in such a place. Unsurprisingly, figure 10, for the combined enrolment in a STEM course in a Russell Group institution, largely reflects the similarity in the patterns

in the previous two figures: the proportions are notably higher for NRP participants than for all eligible pupils and undertaking a placement is associated with a higher enrolment rate (7 percentage points higher) for all pupils and for FSM pupils.

Summary

The evidence from the preferred comparison group of all eligible pupils indicates that NRPs have particular benefits for the number and quality of STEM A Levels achieved and on the likelihood of enrolling in a STEM course at a Russell Group HEI. Specifically, it is estimated that undertaking a placement is associated with:

- A higher mean number of STEM A Levels for all pupils (0.2 A Levels higher) and FSM pupils (0.3 A Levels higher).
- A higher mean point score for STEM A Levels for all pupils (7 points higher) and for FSM pupils (11 points higher) (roughly corresponding to one grade for one A Level).
- A higher enrolment rate in a STEM course in HE of 8 percentage points for all pupils and for FSM pupils.
- A higher enrolment rate in a Russell Group HE institution of 8 percentage points for all pupils and for FSM pupils.
- A higher enrolment rate in a STEM course at a Russell Group HE institution of 7 percentage points for all pupils and for FSM pupils.

Later work in the evaluation will include a report in spring 2020 extending this preliminary impact analysis to include:

- Analysis of the impacts of the placements on key stage 5 (A Level) results and HE outcomes using HESA data for three cohorts of placement students (2014, 2015 and 2016).
- Analysis of the impacts of the placements on key stage 5 (A Level) results and HE outcomes using combined HESA data and all four waves of the student survey data for the 2016 cohort of placement students.

A further report in spring 2023 will include an analysis of the impacts of the placements on post-HE study and employment using the graduate outcomes survey for all three cohorts.

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