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Evaluation of Nuffield Research Placements:

Final Impact Report

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Foreword

The Nuffield Foundation is delighted to be publishing the independent evaluation of its Nuffield Research Placement programme. This foreword provides some context to the evaluation and considers the wider implications of its findings.

Background

In 1996 the Nuffield Foundation established the 'School Science Bursaries' programme, providing the opportunity for talented students across the UK to undertake research placements during the summer holidays between Year 12 and Year 13 in England, Wales and Northern Ireland – or between S5 and S6 in Scotland - a year before their final examinations, A levels or Advanced Highers

Placements were in universities, independent research centres and industry, with students working under the supervision of experienced researchers on authentic and high-quality STEM-related projects. All produced substantive outputs, usually in the form of a written report and presentation. The experiences gained from the placements were valuable in deepening students' STEM and research knowledge, as well as encouraging them to consider and pursue relevant studies and careers. But completion of the placement also constituted valuable evidence of their skills and commitment that could be used for their university applications and curricula vitae.

In 2012 the programme was rebranded as 'Nuffield Research Placements' (NRPs), maintaining the basic model and core elements of the placements themselves. Various changes were made to better align its focus with the Foundation's mission and research interests, particularly around transition points and widening access to educational opportunities:

- The programme was expanded to reach around a thousand students a year across the UK.
- Having originally mainly served students in independent and selective schools, it was reoriented towards students from disadvantaged backgrounds, whether from low income households, from families with no history of higher education, or those in care. From 2018 the scheme has exclusively focussed on such students.
- Opportunities were extended beyond schools into further education colleges to reach a wider range of students.
- Placements were extended beyond the natural sciences and engineering sectors to champion STEM skills rather than subjects, and to reach into data science and quantitative social sciences.

External evaluation

Following these changes, in 2016 an independent study of the impact of the programme was commissioned to contribute to the evidence base on interventions supporting student pathways. Undertaken by Frontier Economics and CFE Research, the evaluation covered three cohorts of students, tracking their higher education and subsequent destinations and outcomes, in comparison to similar students who had not undertaken a placement.

An interim report from this evaluation, published in 2019, showed that those undertaking placements were more likely to go on to study a STEM course at a Russell Group university than similar students who had not taken part in placements. The programme was also found to be successful in encouraging an increasingly diverse range of students to apply for and undertake placements. The interim report recommended ways to build on these accomplishments, and these informed its subsequent design. The report here is the final output of the evaluation, and has been long delayed due to complex data access and linkage issues. It includes an assessment of the longer-term impact of participation in placements on students' higher education and initial employment outcomes.

Recent changes

It is important to note that two major changes took place to the NRP programme affecting more recent cohorts of students than those evaluated here. First, in 2020, in order to continue some form of placement opportunity in that pandemic-affected summer, an online version of the programme was swiftly developed during the first lockdown, known as the 'Nuffield Future Researchers' programme. This enabled over 750 students, all from disadvantaged backgrounds, to develop skills and undertake research projects remotely, working with the usual placement providers. A specific external evaluation of that initiative was also positive and identified lessons for the post-pandemic version of the NRP programme.

Second, from 2021 the Foundation moved away from in-house co-ordination of the NRP programme, and gave a clear end point for our financial support. A formal tender process was conducted to select an organisation or partnership to assume responsibility for NRPs for three years, with the expectation that they would secure additional funding to transition to a self-sustaining model. STEM Learning won the tender and spread the funding across five years to run the programme, with a restoration of annual numbers to around 1,000 and a move to a hybrid model combining the original in-person aspects of the placements with a growing range of online resources and support. STEM Learning is now integrating the programme within its portfolio of STEM engagement activities for young people.

Implications of the evaluation findings

From the report that follows, four broad implications might be drawn out, linked to the wider research of the Foundation.

First, the report paints a very positive picture of the long-term impact of the programme on young people's opportunities. But it is important to note that the evaluation relates to the longer and wholly in-person placement that existed before Covid. The transformative nature of the experience for many students was achieved by the immersive and intensive design of the programme. Those running programmes with similar aims to NRPs should endeavour to provide these sorts of qualities.

However, for a variety of reasons, it has become more challenging in recent years to provide opportunities as extensive as 4-6 week in-person placements, and so the hybrid model that STEM Learning has developed may be a more realistic model at scale. It therefore becomes important to ensure that programmes involving organisations hosting student placements (and work experience in general) give more thought to how to support employers in the provision of experiences for students that are compressed but meaningful.

Second, the programme has shown the challenges and benefits of reaching under-served groups. Nuffield has funded an extensive body of research into issues of inequalities of opportunity in pathways from school into higher education, including:

- the relationship between family background and access to – or success in – higher education
- 'mismatch' where students attend less selective universities than their academic credentials warrant (disproportionately affecting women and those with disadvantaged backgrounds) and interventions to address it
- higher education choices of young people who are 'first in family', i.e. those attending university whose parents did not
- university applications and offers for those from racial minorities.

Since 2012, both under the Foundation's direct management and subsequently under STEM Learning, increasingly tightened application criteria and reoriented outreach activities have enabled NRPs to successfully reach a cohort composed entirely of disadvantaged students (either or both Free School Meals or 'first in family'). The programme also now has very ethnically diverse participation: (35% Asian or Asian British, 13% Black or Black British, 14% mixed, multiple or other ethnic group, and 37% white); and 64% of students are female. So the programme plays a notable part in tackling inequalities across these characteristics.

Third, as well as boosting students' skills and confidence in quantitative and scientific methods, placements also help them to acquire or develop the wider 'essential skills' needed for work and explored in our Skills Imperative 2035 project These include creativity, critical thinking, collaboration and interpersonal skills, problem solving, and resilience. They also complement or provide an alternative to the Extended Project Qualification (EPQ), an independent project equivalent to half an A Level, undertaken by around 36,000 sixth form students annually. A Nuffield-funded project is investigating issues around access to the EPQ opportunity and outcomes from it.

Fourth, the NRP programme shows the importance of providing young people with experience in the workplace at a key stage in their education. Recent Nuffield-funded research shows significant inequalities in access to internships and other forms of work experience by socio-economic background and ethnicity. Other projects have shown more broadly that employers desire applicants for jobs who have work experience but also that many young people struggle to find those opportunities. Whilst the negative impact of Covid on both work experience opportunities and career guidance has persisted somewhat, there are some important positive developments. Work experience is now strengthened in the new statutory guidance and in new frameworks. And the national infrastructure of Careers Hubs, Careers Leaders, Cornerstone Employers and Gatsby Benchmarks, are providing more extensive and evidence-based opportunities for all young people. In this context, programmes like NRPs will be increasingly important.

Conclusion

Since its establishment, we estimate that around 25,000 students have benefitted from the NRP programme in its various incarnations. It is one of many interventions aimed at enriching young people's education or supporting those that are disadvantaged. However, they are rarely evaluated in a rigorous way. We hope that sharing details of the evaluation and its initial findings will inform programmes with similar aims; help strengthen approaches to their design and evaluation; and encourage equivalent studies.

Josh Hillman, Director of Education, Nuffield Foundation

Executive Summary

What were Nuffield Research Placements?

The Nuffield Foundation gave post-16 students the opportunity to undertake science, technology, engineering and mathematics (STEM) research experience through the Nuffield Research Placements (NRPs) programme. The programme aimed to deepen students' understanding of STEM subjects and research, and to encourage them to pursue further studies and careers in STEM by arranging four- to six-week STEM research placements for students in the summer between Years 12 and 13 (or equivalent).

Placements were delivered throughout the UK with a balance across the devolved nations broadly matching the cohort population base. They primarily took place in universities (73% of all placements in the years 2014 to 2016) but were also delivered in research institutes and in industry and other parts of the private sector. The placements also covered a range of subject areas including quantitative social sciences (such as maths, statistics and data science) as well as pure science (such as biology, chemistry, physics and engineering) and required work on a tangible project with supervision and written outputs.

The programme operated for over 20 years and it is estimated that more than 20,000 students participated. In later years, the programme was increasingly targeted towards young people with socio-economically disadvantaged backgrounds such that these now represent all beneficiaries.

How have the NRPs been 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 comprised a qualitative element and a longitudinal quantitative element.

The qualitative element undertook an in-depth exploration of the perceptions and experiences of placement providers, schools, colleges and students who participated in 2016 in order to help with understanding how well the programme works for each group and progress made towards achieving the key outcomes for NRPs. Evidence 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.

The quantitative element initially undertook a composition analysis using linked administrative datasets to identify which types of pupils were applying to the programme and which types were successful in their application in the three years 2014, 2015 and 2016. Students were subsequently tracked over time through their A Level achievement and enrolment in higher education (HE) to assess the impacts that placements had on choices about post-school study and career paths in STEM.

The evaluation therefore considered the impacts of the pre-Covid model of placements. Since then, the programme has changed fundamentally both in becoming hybrid face-to-face and remote (having been purely remote during the pandemic) and in moving from direct delivery by Nuffield to being managed by another organisation, STEM Learning. In addition, because the linked administrative datasets only covered pupils in maintained schools in England, the scope of the composition and impact analysis did

not cover NRP applicants (and comparison pupils) from independent schools or further education colleges or in the devolved nations.[1]

Four previous evaluation reports have been published (see NRP Evaluation Reports). These reports present findings from the qualitative element, the composition analysis and initial impact analysis for the 2014 cohort. This report is the final evaluation output and presents findings for the impact analysis for all three cohorts.

Who benefitted from the programme and what were the perceived benefits?

The key findings from the previous stages of the evaluation were:

- **The programme successfully targeted disadvantaged pupils.** Just over one-fifth (22%) of NRP students had been eligible for free school meals (FSM) at some time in the previous six years (our indicator for background disadvantage). Pupils from disadvantaged backgrounds were more likely to apply for and undertake a placement than other pupils. In addition, pupils in schools with higher proportions of FSM pupils and lower average academic attainment were more likely to apply and to be successful in their application, and pupils eligible for FSM were considerably more likely to apply than other pupils in their school.

- **Pupils from ethnic minorities benefitted from the programme to a higher degree than other pupils.** A substantial proportion of NRP students were in a non-white ethnic group: 58% were white, 7% black, 26% Asian and 8% of mixed or other ethnic group. Pupils from ethnic minorities were more likely to apply for and undertake placements than other pupils. Indeed, ethnicity appeared to have an influence over and beyond any association with disadvantage.

- **In spite of the historically low representation of women in STEM, more than half (54%) of NRP students were female.** Given their background characteristics and average educational attainment at the time of possible application, female pupils should have been applying at an even higher rate.

- **The placement experience was 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 reported that placements improved their understanding of what STEM researchers do** on a day-to-day basis but did not appear to influence their attitudes on how interesting a STEM career is or how much they enjoyed the study of STEM subjects. Placements also did 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.

[1] Of the 9,616 applicants in the three years from 2014 to 2016, 2,960 (31%) were not matched to pupils in the National Pupil Database (NPD), constituting 30% of NRP participants and 31% of unsuccessful applicants. Matching was similar across the three years (the proportion not matched was 33% in 2014, 31% in 2015 and 29% in 2016). The Nuffield application data indicated that 9% of all applicants were in independent schools (and 9% in each of the three cohorts) and 19% were in the devolved nations (21% in 2014, 17% in 2015 and 18% in 2016).

How were impacts estimated?

The final analysis presented in this report considers the impacts of completing a placement on A Level achievement and HE enrolment in the year following the placement. Data on A Level achievement for maintained schools in England was obtained from the National Pupil Database (NPD) and on HE enrolment in the UK from the Higher Education Statistics Agency (HESA) for all pupils in the NRP cohort years, with individual matching for NRP applicants (both successful and unsuccessful).[2]

For each outcome, NRP participants were compared to two different comparison groups: unsuccessful applicants to the programme and all pupils in the NPD data eligible to apply for an NRP. As neither of these comparison groups was an exact match for NRP participants, impacts were estimated using regression models that controlled for differences in other observed characteristics which may have driven the outcomes. These models included individual, school and local area characteristics as well as specific controls for some differences in AS Level choices between NRP participants and both comparison groups.

Because the programme aimed 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.

In a final step for the impact analysis, existing evidence on the links between HE enrolment and later employment and earnings for the UK population were used to consider the potential effects of the placements on these later outcomes.

What were the impacts of the NRPs?

The key findings from the impact analysis are:

- **NRPs increased the number and quality of STEM A Levels achieved.** Undertaking a placement was associated with a higher average number of STEM A Levels of 0.3 for all pupils and 0.3 for FSM pupils, and a higher average point score for STEM A Levels of 7.5 for all pupils and 7.3 for FSM pupils (corresponding to almost one grade for one A Level).

- **NRPs increased the likelihood of enrolling in HE and the likelihood of enrolling in a STEM course at a higher status institution (defined as an institution in the Russell Group and/or with a Research Excellence Framework (REF) top 30 rank for STEM courses).**[3] Undertaking a placement was associated with a higher enrolment rate in HE of 6.8 ppt (percentage points) for all pupils and 9.4 ppt for FSM pupils. For students enrolling in HE, undertaking a placement was associated with a higher enrolment rate in a STEM course at a higher status institution of 14.3 ppt and a higher enrolment rate in a STEM course in another HE institution of 4.5 ppt. For FSM students enrolling in HE, placements were associated with a higher enrolment rate in a STEM course at a higher status institution of 12.6 ppt.

- **The improvement in A Level results contributed to the impacts on HE enrolment.** Around half of the impacts of placements on HE enrolment were attributable to the improvement in A Level results and half to a direct impact on HE enrolment. The increased enrolment in STEM courses

[2] The analysis was undertaken in the Office for National Statistics Secure Research Service using data from ONS and other owners and does not imply the endorsement of the ONS or other data owners.

[3] See appendix section A.1 for a full explanation of the HE types and higher status HE institutions.

was mainly attributable to a direct impact on HE rather than being due to improvements in A Level results.

- **Impacts were similar for NRPs undertaken at universities and those undertaken at other types of organisation.** While placements at universities had similar impacts to those undertaken at other places on the number and average point score for STEM A Levels achieved and on HE enrolment, only placements at universities (constituting 73% of all placements) had an impact on the proportion achieving at least one STEM A Level.

- **Some NRP subject areas had larger impacts than other subject areas.** Placements in the subject areas of "astronomy and physics" and "maths, statistics and data science" had the greatest impacts on A Level achievement and HE enrolment, while those in "biology, biomedical and environmental sciences" and "chemistry, biochemistry and forensics" had the smallest impacts (with the impacts from "computing, engineering and manufacturing" placements lying in the middle).

- **Relative to the short duration of the placements, the potential effects of participation in NRPs on later employment and earnings are substantial.** Placements could have increased employment rates by 1.2 ppt and average earnings at age 30 by 3.3%. The potential effect on employment would be almost entirely due to the impact on HE enrolment rather than the impact on HE subject or institution, while the potential effect on earnings would be due both to the impact on HE enrolment (1.1% higher earnings) and to the impact on HE subject and institutions (2.3% higher earnings).

What did the Nuffield Research Placements achieve?

The quantitative analysis in this report shows that placements were associated with substantial positive impacts on A Level achievement and HE enrolment. Placements may have driven the improvement in A Level outcomes by enhanced knowledge and understanding of A Level STEM subject material and by greater motivation for study. Placements both enabled students (through the improved A Level results) and motivated students (through a direct impact on HE choices) to enrol in HE and specifically to enrol in STEM courses at higher status institutions.

By encouraging more pupils to pursue further study in STEM subjects on the path to STEM-related careers, the NRP programme contributed to increasing STEM skills in the workforce, driving economic innovation and growth to the benefit of broader society. For the students, the placements offered not only the potential benefit of rewarding careers but also higher rates of employment and earnings in their working life. Given the focus of the programme on pupils from disadvantaged backgrounds, these benefits would have accrued to a greater degree to those from poorer backgrounds, helping to reduce socioeconomic inequality.

Chapter 1: The Evaluation of Nuffield Research Placements

What were Nuffield Research Placements?

The Nuffield Foundation gave post-16 students the opportunity to undertake science, technology, engineering and mathematics (STEM) research experience through the Nuffield Research Placements (NRPs) programme. The programme aimed to deepen students' understanding of STEM subjects and research, and to encourage them to pursue further studies and careers in STEM by arranging four- to six-week STEM research placements for students in the summer between Years 12 and 13 (or equivalent). The programme operated for over 20 years and it is estimated that more than 20,000 students participated.

Placements were delivered throughout the UK with a balance across the devolved nations broadly matching the cohort population base. They primarily took place in universities (73% of all placements in the years 2014 to 2016) but were also delivered in research institutes and in industry and other parts of the private sector. The placements also covered a range of subject areas including quantitative social sciences (such as maths, statistics and data science) as well as pure science (such as biology, chemistry, physics and engineering) and required work on a tangible project with supervision and written outputs.

Placements were managed by regional co-ordinators. To be eligible for a placement, students were required to be studying for at least one A Level (or equivalent) in a STEM subject and to have five GCSEs (or equivalent) at grade B or above, including maths, English and a science. Applicants were also expected to have an interest in studying STEM at university. In the later years of the programme (including those covered by this evaluation), the Nuffield Foundation focused on reaching students from more disadvantaged backgrounds, and regional co-ordinators prioritised those with particular disadvantages beyond the free school meals (FSM) measure, such as those with low science capital or those who lacked other opportunities in the allocation process.

This evaluation covers placements which were undertaken in the three years 2014, 2015 and 2016. It therefore considers the impacts of the pre-Covid model of placements. Since then, the programme has changed fundamentally both in becoming hybrid face-to-face and remote (having been purely remote during the pandemic) and in moving from direct delivery by Nuffield to being managed by another organisation, STEM Learning.

What were the objectives of the NRP programme?

The objectives of the programme were structured around a set of outcomes for young people, providers, and schools and colleges:

- For young people, the short-term outcomes included improved confidence, independent working, science capital/networks and informed decision-making, as well as enhancing opportunities for achieving STEM-related awards. The placements also aimed to support higher education (HE) and job interviews, UCAS applications, and attendance and completion of HE at research-

intensive and "top" 30 HE institutions. The long-term outcomes included further study in STEM and employment in research.

- For placement providers and supervisors, the short-term outcomes included 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 included offering more authentic research placement opportunities and early career researchers establishing links to local schools and colleges.

- For schools and colleges, the short-term outcomes included more students, particularly FSM-eligible students, from target schools and colleges applying for placements. The long-term outcomes included 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 aimed 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; and

- 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 have the NRPs been 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 covered three cohorts of placements (2014, 2015 and 2016) and was planned to be completed over seven years until 2022. It comprised a qualitative element (led by CFE Research) and a quantitative element (undertaken by Frontier Economics).

The qualitative element undertook an in-depth exploration of the perceptions and experiences of placement providers, schools, colleges and students who participated in 2016 in order to help with understanding how well the programme worked for each group and the progress made towards achieving the key outcomes for NRPs. Evidence 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. 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 and three post-placement) and comparison surveys with *un*successful applicants for the three post-placement surveys (collecting pre-placement information at the first post-placement

interview). The surveys captured changes in students' plans, STEM knowledge, skills and other attributes, and recorded details on further education and career plans.

The quantitative element of the evaluation used linked administrative datasets to:

- Identify which types of students were likely to apply for NRPs and to be successful in their application using linked National Pupil Database (NPD) data (composition analysis); and
- Assess the impacts that placements had on choices about post-school study and career paths in STEM using linked NPD data on key stage 5 (A Level) results and Higher Education Statistics Agency (HESA) data on HE enrolment in the year following placements (impact analysis).

Because the linked administrative datasets only covered pupils in maintained schools in England, the scope of the composition and impact analysis did not cover NRP applicants (and comparison pupils) from independent schools or further education colleges or in the devolved nations.[4]

The composition analysis was reported in 2017 and the qualitative report was published in 2019. Interim impact analysis for the 2014 cohort was also reported in 2019, alongside an overarching interim report. All four reports are available at NRP Evaluation Reports.

The final impact analysis from the longitudinal element which considers the impacts that the placements had on post-school study and career paths in STEM is presented in this report. This was delayed by administrative changes in the process for accessing linked NPD-HESA data and a new requirement for the analysis to be undertaken in the Secure Research Service environment. It also proved infeasible to complete plans to further link the data to the Destination of Leavers of Higher Education data on post-HE outcomes and employment, and an alternative approach using estimated links from existing evidence was used instead.

Who benefitted from the placements?

A key aim of the NRP programme was to offer pupils from disadvantaged backgrounds the opportunity to obtain research experience in STEM subjects. Just over one-fifth (22%) of NRP students had been eligible for FSM at some time in the previous six years (our indicator for background disadvantage). The composition analysis produced substantial evidence that the programme had successfully targeted disadvantaged pupils:

- Pupils from disadvantaged backgrounds (measured by FSM eligibility) were 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 were more likely to apply and to be successful in their application.
- Pupils eligible for FSM were more likely to apply than non-FSM pupils in all 13 of the English NRP regions and were more likely to undertake a placement in all regions.

[4] Of the 9,616 applicants in the three years from 2014 to 2016, 2,960 (31%) were not matched to pupils in the NPD, constituting 30% of NRP participants and 31% of unsuccessful applicants. Matching was similar across the three years (the proportion not matched was 33% in 2014, 31% in 2015 and 29% in 2016). The Nuffield application data indicated that 9% of all applicants were in independent schools (and 9% in each of the three cohorts) and 19% were in the devolved nations (21% in 2014, 17% in 2015 and 18% in 2016).

- Pupils eligible for FSM were considerably more likely to apply than other pupils in their school.

Pupils from ethnic minorities also benefitted from the programme to a higher degree than other pupils. A substantial proportion of NRP students were in a non-white ethnic group: 58% were white, 7% black, 26% Asian and 8% of mixed or other ethnic group. Pupils from ethnic minorities were more likely to apply for and undertake placements than other pupils. Indeed, ethnicity appeared to have had an influence over and beyond any association with disadvantage.

More than half (54%) of NRP students were female, which can be deemed quite a success given the historically low representation of women in STEM. Given their background characteristics and average educational attainment at the time of possible application, female pupils should have been applying at an even higher rate. There were also differences in placement subjects across male and female students: female NRP students were more likely than males to have placements in biology and chemistry related subjects than in physics, computing or engineering related subjects.

What were the perceived benefits?

The qualitative element of the work suggested:

- There were 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 have benefitted from enhancement of broader interest in STEM and improvement in academic attainment. Placement providers may have benefitted from the additional resources and opportunity to develop staff supervisory skills as well as longer-term development of the future talent pipeline.

- Placements did 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 improved students' understanding of what STEM researchers do on a day-to-day basis but did not appear to influence their attitudes on how interesting a STEM career is or how much they enjoyed the study of STEM subjects.

- Placements did not appear to influence the sources of information, advice and guidance that students used in their education and career decisions.

- The placement experience enhanced pupils' perceived 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.

Outline of this report

The remainder of this report presents the final impact analysis and is structured in the following way:

- Chapter 2 provides a description of the evaluation approach for the impact analysis.

- Chapter 3 presents the findings for the impacts on students' A Level results.

- Chapter 4 presents the findings for the impacts on initial HE enrolment.

- Chapter 5 considers the potential effects of the placements on later employment and earnings.
- Chapter 6 concludes with some reflections on the achievements of the NRP programme.
- The appendix provides further technical details for the impact analysis.

Chapter 2: How were impacts estimated?

This chapter describes the approach used to estimate the impacts of the placements. The first section presents the outcomes considered, while the second section explains why students eligible for FSM were of particular interest. The third section describes the data and methodology used to identify impacts. The final section outlines how existing evidence was used to consider the potential effects of the NRPs on later employment and earnings. Further technical details are provided in the appendix.

Which impacts were considered?

The analysis considered the impacts of completing a placement on two sets of outcomes:

- A Level achievement: whether at least one STEM (science, technology, engineering and mathematics) A Level was achieved, number of STEM A Levels achieved, and average points score in STEM A Levels (for those with at least one STEM A Level); and
- HE enrolment in the year following the placement: whether students enrolled in HE and the HE type defined by institution and degree subject.[5]

A Level achievement was not a specific programme objective but may have been a step towards encouraging or enabling students to pursue further study and careers in STEM. This was considered to provide insight on whether NRPs impact future choices directly or via the effects on A Level study.

Which placement students were of particular interest?

Because the programme aimed 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. Just over one-fifth (22%[6]) of NRP students had been eligible for FSM at some time in the previous six years, compared to 16% for all AS Level pupils in the three cohorts and 11% for all AS Level pupils eligible for the programme in the three cohorts.

How were impacts estimated?

Data on A Level achievement for maintained schools in England was obtained from the National Pupil Database (NPD) and on HE enrolment in the UK from the Higher Education Statistics Agency (HESA) for all pupils in the NRP cohort years, with individual matching for NRP applicants (both successful and unsuccessful).[7]

For each outcome, NRP participants were compared to two different comparison groups from the three years of the study:

1. Unsuccessful applicants: all unsuccessful applicants to the programme; and

[5] Less than 1% of the 2014 cohort of NRP applicants began further education in 2015/2016 and the analysis therefore focused on HE enrolment.

[6] This proportion was similar across all three cohorts: 21% in 2014, 20% in 2015 and 22% in 2016.

[7] The analysis was undertaken in the Office for National Statistics Secure Research Service using data from ONS and other owners and does not imply the endorsement of the ONS or other data owners.

2. All eligible students: all pupils in the NPD data eligible to apply for an NRP.

As neither of these comparison groups was an exact match for NRP participants, impacts were estimated using regression models that controlled for differences in other observed characteristics which may have driven the outcomes. These models included individual, school and local area characteristics as well as specific controls (whether students studied three or more STEM subjects at AS Level and whether they studied STEM subjects other than mathematics at AS Level) for some differences in AS Level choices between NRP participants and both comparison groups.

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

- The analysis was restricted to pupils in maintained schools in England because of the scope of the NPD data, and the analysis did not cover NRP applicants (and comparison pupils) from independent schools or further education colleges or in the devolved nations.[8]
- The impact on enrolment in HE only covered the year following A Level completion and did not include enrolment following a gap year.
- While using unsuccessful applicants as a comparison group had the advantage that they were likely to closely match NRP participants in other characteristics which could drive outcomes, there were two drawbacks to using this comparison group. First, the sample size was relatively small. Second, successful applicants may have differed from unsuccessful ones due to the NRP selection process. This selection varied due to such factors as the availability of places in particular subject areas and the ways in which co-ordinators may have given preference to students who they thought would benefit the most. The latter in particular could have introduced an unknown bias in the differences with the unsuccessful applicant comparison group.
- While using all eligible pupils as a comparison group had the advantage of an extremely large size (which substantially raised the likelihood of identifying any programme impacts), applicants to the programme may have differed 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 contained many students who had 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 was limited.

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

How were potential effects on later employment and earnings considered?

As data on later employment and earnings for NRP applicants and placements was not available, existing evidence on the links between HE enrolment and later employment and earnings for the UK population was used to consider the potential effects of the placements on these later outcomes.

[8] Of the 9,616 applicants in the three years from 2014 to 2016, 2,960 (31%) were not matched to pupils in the NPD, constituting 30% of NRP participants and 31% of unsuccessful applicants. Matching was similar across the three years (the proportion not matched was 33% in 2014, 31% in 2015 and 29% in 2016). The Nuffield application data indicated that 9% of all applicants were in independent schools (and 9% in each of the three cohorts) and 19% were in the devolved nations (21% in 2014, 17% in 2015 and 18% in 2016).

Chapter 3: Did placements improve STEM A Level results?

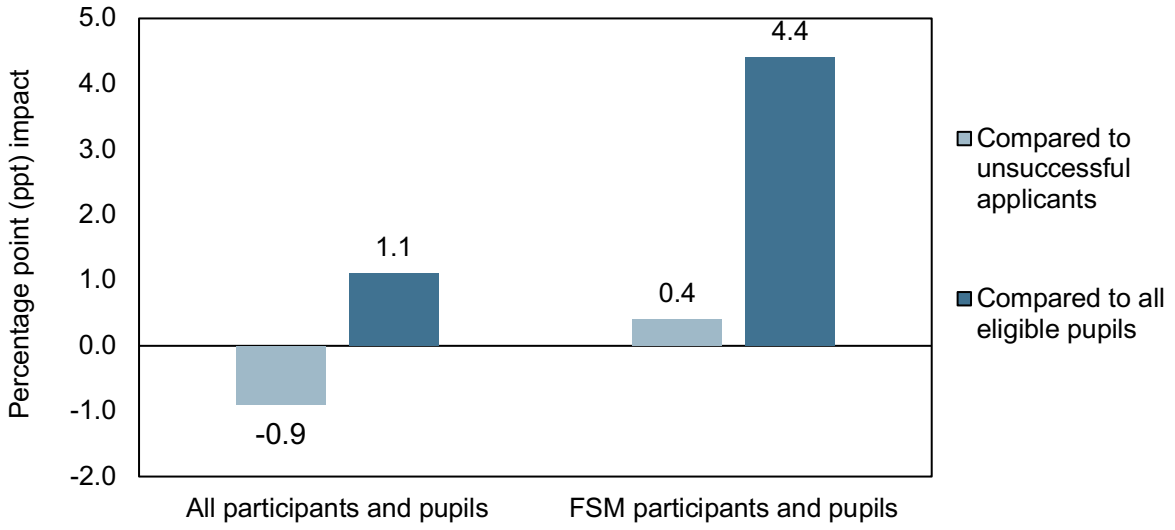
This chapter presents findings for the impacts of the placements on A Level results. The first section presents the headline findings for all students and for students eligible for FSM. The second and third sections consider the impacts of different types of placements and placements in different subject areas. The final section summarises the findings.

Impacts on STEM A Level results

Some 88% of all NRP students in the combined three years of 2014, 2015 and 2016 went on to achieve at least one STEM A Level in the following year. This proportion was higher than for both comparison groups (87% for unsuccessful applicants and 82% for all pupils eligible for NRPs). Similarly for FSM students, the proportion achieving at least one STEM A Level was higher for NRP students (84%) than for unsuccessful applicants (80%) and all eligible pupils (74%),

Figure 1 presents the estimated impacts of the placements, that is, the differences with each comparison group after controlling for differences in other characteristics. Allowing for these other characteristics meant that the proportion achieving at least one STEM A Level was 0.9 ppt (percentage points) lower for NRP students than unsuccessful applicants and 1.1 ppt higher than for all eligible pupils, but the impacts were not statistically significant. Allowing for other characteristics for FSM pupils meant that the proportion achieving at least one STEM A Level was 0.4 ppt higher for NRP students than unsuccessful applicants and 4.4 ppt higher than for all eligible pupils, but the impacts were also not statistically significant.

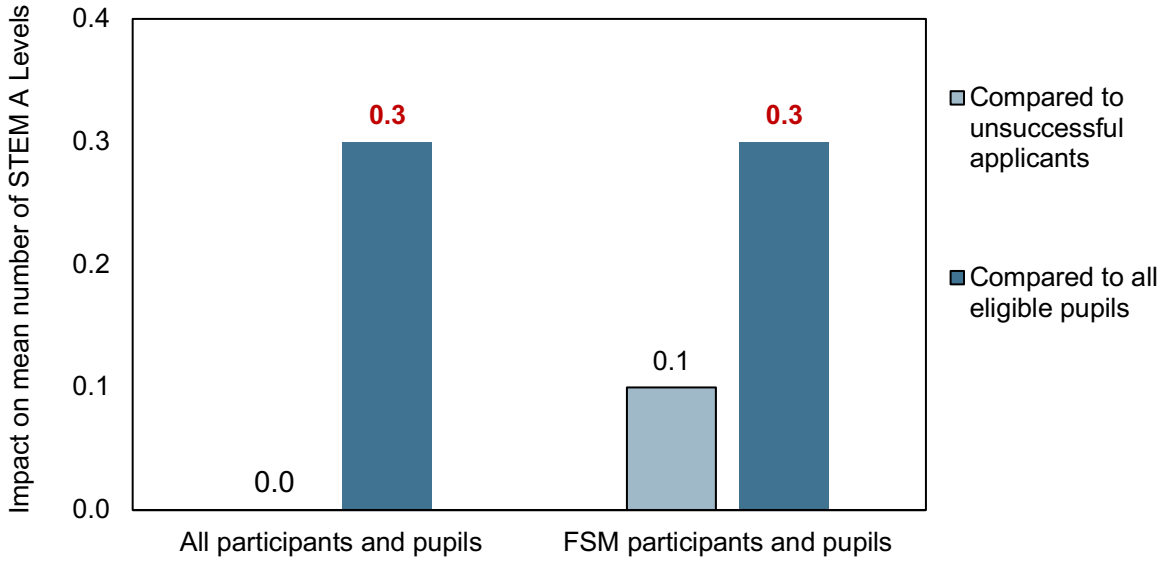
Figure 1: Estimated impacts on proportion achieving at least one STEM A Level



Notes: None of the impacts were statistically significant at the 95 percent level. Impacts were estimated using a logit model with control variables for the probability of achieving at least one STEM A Level. Sample sizes were 5,965 and 275,320 for all participants and pupils and 1,180 and 30,015 for FSM participants and pupils.

NRP students went on to achieve an average of 2.5 STEM A Levels. There was no statistically significant difference with unsuccessful applicants, but undertaking a placement was associated with a higher mean number of STEM A Levels (0.3 higher) than for all eligible pupils (figure 2). For FSM students, those undertaking a placement went on to achieve an average of 2.3 STEM A Levels. As for all pupils, there was no statistically significant difference with unsuccessful applicants, but undertaking a placement was associated with a higher mean number of STEM A Levels (again, 0.3 higher) than for all eligible FSM pupils.

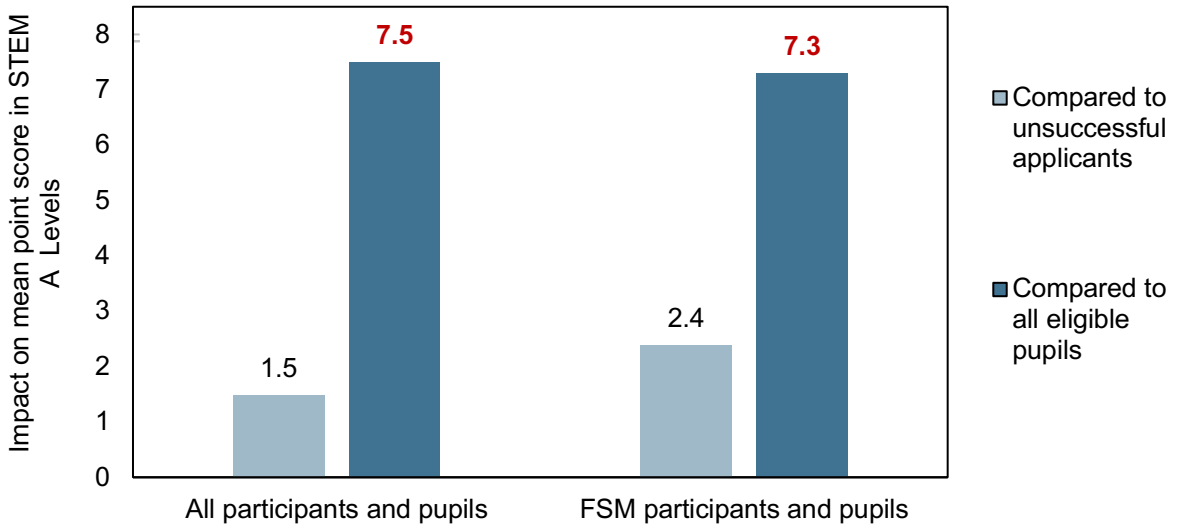
Figure 2: Estimated impacts on number of STEM A Levels achieved



Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. Impacts were estimated using a linear regression model with control variables for the number of STEM A Levels achieved. Sample sizes were 5,965 and 275,320 for all participants and pupils and 1,180 and 30,015 for FSM participants and pupils.

NRPs also had benefits for the average point score in STEM A Levels among those achieving at least one STEM A Level (figure 3). All NRP students achieved an average score of 249, while FSM NRP students achieved an average score of 238, and undertaking a placement was associated with a higher mean score (7.5 points higher) for all eligible pupils and a higher mean score (7.3 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 achieved an average AAB set of grades for three A Levels rather than ABB or that they achieved an average ABC rather than BBC.

Figure 3: Estimated impacts on average point score in STEM A Levels



Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. Impacts were estimated using a linear regression model with control variables for the average point score in STEM A Levels. Sample sizes were 5,190 and 225,105 for all participants and pupils and 965 and 22,435 for FSM participants and pupils.

Differences across placement types

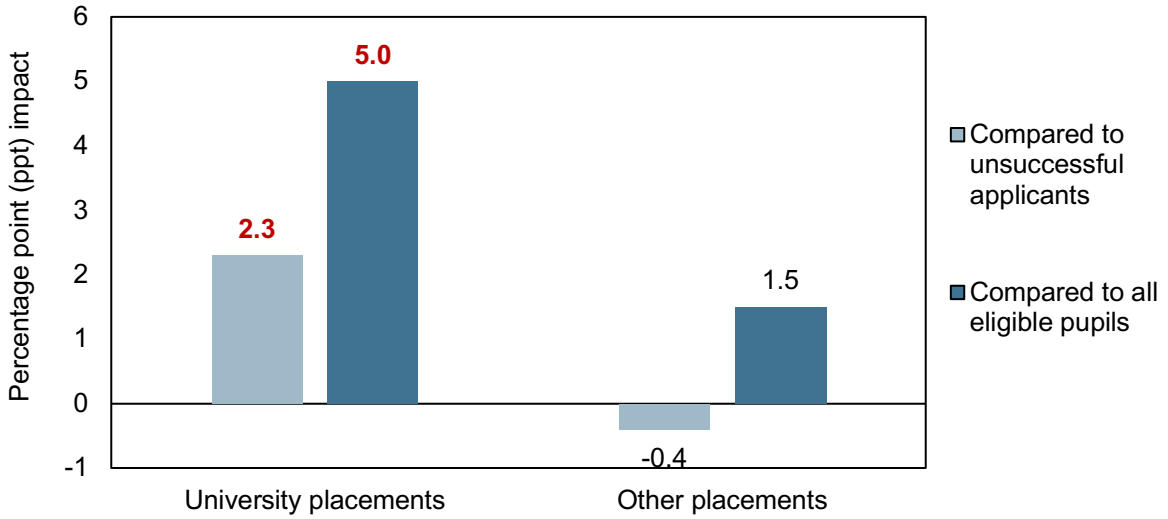
The vast majority of placements (73%) in 2015 and 2016[9] were undertaken at universities.[10] Much smaller proportions were undertaken in the private sector (16%), research institutes (4%) and other types of organisations (7%). Given the small number of placements in the three non-university types, the analysis considered the differences between placements at universities and those at the other three types of places combined.

University placements had a positive impact on the likelihood of achieving at least one STEM A Level (figure 4), while both university and non-university placements had positive impacts on the number of STEM A Levels achieved (figure 5) and the average point score in STEM A Levels (figure 6) in comparison to all eligible pupils. There were no statistically significant differences in the size of impacts between the two types of placements for any of the A Level outcomes and the estimated sizes of impacts were similar for the number of STEM A Levels and average point score.

[9] Due to limitations on the permissions to link NRP programme data with administrative data for the 2014 cohort, the analysis across types of placements could only be undertaken for the 2015 and 2016 cohorts.

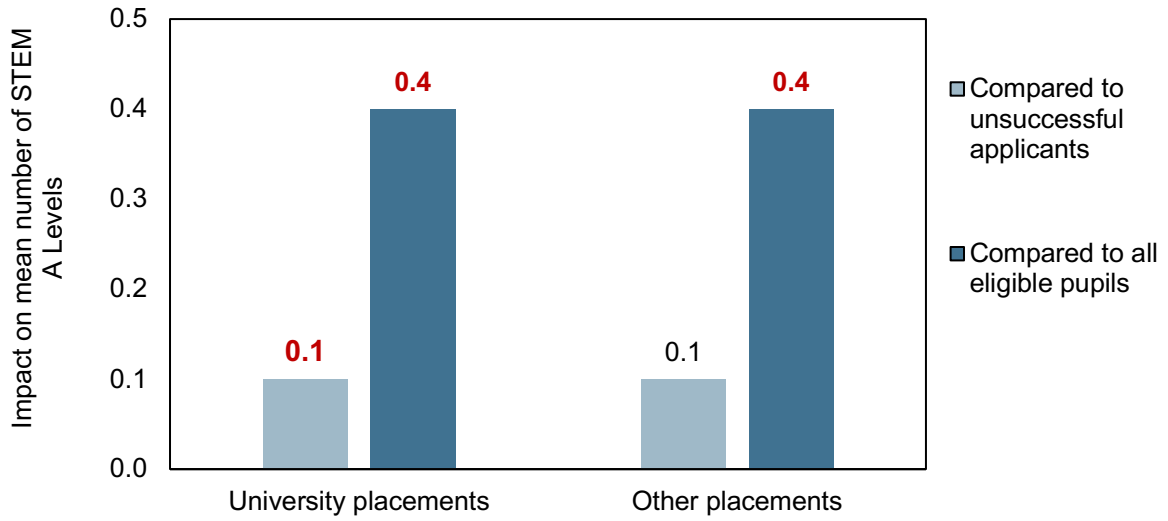
[10] Impacts across placement type and subject area were not estimated for the FSM sample due to the small sample size for FSM participants and pupils.

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



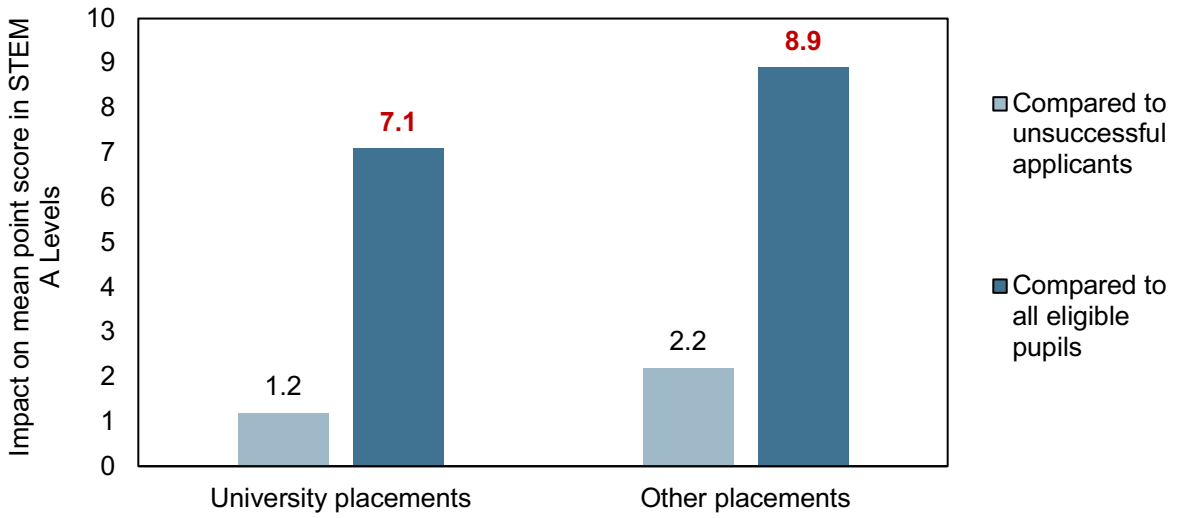
Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. There were no statistically significant differences between university placements and other placements. Impacts were estimated using a logit model with control variables for the probability of achieving at least one STEM A Level. Sample sizes were 4,180 for the comparisons with unsuccessful applicants and 187,790 for the comparisons with all eligible pupils.

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



Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. There were no statistically significant differences between university placements and other placements impacts were estimated using a linear regression model with control variables for the number of STEM A Levels achieved. Sample sizes were 4,180 for the comparisons with unsuccessful applicants and 187,790 for the comparisons with all eligible pupils.

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



Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. There were no statistically significant differences between university placements and other placements impacts were estimated using a linear regression model with control variables for the average point score in STEM A Levels. Sample sizes were 3,680 for the comparisons with unsuccessful applicants and 154,725 for the comparisons with all eligible pupils.

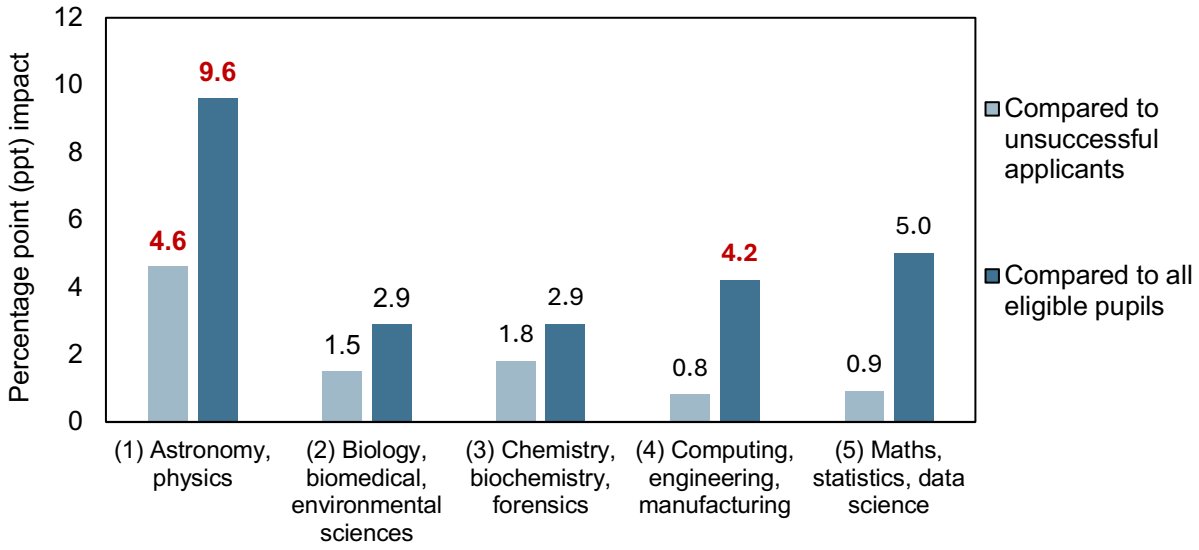
Differences across placement subjects

The most common placement subject area in 2015 and 2016 was "biology, biomedical and environmental sciences", with 40% of placements in this field. Other placement subject areas included "astronomy and physics" (13%), "chemistry, biochemistry and forensics" (15%), "computing, engineering and manufacturing" (23%), and "maths, statistics and data science" (9%).

Placements in two subject areas ("astronomy and physics" and "computing, engineering and manufacturing") had positive impacts on the likelihood of achieving at least one STEM A Level (figure 7), although there were no statistically significant differences in impacts across the five subject areas.

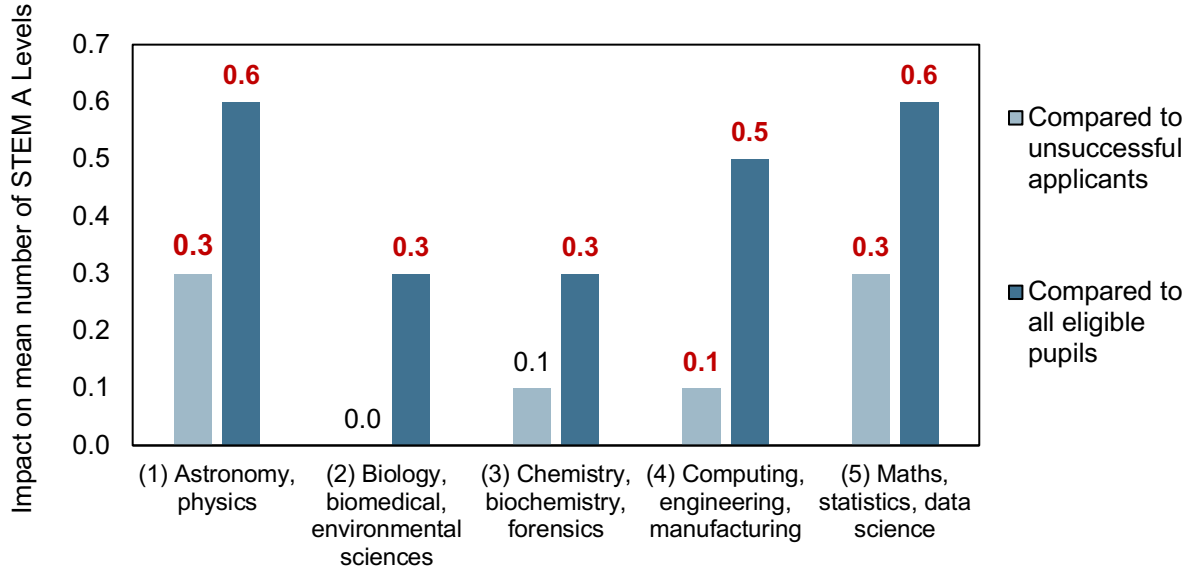
In contrast, placements in all subject areas had positive impacts (at least for the comparisons with all eligible pupils) on both the number of STEM A Levels achieved and the average point score in STEM A Levels (figures 8 and 9) with the exception of "biology, biomedical and environmental sciences" for the average point score. In addition, the impacts were statistically significantly higher for placements in "astronomy and physics" and "maths, statistics and data science" and lower for placements in "biology, biomedical and environmental sciences" and "chemistry, biochemistry and forensics".

Figure 7: Estimated impacts on proportion achieving at least one STEM A Level by placement subject area



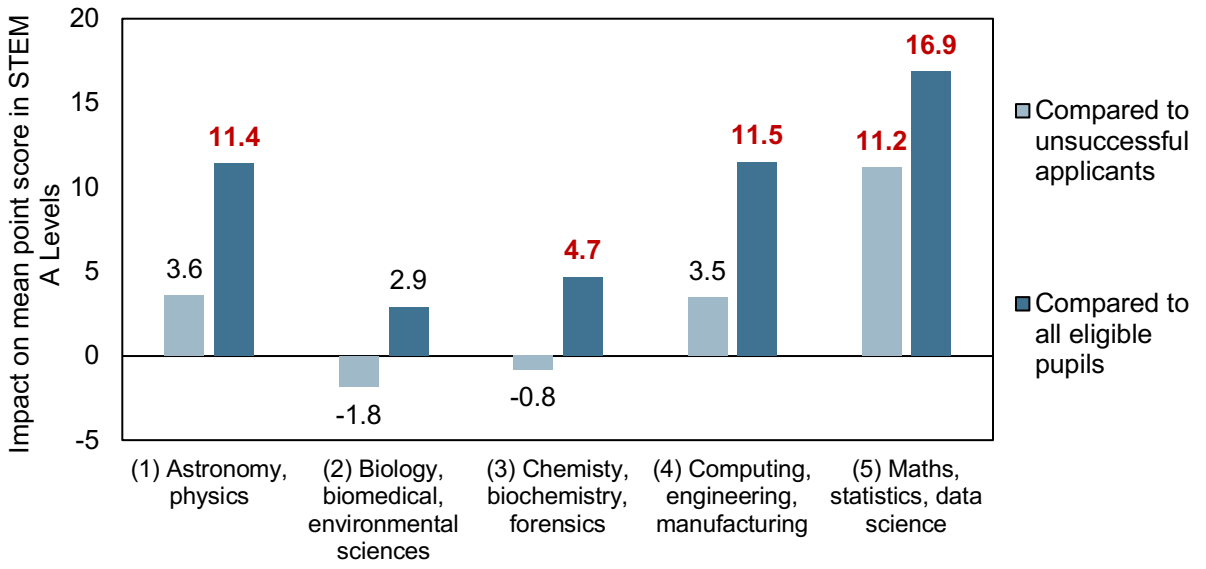
Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. There were no statistically significant differences in impacts across the subject areas. Impacts were estimated using a logit model with control variables for the probability of achieving at least one STEM A Level. Sample sizes were 4,180 for the comparisons with unsuccessful applicants and 187,790 for the comparisons with all eligible pupils.

Figure 8: Estimated impacts on number of STEM A Levels achieved by placement subject area



Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. For the comparisons with unsuccessful applicants, impacts were statistically significantly greater for subject area (1) over (2), (3) and (4); and for (5) over (2). For the comparisons with all eligible pupils, impacts were statistically significantly greater for subject area (1) over (2) and (3); for (4) over (2); and for (5) over (2) and (3). Impacts were estimated using a linear regression model with control variables for the number of STEM A Levels achieved. Sample sizes were 4,180 for the comparisons with unsuccessful applicants and 187,790 for the comparisons with all eligible pupils.

Figure 9: Estimated impacts on average point score in STEM A Levels by placement subject area



Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. For the comparison with unsuccessful applicants, impacts were statistically significantly greater for subject area (1) over (2); for (4) over (2); and for (5) over all other areas. For the comparisons with all eligible pupils, impacts were statistically significantly greater for subject area (1) over (2) and (3); for (4) over (2) and (3); and for (5) over (2) and (3). Impacts were estimated using a linear regression model with control variables for the average point score in STEM A Levels. Sample sizes were 3,680 for the comparisons with unsuccessful applicants and 154,725 for the comparisons with all eligible pupils.

Summary

The evidence from the preferred comparison group of all eligible pupils indicates that NRPs had particular benefits for the number and quality of STEM A Levels achieved. Specifically, it is estimated that undertaking a placement was associated with:

- A higher mean number of STEM A Levels for all pupils (0.3 A Levels higher) and FSM pupils (also 0.3 A Levels higher); and
- A higher mean point score for STEM A Levels for all pupils (7.5 points higher) and for FSM pupils (7.3 points higher) (corresponding to almost one grade for one A Level).

This may reflect how placements improved pupils' understanding and knowledge of the STEM A Level material and increased their motivation in their subsequent A Level study.

There were some differences in the impacts across the types of placements:

- While placements at universities and placements at other types of organisations had similar impacts on the number of STEM A Levels achieved and the average point score in STEM A Levels, only those at universities had an impact on the proportion achieving at least one STEM A Level.
- Placements in the subject areas of "astronomy and physics" and "maths, statistics and data science" had the greatest impacts on A Level outcomes, while those in "biology, biomedical and

environmental sciences" and "chemistry, biochemistry and forensics" had the smallest impacts (with the impacts from "computing, engineering and manufacturing" placements lying in the middle).

The differences in impacts across placement subjects suggest that placements in some subject areas were more supportive of A Level achievement. However, it is also possible that the differences across subjects may have been due to students who were inherently more likely to achieve better A Level results being more likely to request placements in the subject areas of "astronomy and physics" and "computing, engineering and manufacturing".

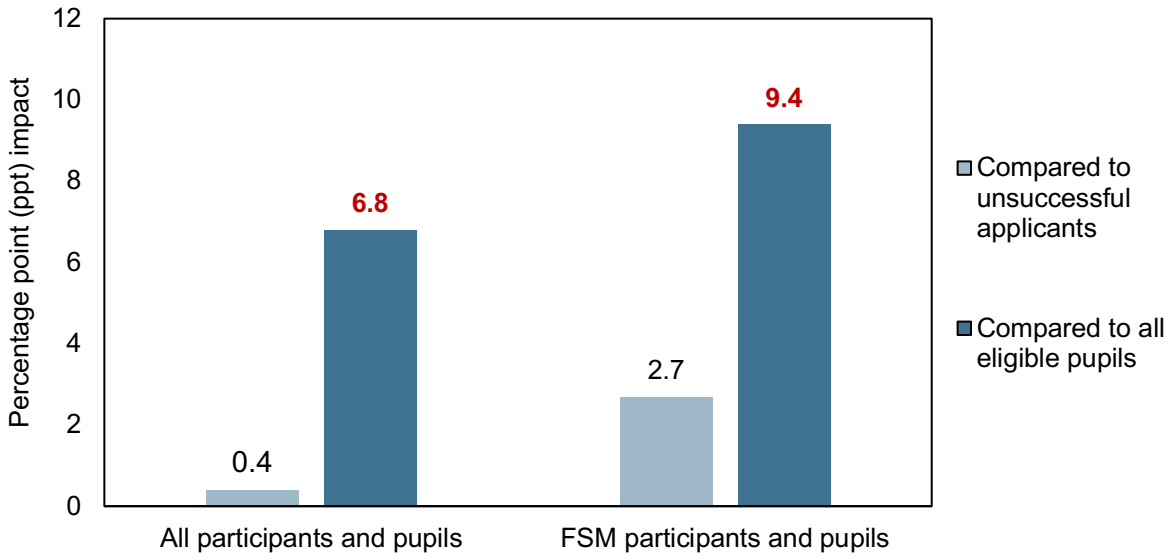
Chapter 4: Did placements improve access to STEM Higher Education?

This chapter presents findings for the impacts of the placements on enrolment in HE. The first section presents the headline findings for all students and for students eligible for FSM. The second section explores the extent to which impacts on HE operated through interim impacts on A Level outcomes. The following two sections consider the impacts of different types of placements and placements in different subject areas. The final section summarises the findings.

Impacts on STEM HE enrolment

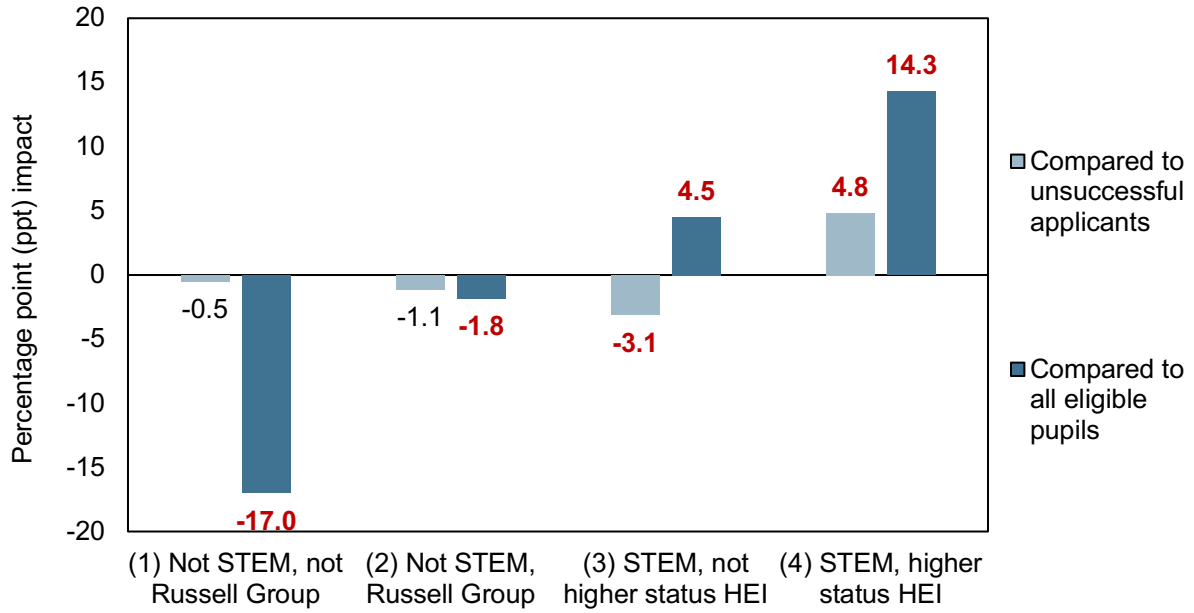
Some 75% of all NRP students in the combined three years of 2014, 2015 and 2016 went on to enrol in HE in the following year after completing A Levels. There was no statistically significant difference with unsuccessful applicants, but undertaking a placement was associated with a greater likelihood of HE enrolment (6.8 ppt higher) than for all eligible pupils (figure 10). For FSM students, 70% of those undertaking a placement went on to enrol in HE in the following year. As for all pupils, there was no statistically significant difference with unsuccessful applicants, but undertaking a placement was associated with a greater likelihood of HE enrolment (9.4 ppt higher) than for all eligible FSM pupils.

Figure 10: Estimated impacts on proportion enrolled in HE



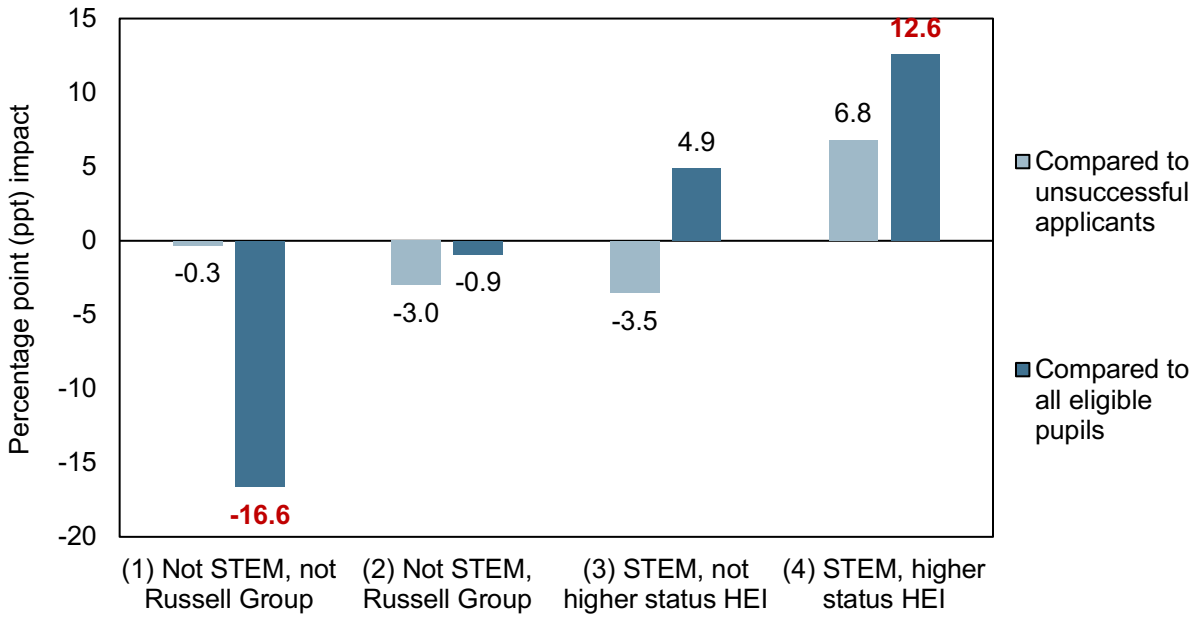
Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. Impacts were estimated using a logit model with control variables for the probability of enrolling in HE. Sample sizes were 5,965 and 275,320 for all participants and pupils and 1,180 and 30,010 for FSM participants and pupils.

Figure 11: Estimated impacts on HE type for all students



Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. Impacts were estimated using a multinomial logit model with control variables for the four probabilities of being in each HE type. Sample sizes were 4,425 for the comparisons with unsuccessful applicants and 175,970 for the comparisons with all eligible pupils. See appendix section A.1 for an explanation of the higher status HEIs (higher education institutions).

Figure 12: Estimated impacts on HE type for FSM students



Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. Impacts were estimated using a multinomial logit model with control variables for the four probabilities of being in each HE type. Sample sizes were 785 for the comparisons with unsuccessful applicants and 17,400 for the comparisons with all eligible pupils. See appendix section A.1 for an explanation of the higher status HEIs.

Almost half (49%) of NRP students who enrolled in HE in the following year began a STEM course at a higher status institution (defined as an institution in the Russell Group and/or with a Research Excellence Framework (REF) top 30 rank for STEM courses).[11] Some 21% entered a STEM course at another institution, while 18% began non-STEM courses at a Russell Group university and 12% began a non-STEM course at another institution. The proportions for FSM NRP students enrolling in HE were similar (44%, 25%, 18% and 13% respectively).

For all pupils, undertaking a placement was associated with a greater likelihood of enrolling in a STEM course at a higher status institution (figure 11). In comparison to unsuccessful applicants, the impact is 4.8 ppt with a negative impact (of 3.1 ppt) on the likelihood of studying a STEM subject at an alternative institution. In comparison to all eligible pupils, the impact is 14.3 ppt, accompanied by a smaller positive impact on studying STEM at another institution (of 4.5 ppt) and negative impacts on entering a non-STEM course at a Russell Group institution (of 1.8 ppt) or at another institution (of 17.0 ppt). For FSM pupils, undertaking a placement was also associated with a greater likelihood (of 12.6 ppt) of enrolling in a STEM course at a higher status institution and a negative impact on entering a non-STEM course at a non-Russell Group institution (of 16.6 ppt) (figure 12).

How much of the HE impacts operated through impacts on A Levels?

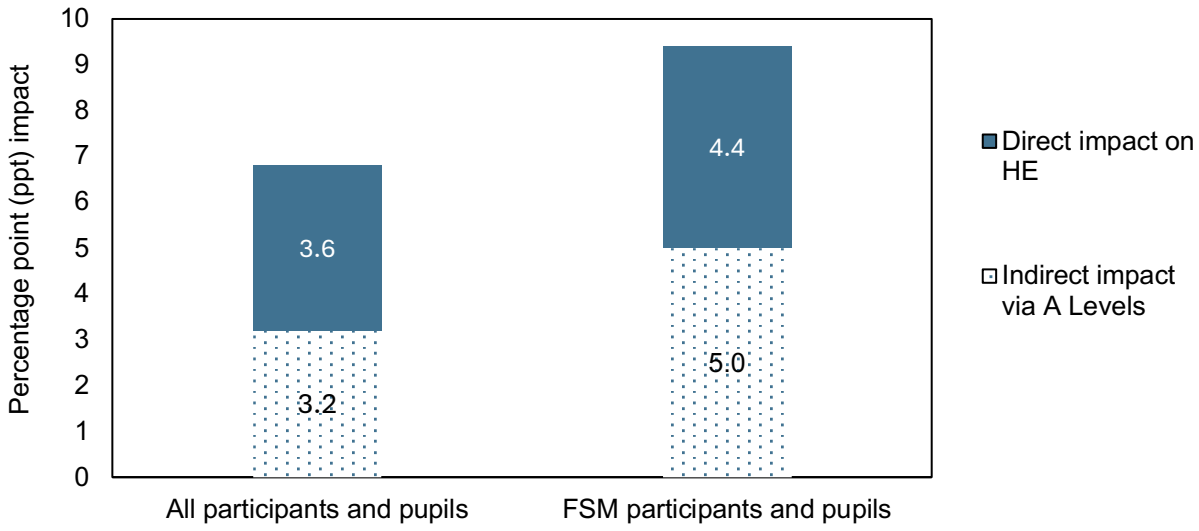
Impacts on HE enrolment may have been indirect, operating through the impacts that placements had on A Level results which opened up new HE opportunities, or may have been direct operating over and above any change in A Level results. We can gain insight into the direct impact by estimating the impact on HE enrolment controlling for A Level results and can then derive the indirect impact as the residual between the total impact and the direct part.

The total impact on HE enrolment compared to all eligible pupils[12] is quite evenly divided between the direct and indirect impact (figure 13). Of the 6.8 ppt total impact for all pupils, 3.2 ppt is due to changes in A Level results while 3.6 ppt is due to a direct impact on HE enrolment. Similarly for FSM pupils, of the 9.4 ppt total impact, 5.0 ppt is due to the impact on A Level results while 4.4 ppt is due to a direct impact on HE enrolment.

[11] See appendix section A.1 for a full explanation of the HE types and higher status HE institutions.

[12] The breakdown into direct and indirect impacts focuses on the comparisons with eligible pupils because the comparisons with unsuccessful applicants had many fewer statistically significant impacts.

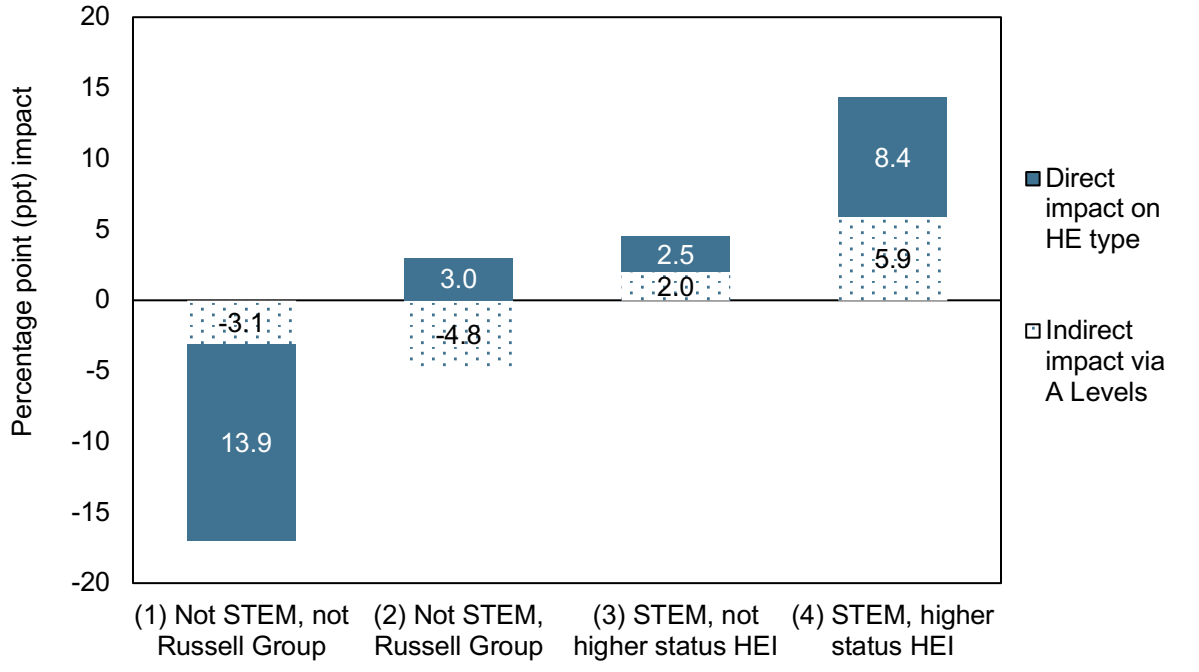
Figure 13: Direct and indirect impacts on proportion enrolled in HE compared to all eligible pupils



Notes: Sample sizes were 275,320 for all participants and pupils and 30,010 for FSM participants and pupils.

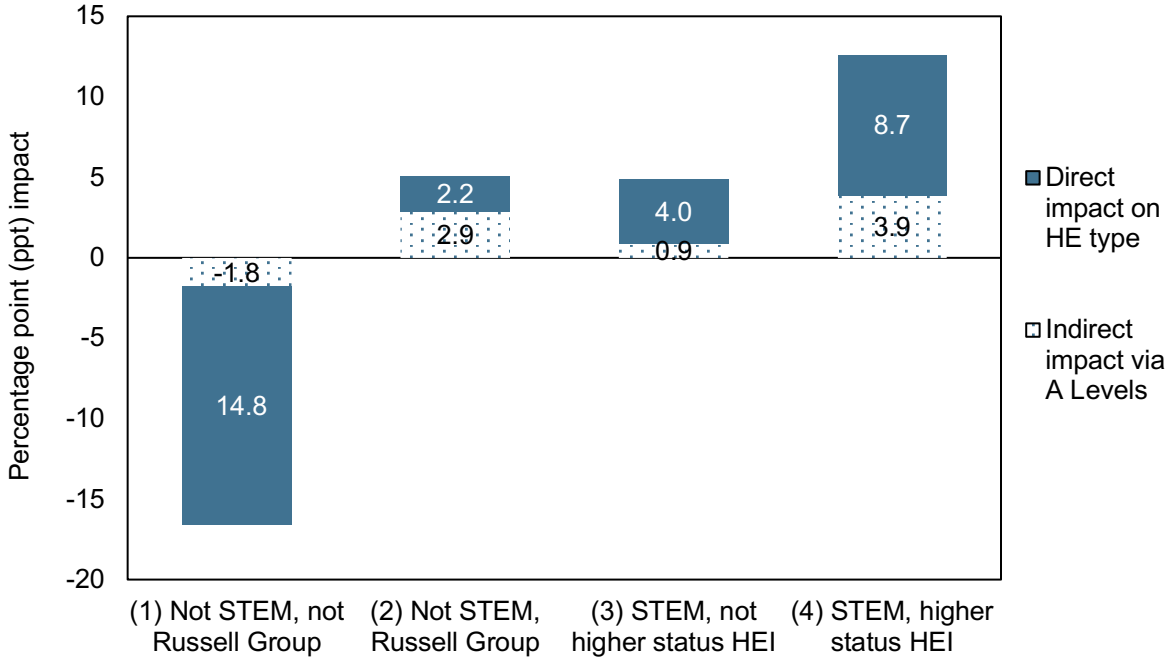
However, much larger proportions of the impacts on the type of HE are due to a direct impact rather than operating through A Level results (figures 14 and 15). For example, the total impact of 14.3 ppt on enrolling in a STEM course at a higher status institution divides into 5.9 ppt for the indirect impact through A Levels and 8.4 ppt for the direct impact. The direct impacts are relatively slightly stronger for FSM pupils: the total impact of 12.6 ppt on enrolling in a STEM course at a higher status institution divides into 3.9 ppt for the indirect impact through A Levels and 8.7 ppt for the direct impact.

Figure 14: Estimated impacts on HE type for all students compared to all eligible pupils



Notes: Sample size was 175,970.

Figure 15: Estimated impacts on HE type for FSM students compared to all eligible FSM pupils



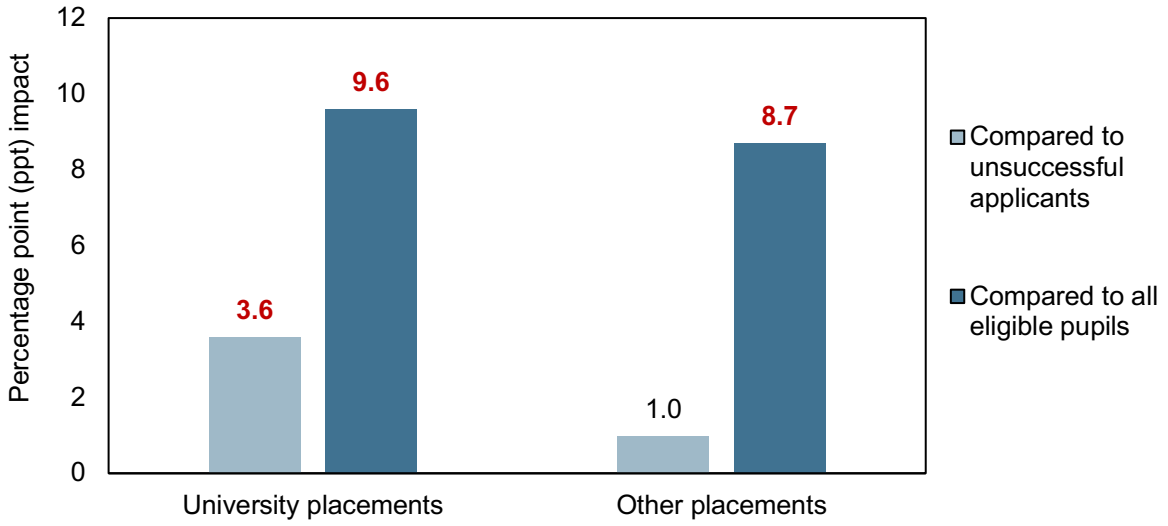
Notes: Sample size was 17,400.

Differences across types of placements

Both university and non-university placements had positive impacts on HE enrolment compared to all eligible pupils (figure 16).[13] University placements also had a positive impact compared to unsuccessful applicants, but there were no statistically significant differences in the size of impacts between the two types of placements for either comparison group.

[13] As for the A Level outcomes, impacts across placement type and subject area were not estimated for the FSM sample due to the small sample size for FSM participants and pupils.

Figure 16: Estimated impacts on proportion enrolled in HE by placement type



Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. There were no statistically significant differences between university placements and other placements. Impacts were estimated using a logit model with control variables for the probability of enrolling in HE. Sample sizes were 4,180 for the comparisons with unsuccessful applicants and 187,790 for the comparisons with all eligible pupils.

The approach for estimating impacts on HE type for placement type and subject differed from that used for all placements due to data limitations and ease of exposition (see annex section A.4). Consequently, the estimated impacts in tables 1 and 2 do not directly align with figure 11, but still provide a robust comparison in impacts across placement types and subject areas.

Compared to all eligible pupils, both university placements and non-university placements substantially increased the likelihood of enrolling in a STEM course at a higher status institution and reduced the likelihood of enrolling in a non-STEM course (table 1). Compared to unsuccessful applicants, only university placements impacted positively on the type of HE with much smaller impacts only between the type of institution within STEM courses. However, there were no statistically significant differences in the impacts on HE type between university and non-university places.

Table 1: Estimated impacts on HE type for all students by placement type

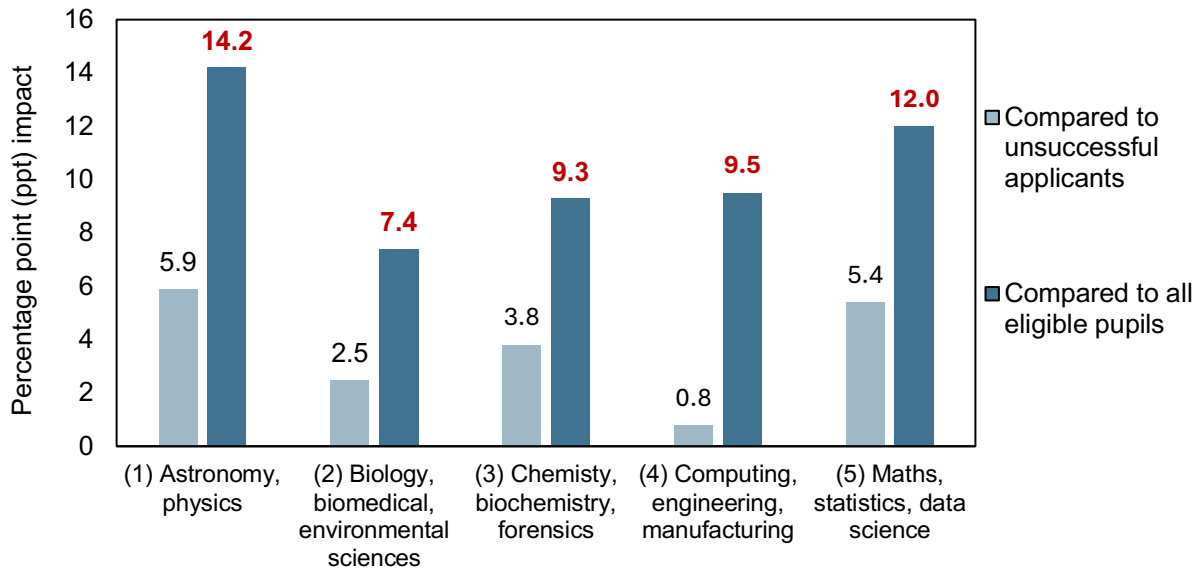
Estimated impact of NRP on proportion of pupils in HE type	HE Type			
	(1) Not STEM, not Russell Group	**(2) Not STEM, Russell Group**	**(3) STEM, not higher status HEI**	**(4) STEM, higher status HEI**
Compared to unsuccessful applicants				
University placements	1.1 ppt	- 2.6 ppt	**- 3.5 ppt**	**4.4 ppt**
Other placements	- 1.0 ppt	- 1.4 ppt	0.2 ppt	1.6 ppt
Statistically significant differences across type	None	None	None	None
Compared to all eligible pupils				
University placements	**- 16.3 ppt**	**- 8.5 ppt**	- 1.4 ppt	**15.1 ppt**
Other placements	**- 20.7 ppt**	**- 7.8 ppt**	2.2 ppt	**13.8 ppt**
Statistically significant differences across type	None	None	None	None

Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. Impacts were estimated using four logit models with control variables for the probability of being in each of the four HE types. Sample sizes were 3,180 for the comparison with unsuccessful applicants and 120,810 for the comparison with all eligible pupils. Numbers do not sum to 100 ppt across the four HE types in each row due to the use of four separate models to estimate impacts (see appendix section A.4).

Differences across placement subjects

Compared to all eligible pupils, placements in all five subject areas increased the likelihood of HE enrolment (figure 17), but there were no statistically significant differences in the size of impacts across the subject areas.

Figure 17: Estimated impacts on proportion enrolled in HE by placement subject area



Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. There were no statistically significant differences in impacts across the subject areas. Impacts were estimated using a logit model with control variables for the probability of enrolling in HE. Sample sizes were 4,180 for the comparisons with unsuccessful applicants and 187,790 for the comparisons with all eligible pupils.

Compared to all eligible pupils, placements in all five subject areas substantially increased the likelihood of enrolling in a STEM course at a higher status institution and reduced the likelihood of enrolling in a non-STEM course at a Russell Group or other institution (table 2). There were similar but fewer and smaller impacts for the comparison with unsuccessful applicants, the main exception being for placements in the "biology, biomedical and environmental sciences" group, which reduced the likelihood of enrolling in a STEM course at a higher status institution relative to unsuccessful applicants. There were also marked differences in the size of impacts across the subject areas: placements in the "astronomy and physics" group had the greatest impacts, while those in the "biology, biomedical and environmental sciences" group had the smallest impacts.

Table 2: Estimated impacts on HE type for all students by placement subject

Estimated impact of NRP on proportion of pupils in HE type	HE Type			
	(1) Not STEM, not Russell Group	**(2) Not STEM, Russell Group**	**(3) STEM, not higher status HEI**	**(4) STEM, higher status HEI**
Compared to unsuccessful applicants				
(1) Astronomy, physics	**- 5.0 ppt**	**- 9.2 ppt**	- 3.4 ppt	**16.7 ppt**
(2) Biology, biomedical, environmental sciences	2.9 ppt	3.3 ppt	- 1.2 ppt	**- 6.4 ppt**
(3) Chemistry, biochemistry, forensics	- 1.0 ppt	-2.5 ppt	- 2.3 ppt	5.5 ppt
(4) Computing, engineering, manufacturing	1.9 ppt	**- 5.8 ppt**	- 3.8 ppt	6.9 ppt
(5) Maths, statistics, data science	- 4.9 ppt	- 6.0 ppt	- 5.8 ppt	**16.0 ppt**
Statistically significant differences across subjects	(2) > (1) (5) (4) > (1)	(2) > (1) (4) (5) (3) > (1)	None	All others > (2) (1) > (3) (4)
Compared to all eligible pupils				
(1) Astronomy, physics	**- 25.5 ppt**	**- 14.8 ppt**	- 2.6 ppt	**27.0 ppt**
(2) Biology, biomedical, environmental sciences	**- 13.4 ppt**	- 2.9 ppt	1.7 ppt	**5.7 ppt**
(3) Chemistry, biochemistry, forensics	**- 16.6 ppt**	**- 8.4 ppt**	- 1.6 ppt	**15.3 ppt**
(4) Computing, engineering, manufacturing	**-18.8 ppt**	**- 12.0 ppt**	- 0.9 ppt	**19.2 ppt**
(5) Maths, statistics, data science	**-23.2 ppt**	**- 12.4 ppt**	- 4.3 ppt	**26.3 ppt**
Statistically significant differences across subjects	(2) > (1)	(2) > (1) (4) (5)	None	All others > (2) (1) > (3)

Notes: Numbers in bold red indicate statistically significant impacts at the 95 percent level. Impacts were estimated using four logit models with control variables for the probability of being in each of the four HE types. Sample sizes were 3,180 for the comparison with unsuccessful applicants and 120,810 for the comparison with all eligible pupils. Numbers do not sum to 100 ppt across the four HE types in each row due to the use of four separate models to estimate impacts (see appendix section A.4).

Summary

The evidence from the preferred comparison with all eligible pupils indicates that NRPs had particular benefits on the likelihood of enrolling in HE and in a STEM course at a higher status institution. Specifically, it is estimated that undertaking a placement is associated with:

- A higher enrolment rate in HE of 6.8 ppt for all pupils and 9.4 ppt for FSM pupils; and
- For all students enrolling in HE, a higher enrolment rate in a STEM course at a higher status institution of 14.3 ppt and a higher enrolment rate in a STEM course in another HE institution of 4.5 ppt. For FSM students enrolling in HE, a higher enrolment rate in a STEM course at a higher status institution of 12.6 ppt.

Around half of the impacts on HE enrolment were attributable to the improvement in A Level results and half to a direct impact on HE enrolment. The increases in enrolment in STEM courses were mainly attributable to direct impacts on HE rather than due to improvements in A Level results.

This evidence suggests that the placements both enabled students (through the improved A Level results) and motivated students (through the direct impact on HE choices) to pursue further study in STEM subjects, following a path towards a STEM-related career. The stronger direct effect on HE subject choice indicates that the placements were particularly important for motivating interest in further STEM study.

There were some differences in the impacts across the types of placements:

- Placements at universities and placements at other types of organisations had similar impacts on HE enrolment and on HE type.
- Placements in all subject areas had positive impacts on HE enrolment and enrolling in STEM courses at higher status institutions, but placements in the "astronomy and physics" subject group had the greatest impacts while placements in the "biology, biomedical and environmental sciences" subject group had the smallest impacts.

The differences in impacts across placement subjects suggest that placements in some subjects had a greater influence on student HE choices. However, it is also possible that the differences across subjects may have been due to students who were inherently more likely to pursue career paths in STEM being more likely to request placements in the subject area of "astronomy and physics".

Chapter 5: What were the potential effects on earnings and employment?

This chapter considers how the impacts on HE enrolment in the year following an NRP might have later effects on earnings and employment. The first section presents the existing evidence on the links between HE enrolment and later employment and earnings, while the second and third sections use these links to derive the potential effects of the placements. The final section summarises the findings.

It should be noted that these figures are derived from existing evidence on the links between HE enrolment and later employment and earnings for the average student rather than from direct observations of later employment and earnings for placement pupils.

How much does initial HE enrolment affect later employment and earnings?

Table 3 presents a summary of the links between HE enrolment and later employment and earnings derived from four evidence sources. Further details on this evidence and some of the caveats for the s in table 3 are presented in appendix section A.5.

Table 3: Links between initial HE enrolment and later employment and earnings

HE enrolment	**Proportion in employment (lifetime) relative to five good GCSEs but no HE [a]**	**Earnings at age 30 relative to five good GCSEs but no HE [c]**
No HE	Base	Base
HE enrolment	+ 16.1 ppt	+ 15.5%
HE Type	**Proportion in employment (five years after graduation) relative to HE type (1) [b]**	**Earnings at age 30 relative to HE type (1) [d]**
(1) Not STEM, not Russell Group	Base	Base
(2) Not STEM, Russell Group	- 7.6 ppt	+ 21.6%
(3) STEM, not higher status HEI	- 3.0 ppt	+ 5.3%
(4) STEM, higher status HEI	+ 1.0 ppt	+ 22.1%

Sources: Derived from (a) ONS employment rates (accessed 7 October 2024), (b) Belfield et al (2018), (c) Britton et al (2021), (d) Britton et al (2022).

Notes: ppt indicates percentage points.

HE enrolment is linked to a higher lifetime employment rate of around 16 ppt and higher earnings at age 30 of around 16%. Compared to the base group of HE in a non-STEM subject and not at a Russell Group

institution, HE in a STEM subject at a higher status institution is linked to a higher employment rate five years after graduation of around 1 ppt and higher earnings at age 30 of around 22%. The remaining two HE types (types (2) and (3)) are linked to lower employment rates[14] and higher earnings relative to the base group.

How much could the placements have increased employment?

Combining the estimated programme impacts (using the comparison with all eligible pupils) with the existing evidence indicates that placements could have increased the likelihood of being in employment by an average 1.2 ppt (table 4). Most of this increase (1.1 ppt) was driven by the impact on HE enrolment, with a smaller part (0.1 ppt) driven by the impacts on HE type. Although the impacts on HE type were larger than those for HE enrolment (first column in table 4), these were outweighed by much smaller employment returns than for HE enrolment (second column in table 4).[15]

Table 4: Potential effects on later employment

		NRP impact	Links from evidence	Effect on employment rate	Total effect on employment rate
HE enrolment		+ 6.8 ppt	+ 16.1 ppt	+ 1.1 ppt	+ 1.2 ppt
HE Type	(2) Not STEM, Russell Group	- 1.8 ppt	- 7.6 ppt	+ 0.1 ppt	
	(3) STEM, not higher status HEI	+ 4.5 ppt	- 3.0 ppt		
	(4) STEM, higher status HEI	+ 14.3 ppt	+ 1.0 ppt		

Notes: ppt indicates percentage points. NRP impacts are compared to all eligible pupils. The NRP impact on HE type is only for students enrolled in HE so the average HE enrolment rate of 75% for NRP participants is used to calculate the effect on the employment rate from the impacts on HE type.

It should be noted that the benefits underlying these average potential employment effects are concentrated in a much smaller number of students who were impacted by the programme. The 1.1 ppt average increase from HE enrolment would be concentrated in the 6.8 percent of NRP students who enrolled in HE because of the programme and who each subsequently benefitted from a 16.1 ppt greater likelihood of employment. It is more difficult to interpret the potential effects of the impacts on HE type because there is no unique mix of individual impacts to explain the average changes.[16]

[14] The authors of the IFS report from which these figures are derived note that the employment returns may be affected by the fact that former students who move abroad are recorded in the data as not being in employment (because the data only observes those in employment in the UK and cannot identify those living abroad from those not in employment). This may contribute to HE types (2) and (3) having negative employment returns relative to HE type (1).

[15] For the comparisons with unsuccessful applicants, the smaller estimated impacts mean that the potential effect on employment was only 0.23 ppt with 0.06 ppt driven by the impacts on HE enrolment and 0.17 ppt driven by the impacts on HE type.

[16] For example, one possible mix is that 4.5% of NRP pupils moved from HE type 1 to HE type 3 (each with a loss of 3.0 ppt in their employment probability), 1.8% moved from HE type 2 to HE type 4 (each with a gain of 7.6 ppt in their employment probability) and 12.5% moved from HE type1 to HE type 4 (each with a gain of 1.0 ppt in their employment probability).

For FSM participants and pupils, the larger impact of the placements on HE enrolment means that the potential employment effects are also slightly larger for FSM pupils than for all pupils:[17] the evidence suggests that placements could have increased the likelihood of being in employment by an average 1.6 ppt. As for all participants, most of this increase (1.51 ppt) was driven by the impact on HE enrolment, with a smaller part (0.04 ppt) driven by the impacts on HE type.[18] However, it should be noted that these numbers are calculated using evidence on links to employment for all students and not an FSM sample.

How much could the placements have increased earnings?

Calculated in the same way as for employment, the analysis indicates that placements could have increased average earnings (for those in work) by 3.3% (table 5). Most of this increase (2.3%) was driven by the impacts on HE type, with a smaller role (1.1%) driven by the impact on HE enrolment.[19]

Table 5: Potential effects on later earnings

		NRP impact	Links from evidence	Effect on earnings	Total effect on earnings
HE enrolment		+ 6.8 ppt	+ 15.5%	+ 1.1%	+ 3.3%
HE Type	(2) Not STEM, Russell Group	- 1.8 ppt	+ 21.6%	+ 2.3%	
	(3) STEM, not higher status HEI	+ 4.5 ppt	+ 5.3%		
	(4) STEM, higher status HEI	+ 14.3 ppt	+ 22.1%		

Notes: NRP impacts are compared to all eligible pupils. The NRP impact on HE type is only for students enrolled in HE so the average HE enrolment rate of 75% for NRP participants is used to calculate the effect on earnings from the impacts on HE type. The effects do not sum precisely to the total due to rounding.

As with employment, it should be noted that the benefits underlying these average potential earnings gains are concentrated in a much smaller number of students impacted by the programme. The average 1.1% increase in earnings from the impacts on HE enrolment would be concentrated in the 6.8% of NRP students who enrolled in HE because of the programme and who each subsequently benefitted from an average 15.5% higher earnings. Again, it is more difficult to interpret the potential effects of the impacts on HE type because there is no unique mix of individual impacts to explain the average changes.[20]

For FSM participants, the potential effects on earnings are similar to those for all participants because of the similar impacts on HE type. Placements could have increased average earnings by 3.5% for FSM

[17] In calculating the potential effects for FSM participants, the proportion in HE was 70% (compared to 75% for all participants).
[18] For the comparisons with unsuccessful applicants, the smaller estimated impacts mean that the potential effect on employment for FSM pupils was only 0.7 ppt, with 0.4 ppt driven by the impacts on HE enrolment and 0.3 ppt driven by the impacts on HE type.
[19] For the comparisons with unsuccessful applicants, the smaller estimated impacts mean that the potential effect on earnings was only 0.6%, with 0.1% driven by the impacts on HE enrolment and 0.5% driven by the impacts on HE type.
[20] For example, one possible mix is that 4.5% of NRP pupils moved from HE type 1 to HE type 3 (each with an average gain of 5.3% in earnings), 1.8% moved from HE type 2 to HE type 4 (each with an average gain of 0.5% in earnings) and 12.5% moved from HE type1 to HE type 4 (each with an average gain of 22.1% in earnings).

pupils, with 1.5% driven by the impact on HE enrolment and 2.0% driven by the impacts on HE type.[21] Again, however, it should be noted that these numbers are calculated using evidence on links to employment for all students and not an FSM sample.

Summary

Combining the estimated impacts on HE with existing evidence on the links between HE enrolment and later work outcomes indicates that NRPs are likely to have had important effects on later employment and earnings. Specifically, the evidence suggests that undertaking a placement is associated with:

- A higher employment rate of 1.2 ppt, almost entirely due to the impact on HE enrolment rather than the impact on HE subject or institution.
- Higher earnings at age 30 by 3.3%, due both to the impact on HE enrolment (1.1% higher earnings) and to the impact on HE subject and institutions (2.3% higher earnings).

Given that these figures are indicative of the potential benefits that could last for much of the working life, these are substantial returns from an intervention that lasted only a few weeks.

[21] For the comparisons with unsuccessful applicants, the smaller estimated impacts mean that the potential effect on earnings for FSM pupils was only 0.9%, with 0.4% driven by the impacts on HE enrolment and 0.5% by the impacts on HE type.

Conclusions

The NRP programme aimed to deepen students' understanding of STEM subjects and research and to encourage them to pursue further studies and careers in STEM. In the qualitative element of this evaluation, students reported that placements had improved their understanding of what STEM researchers do on a day-to-day basis. However, they did not think that the placement experience had influenced their interest in a STEM career and future study plans.

The quantitative analysis has shown that, in spite of these student perceptions, placements were associated with substantial positive impacts on A Level achievement and HE enrolment. Placements may have driven the improvement in A Level outcomes by enhanced knowledge and understanding of A Level STEM subject material and by greater motivation for study. Placements both enabled students (through the improved A Level results) and motivated students (through a direct impact on HE choices) to enrol in HE and specifically to enrol in STEM courses at a higher status institution.

By encouraging more pupils to pursue further study in STEM subjects on the path to STEM-related careers, the NRP programme contributed to increasing STEM skills in the workforce, driving economic innovation and growth to the benefit of broader society. For the students, the placements offered not only the potential benefit of rewarding careers but also higher rates of employment and earnings in their working life. Given the focus of the programme on pupils from disadvantaged backgrounds, these benefits would have accrued to a greater degree to those from poorer backgrounds, helping to reduce socioeconomic inequality.

References

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Appendix: Technical Detail

This appendix provides further technical detail for the estimation of impacts on A Level results and HE enrolment and the derivation of potential later effects on employment and earnings.

A.1 Which impacts were considered?

The analysis considered the impacts of completing a placement on two sets of outcomes:

- A Level achievement: whether students achieved at least one STEM (science, technology, engineering and mathematics) A Level; number of STEM A Levels achieved; and average points score in STEM A Levels (for those with at least one STEM A Level); and
- Higher education (HE) enrolment in the year following the placement: whether students enrolled in HE and the HE type defined by institution and degree subject.

In order to capture institutions with higher status for STEM courses as well as more broadly across all subjects, institutions were defined as being "higher status" if they were in the Russell Group and/or in the group of 30 institutions with the highest scores for STEM subjects in the Research Excellence Framework (REF) assessment. Quality profiles from the REF report for 2021 (REF results 2021) were used to designate these 30 HE institutions as those with the highest score in STEM subjects. The "overall" assessment for each STEM course was converted into a single number by multiplying the proportion in each standard by the standard level and summing over the four standards.

Table 6 presents a list of the higher status HE institutions, including 20 in the Russell Group with a REF top 30 rank for STEM courses; four only in the Russell Group; and ten not in the Russell Group but with a REF top 30 rank for STEM courses. Hence, the higher status group of HE institutions consists of those in the Russell Group plus ten which score highly for STEM subjects in the REF.

An initial examination of HE subjects and institutions in the data showed that NRP students were more likely than other pupils to enrol in STEM courses and in the higher status HE institutions. HE type was therefore categorised into four ranked groups:

(1) Not STEM subject and not Russell Group university

(2) Not STEM subject but Russell Group university

(3) STEM subject but not at a higher status institution

(4) STEM subject and higher status institution

There were three reasons for these categories:

- The key objective of NRPs is to encourage STEM further study and the key division is therefore studying a STEM subject (types (3) and (4) versus (1) and (2)).
- Being at a highly ranked institution for STEM courses only has added value if the student is studying a STEM subject, while being at a Russell Group institution is an improved outcome even if the student is not studying a STEM subject (type (2) versus (1)).

- Because of the small number of higher status institutions which are not in the Russell Group, group (4) combines all the higher status institutions to ensure sufficient numbers of students in the group.

For all students enrolling in HE, the proportions across the four HE types were 35%, 24%, 20% and 21%, compared to proportions of 11%, 18%, 21% and 49% for placement students.

Table 6: HE Institutions in the Higher Status Group

Russell Group and REF top 30 rank for STEM courses	Cardiff University Imperial College of Science, Technology and Medicine King's College London Queen Mary and Westfield College, University of London London School of Economics & Political Science The University of Manchester University College London University of Birmingham University of Bristol University of Cambridge University of Edinburgh University of Glasgow University of Leeds University of Liverpool University of Nottingham University of Oxford University of Sheffield University of Southampton University of Warwick University of York
Only Russell Group	The Queen's University of Belfast University of Durham University of Exeter University of Newcastle Upon Tyne
Only REF top 30 rank for STEM courses	Birkbeck College Institute of Cancer Research: Royal Cancer Hospital Institute of Zoology Liverpool School of Tropical Medicine London School of Hygiene and Tropical Medicine University of Strathclyde The University of East Anglia The University of Lancaster University of Dundee University of St Andrews

A.2 Which placement students were of particular interest?

Because the programme aimed 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 free school meals (FSM).

Following the initial analysis, the evaluation advisory group suggested considering impacts for FSM pupils disaggregated by ethnicity, that is, considering whether there were impacts both for FSM pupils of white ethnicity and for FSM pupils of non-white ethnicity. However, the smaller samples for this breakdown meant that there were few statistically significant results and conclusions could not be drawn on whether the results for the entire FSM sample also held for both ethnic subgroups. Consequently, the results for the FSM ethnic subgroups have not been reported.

A.3 What controls were used in the regression models?

For both comparison groups, impacts were estimated using regression models with controls for other observed characteristics which may have driven the differences in outcomes:

- The models included individual characteristics (gender, ethnicity, FSM eligibility at key stage 4 and average GCSE point score); school characteristics (proportion of pupils eligible for FSM and proportion of pupils with five or more good GCSEs at the school attended for key stage 4) and local characteristics (region and IDACI (Income Deprivation Affecting Children Index) score at the local authority level).

- NRP participants were more likely to have studied three or more STEM subjects at AS Level and were more likely to have studied STEM subjects other than mathematics at AS Level than the comparison groups. Both prior study measures were therefore included in the regression models as controls.

The use of school fixed effects was not feasible due to the small numbers in each school, but standard errors in the regression models allowed for potential clustering effects at the school level to take account of the likelihood that applying to the NRP programme is influenced by the school attended.

A.4 What specifications were used to estimate impacts?

The impacts for the continuous outcomes (number of STEM A Levels and point score in STEM A Levels) were estimated using linear regression models, while logit probability models were used for binary outcomes (whether achieved at least one STEM A Level and whether enrolled in HE).

For the four outcome categories in HE type, impacts were estimated using a multinomial logit model which estimates the likelihood of being in each of the four categories for any set of explanatory variables. This means that the marginal effects (the impacts) sum to 100% across the four HE types in each model (that is, for each sample and comparison group).

This multinomial logit approach for HE type was feasible for most of the analysis which had large sample sizes and considered the impact of the binary variable of placement versus no placement. However, estimating the impact of multicategory variables for placement type (three groups including no placement) and placement subject (six groups including no placement) on the four HE types was too demanding on the data. Instead of single multinomial logit models, four logit models (one for each of the four HE types) were estimated for placement type and for placement subject. In these separate logit models, the marginal effects (the impacts) for each HE type are relative to the combination of no placement *and* the other three HE types (rather than estimating all pairwise differences as in the multinomial logit model). This means that the impacts do not sum to 100% across the four HE types for each sample and comparison group, but this approach still captures the essential differences in impacts across placement type and placement subject.

A.5 How were potential effects on later employment and earnings considered?

A final step in the evaluation considered how the impacts on HE enrolment might have led to later improvements in employment and earnings. Data on these later outcomes for NRP applicants and participants was not available, so existing evidence on the links between HE enrolment and later employment and earnings for the UK population was used instead.

Existing evidence was used on links between:

- HE enrolment and lifetime proportion in employment (using Office for National Statistics (ONS) statistics);
- HE type and proportions in employment five years after graduation (Institute for Fiscal Studies (IFS) analysis published in Belfield et al (2018));
- HE enrolment and earnings at age 30 (IFS analysis published in Britton et al (2021)); and
- HE type and earnings at age 30 (IFS analysis published in Britton et al (2022)).

The three IFS sources were selected because they provided evidence both on the returns to HE enrolment and on the returns to enrolment in different institutions and subjects, permitting a matching with the groups used for the NRP impact estimates. These studies used the Longitudinal Educational Outcomes (LEO) data (containing NPD and HESA matched to HMRC/DWP tax records by the Department for Work and Pensions) to estimate the impacts of HE enrolment and HE type on the later employment and earnings outcomes using models with wide-ranging controls for individual characteristics, prior school attainment and school effects. The remaining source from ONS statistics was required to complete a gap in the employment returns to HE enrolment. However, these statistics are simple correlations rather than estimated impacts because the links do not control for any other characteristics.

Both the ONS statistics and the IFS analysis for HE enrolment are relative to no HE and five good GCSEs, which matches reasonably well with the comparison groups used in this study (all pupils eligible to apply for NRPs and unsuccessful applicants). Belfield et al (2018) report separate returns for men and women, which were simply averaged.

For HE type, the evidence on earnings at age 30 included estimated impacts on the returns to specific "courses" (subject and institution) relative to a base course. Hence, a weighted (by number of students) average for each HE type could be derived using information on which courses were STEM and which institutions were in the Russell Group and in the higher status group. This was then normalised for the relative returns to HE types (2) to (4) over HE type (1).

However, the evidence for employment five years after graduation reported the returns to subject and the returns to institution separately (and also separately for men and women). The returns were first averaged across men and women. The returns to STEM and non-STEM subjects and the returns to the four institution types (not higher status; Russell Group only; REF top 30 STEM rank only; both Russell Group and REF top 30 STEM rank) were then derived. There were two possible methods to combine this information to estimate the returns to the eight subgroups (which could then be combined to derive the returns for the four HE types used in this study). The first could apply the *average* return to STEM to each of the four institution groups (assuming a constant STEM premium), while the second could apply

the *average* return to each institution group to non-STEM and STEM courses (assuming a constant institution premium). These two methods were tested using the earnings data, which could be compared with the directly estimated returns by course. The second method proved to be substantially better (closer to the direct estimate for six of the eight subgroups), reflecting the dominant pattern in the earnings data of institution being more important than subject. Consequently, the assumption of constant institution premium was applied in combining the subject and institution returns for the employment data.

It should be noted that the estimates for later *employment* have several important caveats:

- The ONS number is a raw difference without any controls for selection into HE and therefore not a robust measure of impact.
- The ONS figure is the return to "lifetime" employment from HE, while the IFS report delivers the employment returns to different types of HE five years after graduation. Both are based on HE graduation (that is, course completion) which does not match the NRP impact for HE enrolment, and combining them into a total effect has an undefined point in time.
- The returns to employment by course underlying the returns by HE type were derived from separate estimates for subject and institution rather than direct measures.
- The IFS report notes that the employment returns in the LEO data may be affected by the fact that former students who move abroad are recorded as not being in employment (because the data only observes those in employment in the UK and cannot identify those living abroad from those not in employment). This may bias the findings on employment rates across the HE types.