



House of Commons
Science, Innovation and
Technology Committee

Diversity and inclusion in STEM: Government Response to the Committee's Fifth Report

Third Special Report of Session
2022–23

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Science, Innovation and Technology Committee

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Second Special Report

On 24 March 2023 the Science and Technology Committee published its Fifth Report of Session 2022–23, Diversity and Inclusion in STEM (HC 95). The Government Response was received on 25 May 2023. The Response is appended to this Report.

Appendix: Government Response

Introduction

1. The Science and Technology Committee published its report, 'Diversity and Inclusion in STEM' on 24 March 2023. The Government welcomes the report and is grateful to everyone who participated in the inquiry and for the recommendations provided.
2. This document sets out the Government's response to the report. The committee's conclusions and recommendations have been numbered by the order in which they appear in the report and have been grouped according to subject matter.
3. The Government agrees with the ambition set out in the Committee's report that significant progress must still be made in terms of diversity and inclusion in STEM and is committed to continuing to take action to address these issues. The Government accepts (fully or in part) the majority of the Committee's recommendations. Where the Government does not fully accept recommendations, this is because there are existing or planned actions to improve outcomes.

Overview

Recommendation 2

The benefits of raising levels of diversity and inclusion in STEM education, research settings and workplaces were highlighted by many contributors to our inquiry. The Government, UKRI, other research funders, industry and the education sector have led and participated in many worthy inquiries, reports and initiatives. Yet progress has been limited at best. The status quo must not be accepted by those with the ability to drive change. It is not simply a legacy problem that will fade as society becomes more diverse. Action must be taken that truly moves the dial. The Government should make improving diversity and inclusion in STEM—and indeed in all aspects of society—a central part of its day-to-day activities and future agenda. It's not just good for business, it is fundamentally about being fair, and doing the right thing. The education and research sectors must follow the Government's lead and take a systemic approach to the challenge, making the STEM ecosystem in the UK a beacon of good practice when it comes to addressing under-representation. (Paragraph 32)

Government Ambition on STEM

4. The Government acknowledges the significant benefits of fostering an inclusive, diverse and welcoming environment in STEM education, research, and employment settings. Improving diversity and inclusion in STEM settings is a crucial aspect of

achieving the Government's plan to confirm the UK's status as a science and technology superpower, as reflected in the UK Science and Technology (S&T) Framework published in March 2023.¹

5. The Government considers harnessing innovation a fundamental part of driving diversity and inclusion in STEM and to delivering on our mission to drive equality of opportunity across the UK. The Government has already taken clear action to drive innovation beyond traditional routes and areas by:

- working with UKRI and the science, research, technology and innovation (SRTI) sector to deliver a range of initial and long-term interventions in the R&D People and Culture Strategy² to ensure we attract, develop and retain top innovators and scientists to meet future challenges;
- harnessing the Innovation Economy through our implementation of the Innovation Strategy and the ongoing delivery of the UK's ambitious Science & Technology Framework;
- strengthening clusters to attract inward investment across all corners of the UK to unleash local and national economic growth through ground-breaking innovation and science;
- publishing the results and findings from the Research and Innovation Workforce survey in March 2023³;
- collaborating with Innovate UK on initiatives such as the Young Innovators Programme and Women in Innovation Awards, creating an agile and responsive skills system, which delivers the skills needed to support a world-class workforce in STEM sectors and drive economic growth

6. The Department for Education is responsible for developing a cross-government action plan for the Talent and Skills intervention within the UK's S&T Framework. It recognises that demand for STEM skills is growing across the UK and the need to ensure that everyone, regardless of where they live or come from, has the opportunity to pursue a STEM career. Addressing the UK's shortage of STEM skills is essential to supporting this country's economy and its growth. For example, the digital skills gap alone is estimated to cost the UK economy £63 billion per year in lost potential gross domestic product (GDP) and is expected to widen, resulting in a workforce inadequately equipped to meet the demands of the digital age.⁴

7. To overcome STEM shortages in the long term, we need to show young people that they can pursue a STEM pathway regardless of their characteristics. With the right support and teaching, any young person can be encouraged to consider a career in STEM. While we have seen improvement in the number of women, ethnic minorities, and disadvantaged pupils studying STEM subjects, the Government recognises that there is still more to be done. The Committee's report has identified areas of focus that we are determined to address. We will continue working towards ensuring that all pupils are equally likely to succeed in STEM, during their time at school and beyond.

1 <https://www.gov.uk/government/publications/uk-science-and-technology-framework>

2 <https://www.gov.uk/government/publications/research-and-development-rd-people-and-culture-strategy>

3 <https://www.gov.uk/government/publications/research-and-innovation-ri-workforce-survey-report-2022>

4 DCMS (2022), UK Digital Strategy, p.36.

8. The Government is committed to driving wider participation in STEM and that a more diverse range of people enter the science and technology workforce by 2030. To achieve this, the Department for Education is working on a cross-Government action plan with the Home Office, the Department for Science, Innovation and Technology, the Department for Business and Trade and the Cabinet Office. Initial work will include: analysing the relevant data to develop a comprehensive understanding of the supply of, and demand for, science and technology skills for the technologies that we intend to prioritise; taking forward the Prime Minister's ambition for all young people to study mathematics to 18; working across Government, the education sector and employers, to develop the pipeline of individuals entering priority computing and digital sectors; finding and attracting the next generation of Artificial Intelligence leaders from around the world; and continuing to roll out a network of 21 employer-led Institutes of Technology helping to widen participation in higher technical training.

Study of STEM subjects at school and college

9. As highlighted by the Committee, the Government recognises that there is a significant difference in the number of boys and girls who choose to study STEM subjects in school and acknowledges the wider diversity challenges in STEM education. Addressing these issues at school level is essential if we are to improve inclusion in STEM sectors and society in general. We know that studying STEM A levels can boost a young person's earning potential once they leave education, and that there continues to be a growing demand for pupils with STEM qualifications in the job market. By further increasing the number of pupils from underrepresented groups who take STEM subjects in school, we can proactively address entrenched imbalances in the sector, as well as reducing shortages of STEM skills.

10. The data suggests we are making progress. For example, since 2010, there has been a 35% increase in the number of STEM A level entries from girls in England. This is encouraging but it is vital that we maintain this momentum so that even more pupils succeed in STEM.

11. From 2013, the Department for Education has reformed the National Curriculum and qualifications and committed significant funding to support teachers to deliver an ambitious, knowledge-rich STEM curriculum, and to inspire and motivate pupils, particularly those from underrepresented groups, to pursue these subjects. For example, in the financial year 2022–23, the Department spent approximately £57.4million on STEM programmes including the Inclusion in Schools project delivered by the Association for Science Education and the STEM Ambassadors programme which have both had a positive effect on inclusion in STEM subjects. The Department has also ensured programmes such as the Advanced Mathematics Support Programme (AMSP) and Steps to University for Mathematical Pupils (SUMS) continue to have a particular focus on supporting girls into mathematics beyond GCSE. The AMSP programme is increasing participation in Core Maths, AS/A level Mathematics and Further Mathematics by improving the quality of teaching; and SUMS is providing enrichment and engagement sessions targeted at Year 12 girls. Further detail is provided in our response to recommendations 8,12 and 13.

12. The Committee makes its recommendations at a time when we are taking forward a programme of work to ensure that both primary and secondary aged children have multiple opportunities to meet inspiring role models from a range of backgrounds. This will give pupils a real insight into what work is like and what it takes to be successful in the workplace. A key aim is to expose underrepresented groups to a wide variety of role models in order to raise their aspirations and to challenge stereotypical views of what young people can or cannot achieve, based on gender, class, or disability. More detail is provided in our response to recommendation 5.

13. Ofsted plays an important role in ensuring all pupils have access to a broad, ambitious, knowledge-rich curriculum that includes high quality STEM teaching. Through school inspection, inspectors consider the breadth of the curriculum, and the extent to which pupils have equal access to high-quality education. Ofsted specifically considers the extent to which a school's curriculum is designed and implemented in ways that will raise aspirations, including for a future STEM career, and will address any barriers to girls' take up of STEM subjects, and among pupils who are disadvantaged or with Special Educational Needs and Disabilities (SEND).

Teacher Supply

14. The teachers in charge of delivering the curriculum are a critical component in developing pupils' aspirations in STEM, as identified by the Committee. The Department knows that teacher quality is the most important in-school factor for improving pupil outcomes.

15. The Department is creating a world-class teacher development system, building from Initial Teacher Training (ITT), through to early career support, specialisation, and onto school leadership. This is creating a golden thread of professional development that teachers can draw on, at every stage of their careers. These reforms will support teachers and school leaders in every phase, subject and context. Our reforms aim to support teacher supply across all subjects. We recognise, however, that recruitment and retention of teachers, in some subjects, including STEM subjects, remains more challenging and so the Department has put in place additional targeted initiatives to tackle this issue.

16. For STEM subjects in particular, the Department's policies include targeted bursaries and scholarships, funding subject knowledge enhancement programmes, and developing a new physics ITT course for engineers. In October 2022, we announced an ITT financial incentives package worth up to £181million for those starting ITT in academic year 2023/24, which is a £52million increase on 2022/23. For the 2023/24 academic year, the Department has also extended bursary and scholarship eligibility to all non-UK national trainees in physics. Additionally, the International Relocation Payment (IRP) pilot—a single one-off payment of £10,000—will be available to non-UK trainees and teachers of physics from September 2023. The payment is a contribution towards the costs that would be faced in moving to England to teach or train. The Department is also providing a Levelling-Up Premium, worth up to £3,000 tax-free, for mathematics, physics, chemistry and computing teachers in the first five years of their careers who choose to work in disadvantaged schools, including in Education Investment Areas (EIAs).

STEM research and workforce

17. The Government recognises the systemic issues around diversity and inclusion within the UK's Research & Development (R&D) and STEM system that are set out in the Committee's report. It is committed to working closely with the sector to implement the R&D People and Culture Strategy and to building on all the work already being done by people and institutions across the sector to make the UK a truly great place for research and innovation. This has included:

- A cross-sectoral consultation led by UKRI to inform development of a New Deal for Postgraduate Researchers, with a report analysing the responses published on 2 May. As a next step, government and UKRI will work with the sector to identify and implement priority actions emerging from the report;
- Driving sector-wide adoption of the 'Résumé for Research and Innovation' (R4RI) narrative CV, which broadens the range of experiences and accomplishments that are recognised, enabling movement of skilled people and ideas between sectors—including at a major international event hosted by UKRI in March 2022;
- Launching the GREAT Global Talent website in January 2022 to attract highly skilled, international talent, providing key information on the UK offer and making it easier to come to the UK;
- Publishing the Tickell Review of Research Bureaucracy in July 2022, which advised on a substantial reduction in research bureaucracy, ensuring changes to systems and processes encourage a positive research culture;
- Publishing a report of the first cross-sector survey of the R&I workforce in March 2023, which will help to inform future policy and analysis for the Government and the sector.

18. As we take forward the Government's ambitious programme, we will look for further opportunities to strengthen the measures in place that aim to improve diversity and inclusion within STEM, so that every young person feels encouraged, capable and supported to reach their full potential when choosing this pathway for their education and career.

Study of STEM subjects at school and college

Recommendation 6

The data on STEM subject uptake and attainment at GCSE and A-level paints a complex picture. There are clear differences between boys and girls, with the latter seemingly less inclined to pursue STEM subjects than the former. The evidence our inquiry received offered no consensus as to the reasons for this difference—preference, consideration of future career prospects, and greater conservatism on the part of boys being suggested causes. (Paragraph 70)

19. As highlighted in paragraphs 8 and 9, we are seeing an improvement in female representation in STEM subjects at A level, though there is still more to do to achieve parity. There has been a noticeable increase in the number of young women entering STEM subjects at a post-16 level:

- Girls made up 44% of all STEM entries at A level in 2022 and 51% of all science entries at A level in 2022;
- Since 2010, there has been a 35% increase in the number of STEM A level entries from girls in England;
- Girls now make up half of science A level entries (in biology, chemistry and physics) with an increase of around 44% in the number of science A level entries taken by girls in England between 2010 and 2022;
- In 2022, there were approximately 31,000 more female entries to STEM subjects than in 2010.

20. But there is still progress to be made. For example, girls continue to make up a relatively small proportion of entries to mathematics (37%), physics (23%) and computing (15%). These continuing imbalances are not reflected in attainment. For example, research published in January 2023 by FFT Education Datalab, found that the difference in the average grades for female and male pupils across pupils' Attainment 8 score was largest in physics and computer science, with girls achieving higher.

Recommendation 7

The picture between and within different ethnic and socio-economic backgrounds is similarly complex, however, pupils from some backgrounds, such as Black Caribbean, are clearly underrepresented across STEM subjects at both GCSE and A-level. Others, such as pupils from Chinese backgrounds, are often well represented. (Paragraph 71)

21. As mentioned in paragraph 6, we recognise that there is still some way to go to improve the numbers of young people from these different backgrounds taking STEM subjects at GCSE and A Level. The data below shows that, despite this, in higher education, Asian, Black, Mixed and Other ethnic group UK pupils are more likely to study STEM than their White counterparts and that the number of Asian, Black, Mixed and Other ethnic group UK pupils in STEM courses has grown substantially in the past few years:

- In 2022, 52% of UK Asian, Black, Mixed and Other ethnic group applicants accepted to full time undergraduate HE (Higher Education) were accepted onto STEM subjects, compared to 46% of White accepted applicants;
- Between 2019 and 2022, there was a 22% increase in the number of Asian, Black, Mixed and Other ethnic group applicants from the UK accepted onto full-time undergraduate STEM courses;
- In 2022, 53% of Asian pupils, 48% of Black pupils, 44% of mixed pupils and 47% of pupils from Other backgrounds studying full-time undergraduate courses were studying STEM subjects, compared to 46% of White pupils studying full-time undergraduate courses.

22. The Department for Education has also collated and published two evidence notes on outcomes by ethnicity, both in schools and after leaving school. We continue to closely monitor performance by ethnicity across key outcomes and undertake analysis into the drivers of attainment across the education sector.

Recommendation 8

Access, or lack of it, to the separate study of biology, chemistry and physics at GCSE—known as the ‘triple science’ option—is a decisive factor for many pupils in determining whether they study STEM subjects at university and enter the STEM workforce. If the pool of pupils studying triple science lacks diversity, this will be reflected in STEM settings later in life. The Government should in its response to this Report tell us how it intends to ensure more pupils have access to triple science, or how else it proposes to overcome barriers to pursuing an interest in STEM faced by pupils from certain backgrounds. (Paragraph 72)

Curriculum approach

23. In 2014, the Department reformed the National Curriculum to restore the centrality of knowledge and many schools have since risen to the challenge of putting a knowledge-rich curriculum at the core of what they do. This knowledge-rich approach to the curriculum, both in STEM and across all subjects, is a crucial part of ensuring more pupils can overcome barriers created by disadvantage.

24. In a knowledge-rich curriculum, knowledge acquisition, particularly the mastery of a body of subject specific knowledge, is considered the primary aim. This does not mean teaching knowledge without skills, but is based on an understanding, drawing on evidence from cognitive science, that skills consist of applied knowledge and are therefore domain-specific, rather than generic, meaning they cannot effectively be taught separately from the specific knowledge that underpins them. The development of skills is therefore considered as an outcome rather than the purpose under the knowledge-rich approach.

25. The Department’s curriculum approach is aligned to the influential work of Professor E. D. Hirsch and others who argue in support of core knowledge. Hirsch argues that it is crucial to provide all pupils with access to a core of broadly-shared, societal, ‘communal’ knowledge to help them develop the intellectual and cultural capital they need to succeed. Hirsch explains that subject specific knowledge forms a foundation for new knowledge to ‘stick’ to, making it easier for pupils to commit new information to long term memory. Pupils who have more relevant prior knowledge therefore find it easier to be taught new information, compared to pupils who have less. This can mean that, without the right school curriculum, disadvantaged children who often lack access to this communal knowledge may fall behind their more advantaged peers, who have accumulated more of this knowledge at home and therefore find being taught easier at school. The vital importance of a curriculum approach driven by core knowledge development is also advocated by Tim Oates (Group Director of Assessment Research and Development at Cambridge Assessment), as was recently outlined in a TES article “Tim Oates: in defence of knowledge”, published 22 March 2023.

26. An ambitious knowledge-rich curriculum should also motivate pupils in their subjects, including STEM subjects. It achieves this not only by fostering competence and mastery in each subject, but it also inspires pupils by introducing them to the best that has been thought and said, opening up access to their intellectual, cultural, and scientific inheritance. As Newton says, 'if I have seen further, it is by standing on the shoulders of giants.'

27. In this way, equalising access to core knowledge for all pupils whatever their background through a knowledge-rich STEM curriculum is vital for ensuring underrepresented groups are not discouraged from pursuing STEM pathways because of a lack of confidence or cultural capital. Over the last decade, the Department has reformed the National Curriculum and qualifications and committed substantial spending in STEM subjects to support teachers to deliver high quality knowledge-rich curricula and encourage pupil uptake, particularly among underrepresented groups. These are outlined below.

Science

28. The current programmes of study for science for Key Stages 1 to 3 were introduced into schools from September 2014. The current Key Stage 4 programme of study was introduced from September 2016. The programmes of study were developed so that they set expectations equivalent to those in the highest-performing education jurisdictions in the world. They are knowledge-rich and focus on the core scientific principles which children need to be taught to understand how the world around them works. At GCSE and A level, there is a greater level of mathematical challenge and breadth of practical work across the three sciences.

29. The Department is engaged in a wide spectrum of activity to support the teaching and uptake of science, including:

- funding a network of 29 Science Learning Partnerships (SLPs), have been providing CPD through a school led network since 2016. This provides CPD to teachers and technicians to improve subject knowledge and pedagogy, with CPD covering Key Stage 1–4 and A levels. The Department has contributed £5.2 million in funding, which has enabled the programme to reach approximately 20,000 teachers, technicians, and support staff;
- funding Isaac Physics, an online platform of GCSE and A level physics materials developed by the University of Cambridge, designed to increase the numbers of pupils particularly from typically underrepresented backgrounds studying physics at higher levels;
- supporting the Inclusion in Schools project, delivered by the Association for Science Education, which is designed to increase the uptake of A level physics from pupils in underrepresented groups, including girls;
- funding the Stimulating Physics Network (SPN) to promote the take-up of A level physics and provides coaching support to increase the profile of physics and retention of physics teachers. We have recruited an additional 18 lead schools to support our newest cohort of partners in the Stimulating Physics Network.

We now have a total of up to 60 lead schools across England. All of these schools are benefitting from additional physics support as of September 2022. This programme has received £2.7 million in funding from the Department, and in turn the Network are able to support 350 partner schools;

- funding the Subject Knowledge for Physics Teachers (SKPT) programme, the newest addition to our programmes, which is comprised of a series of blended teaching courses comprising six topics, with modules available each term to support non-specialist teachers of physics to enhance their subject knowledge. Teachers can select the modules they need to build their subject knowledge and professional portfolio. Modules are delivered and supported by physics specialists across England and include face-to-face sessions, online tutorials and independent learning. We have provided £585,000 so far to SKPT, for the years 2022–23 and 2023–24, which helps them to reach 800 teachers;
- funding our ongoing bursary scheme which provides funding for residential CPD courses at the National STEM centre in York. This funding is match funded by the Wellcome Trust. The funding for this programme has totalled £2.6m from the Department, with the intention that STEM Learning can use this to reach approximately 1,900 teachers and technicians;
- becoming a partner signatory to the Tomorrow's Engineers Code pledging to work with the engineering community to improve the quality, targeting, inclusivity and reach of engineering inspiration activities. The Code is a framework for organisations working to increase the number and diversity of young people pursuing engineering careers.

Triple science uptake

30. It is essential that we provide every young person in England with a high-quality, challenging, and robust science curriculum that is accessible to all pupils. At the same time, we must continue to allow schools the flexibility and autonomy to offer the GCSE science pathways that are most appropriate for the specific needs of their pupils. While we strongly support the increased uptake of pupils to triple science, the Government believes that teachers and head teachers are ultimately best placed to make these subject specific decisions. The Department is focused on ensuring that all pupils have equal opportunities to pursue STEM A levels, university courses, and professions, regardless of the science pathway they take in Key Stage 4. We fund several programmes to support the uptake and teaching of STEM subjects across all Key Stages, as well as specific interventions targeted at underrepresented groups.

Computing

31. Computing was introduced as a statutory National Curriculum subject in 2014. The computing curriculum, taught from Key Stages 1 to 4, provides young people with the essential knowledge and skills to succeed as active participants in a digital world, and to help meet the needs of the future digital economy in shortage areas such as programming. This replaced the previous ICT curriculum, which was widely regarded as outdated and as failing to prepare pupils for further study, employment or life in a world increasingly dependent upon technology.

32. The computing curriculum is designed to ensure that all pupils are taught the fundamental principles and concepts of computer science, digital literacy and ICT. England was one of the first G20 countries to introduce coding into the primary curriculum, with pupils taught how to analyse problems in computational terms and write simple computer programs, from the age of 5 onwards. Pupils are taught block based programming as part of the primary curriculum, and graduate to text based programming languages in early secondary (Key Stage 3).

33. To support longevity in the content, given the speed of technological advancement, the broad set of principles outlined in the computing programmes of study were designed to avoid over prescription and early obsolescence. The computing curriculum is deliberately broad to allow flexibility for schools to innovate how the content is taught, so that teachers can include topics they wish to cover, which can include generative AI, the use of large language models or other relevant topics.

34. GCSE computer science is designed to equip pupils with the knowledge they will need for the jobs of the future and to be active creators of digital technology. It aims to enable students to understand and apply the fundamental principles and concepts of computer science, analyse problems in computational terms, understand the fundamental concepts of programming languages and understand the components that make up digital systems. They also study the effects of digital technology on the individual and to wider society, how to apply mathematical skills relevant to computer science, and to develop an understanding of cyber security. Computer science is a relatively new subject, which saw a rapid increase in pupil entries during its first six years. Pupil entries in England have risen from 4,021 in 2013 to 78,450 in 2022.

35. In November 2018, the Department launched the National Centre for Computing Education (NCCE), to improve the teaching of computing and to increase pupil participation in computer science GCSE and A level. The NCCE provides free, high-quality CPD that links directly to the computing curriculum programmes of study, and the computer science GCSE and A level subject content. CPD is available through a network of 30 school led computing hubs and is available to both primary and secondary school teachers and leaders. Notably, NCCE CPD includes the Computer Science Accelerator programme, which, to date, has equipped over 7,800 teachers with the subject knowledge they need to teach the computer science GCSE.

36. In addition, the NCCE has developed free, high-quality, online teaching resources that are mapped to the content of the computing curriculum and GCSE computer science specifications. The resources were developed by subject experts and include sequenced lesson plans and assessments, which can be adapted for the needs of all pupils. The NCCE reported that 84% of teachers using the resources said they had improved their quality of teaching. To date, these resources have been downloaded 1.7m times by teachers in English schools.

37. The work of the NCCE is informed by computer science academics and experts, including Simon Peyton Jones OBE, a renowned British computer scientist who helped to develop the computing curriculum and specialises in the application and implementation of functional programming languages. NCCE ensures that all CPD and resources are

underpinned by rigorous, computer science knowledge and expertise, and promote robust evidence-based teaching approaches, as set out in their '12 principles of Computing Pedagogy'.

38. The Department for Education has provided over £100m to the NCCE, to ensure pupils and teachers can continue to benefit from this support, through to August 2025. The Department recognises that there is a need to encourage more girls to identify computing as an area in which they can excel, being significantly underrepresented within GCSE and A level computer science, and the growing range of computing and digital careers.

39. The NCCE provides a free remote 'Encouraging girls into GCSE Computer Science' short course for teachers and curriculum leaders in secondary computing, to consider different strategies that can be used, both inside and outside of the classroom, to support the narrowing of the participation gap between girls and boys.

40. As part of the £100m funding in computing education, the Department procured a Gender Balance in Computing programme, led by the Raspberry Pi Foundation, which considered practical interventions that schools (at all stages, excluding post-16) could implement to improve girls' participation in computing. Findings from this research are being incorporated into the next phase of the NCCE, through a new Gender Insights programme, which will be available to secondary schools. This programme aims to improve schools' awareness of the barriers to girls' engagement with computing, and to support them in taking a sustained course of action to improve the take up of computer science qualifications within their school.

STEM-wide initiatives

41. The Government supports STEM Inspiration programmes to encourage and inspire young people, particularly those from backgrounds underrepresented in the sector, to continue with STEM studies and to consider careers in science and engineering. These include the STEM Ambassador programme, managed by STEM Learning Ltd, and the CREST Awards, managed by the British Science Association. STEM Ambassadors brings together 25,000 volunteers from over 7,000 employers to lead activities. Over 40% of the Ambassadors are women and 15% are from minority ethnic groups, thus providing a variety of role models and helping to demonstrate that scientists can come from any background. The CREST Awards is the UK's largest national award scheme for project work in STEM subjects and supports pupils to develop research skills, competency, and their enthusiasm for STEM. CREST focuses on reaching audiences underrepresented in STEM, with over 50,000 young people gaining an Award every year across the UK.

42. The Government is determined to find ways to improve the number of girls studying STEM A levels. To this end, it has funded research programmes to investigate ways to tackle gender balance in STEM subjects, including the Improving Gender Balance national research trial for physics. Results from the research are due to be published in 2024. The Government has also published the results of a Behavioural Insights research project testing interventions that tackle the barriers that young women encounter, with the aim of increasing uptake of STEM subjects at A Level.⁵

5 Household factors and girls' aspirations for male-dominated STEM degrees and careers (bi.team)

Technical education

43. A focus on the development of T Levels and improving the offer for apprenticeships will help ensure that everyone, whatever their background and wherever they live, has the chance to have a rewarding career or job in STEM, whether they come via a technical or academic route.

44. T Levels are being rolled out across England, giving more pupils the opportunity to pursue a technical education, in a variety of areas, including STEM subjects. T Levels provide pupils with classroom study and 'on-the-job' experience during an industry placement of at least 315 hours (approximately 45 days). They provide young people with the knowledge and real-world experiences needed to open the door to skilled employment, further study or a higher apprenticeship.

45. T Levels have been developed in collaboration with employers so that the content meets the needs of the industry and effectively prepares pupils for employment in STEM workplaces. T Levels are available in Digital, Engineering and Manufacturing and Health and Science among other routes, with further T Levels being added in future years as the programme scales up.

46. To challenge stereotypes which may hold young people back from applying, including gender stereotypes, we are using T Level ambassadors to showcase a wide range of voices from those already studying T Levels and to provide role models for pupils interested in STEM.

Recommendation 12

The Government should in its response to this Report set out how it intends to deliver on the Prime Minister's stated ambition [on mathematics to 18]. (Paragraph 88)

Recommendation 13

We recommend as an alternative to compulsion the introduction of a requirement for pupils who do not continue with a STEM subject post-16 to take the Advanced Mathematical Support Programme or a Core Science course. Core Science could be developed using the same applied principles as Core Maths and the Advanced Mathematical Support Programme. (Paragraph 89)

47. We know from the 2011 Skills for Life survey that around 8 million adults in England have numeracy skills lower than those expected of a 9 year old.⁶ Our latest evidence shows that only around half of 16–19 year olds study any mathematics at all⁷ and the problem is particularly acute for disadvantaged pupils, 60% of whom do not have Level 2 mathematics and English at age 16.⁸ This problem has implications for the representation of certain groups in STEM in both education and employment.

6 2011 skills for life survey - GOV.UK (www.gov.uk)

7 Post-16 maths participation in 2015–16 (publishing.service.gov.uk)

8 Level 2 and 3 attainment age 16 to 25, Academic Year 2020/21 – Explore education statistics – GOV.UK (explore-education-statistics.service.gov.uk)

Pre-16 mathematics

48. Since 2010, we have reformed the mathematics curriculum and examinations system, moving away from generic and superficial understanding and turning instead to a method informed by the East Asian teaching methods that enable pupils to acquire a deep and long-term understanding of mathematics and the fluency to perform calculations. This was accompanied by the introduction of a National Centre for Excellence in the Teaching of Mathematics, which is now working with a network of 40 Maths Hubs to help local schools improve the quality of their teaching based on best practice. The Maths Hubs programme focuses on improving attainment, including gaps which may be associated with disadvantage, gender, or other factors. We also introduced a Multiplication Tables Check, ensuring every 9-year old knows their timetables. Last June, 27% achieved full marks in the test and the average score was 20 correct answers out of 25. Furthermore, pre-pandemic England achieved its highest ever mathematics score in both 2019 TIMSS international test for year 5 pupils, and the 2018 PISA test of 15 year olds. The UK was 28th in PISA 2009 and moved up to 18th in PISA 2018.

49. Teaching for Mastery pedagogy, which underpins everything that Maths Hubs do, is based on teaching methods used by top-performing East Asian countries. It encompasses a number of approaches focused on ensuring that pupils genuinely know, understand and can apply mathematics - many of which are individually highlighted as effective by Ofsted and others. Mastery is characterised by whole-class teaching, where pupils work on the same content together, ensuring no one gets left behind. It encourages all pupils with the belief that by working hard at mathematics they can succeed and rejects the idea that some pupils “can’t do mathematics”. A randomised controlled trial of the Department’s Centres for Excellence in Maths Programme, which provided mastery teaching support for GCSE resits, found it led to increases in GCSE scores for disadvantaged students.

50. On 17 April 2023, the Secretary of State for Education announced plans to extend the flagship Teaching for Mastery programme, which began in 2016, to reach 65% of secondary schools by 2025. This was accompanied by plans to provide more intensive Maths Hubs support to schools that need it most, ultimately supporting them to adopt evidence-informed mastery pedagogy. These plans sit alongside ongoing work to enhance mathematics teaching in secondary schools. Hubs run projects to bring teachers together across education phases and Key Stages to ensure good progression through the mathematics curriculum and provide professional development resources to support teaching quality.

51. Progress in secondary school, however, does not sit in isolation. Maths Hubs work across Key Stages to help make sure pupils are able to develop and build on firm foundations in mathematics. At primary level, for example, the Secretary of State for Education’s April announcement included the expansion of the primary Teaching for Mastery programme to reach 75% of primary schools by 2025. At the same time the new Mastering Number programme will be expanded to help pupils secure their understanding of multiplication in primary school. For post-16, the Maths Hubs programme will provide support for those teaching Level 2 mathematics at age 16–18, drawing on mastery approaches.

Mathematics to 18

52. The UK remains one of the only countries in the world not to require pupils to study some form of mathematics up to the age of 18. This includes the majority of OECD (Organisation for Economic Co-operation and Development) countries, including Australia, Canada, France, Germany, Finland, Japan, Norway and the USA.

53. As mentioned in paragraph 7, the Prime Minister has set a new mission for all young people to study mathematics to age 18. The driving principle is to ensure that all young people are equipped with the right mathematics knowledge to succeed, whatever their chosen pathway. The mathematics young people are taught post-16 should be tailored to equip them for their future lives and careers, including careers in science and technology. We will build a clear route for all young people to study mathematics post-16, involving either a specific mathematics qualification or another qualification/programme which includes meaningful mathematics content. This includes young people with Special Educational Needs and Disabilities (SEND) who may require a tailored approach.

54. On 17 April, the Prime Minister and Secretary of State for Education set out how we will take the next steps towards delivering this mission. This includes convening an expert advisory group to advise on the essential mathematics skills and knowledge young people need to study, commissioning comparative research on international post-16 mathematics provision, and IfATE (Institute for Apprenticeships and Technical Education) working with employers to review the mathematics content in apprenticeships. This work should conclude over the summer, and we will publish a full plan on the steps to deliver Mathematics to 18, later this year.

55. The Mathematics to 18 expert advisory group will advise on how best to achieve the PM's mission for all young people to be equipped with the right mathematics knowledge. Compulsory core science until 18 is not in the scope of this work but strong numeracy skills will support young people who pursue careers in science and technology.

Advanced Mathematics Support Programme

56. As mentioned in paragraph 10, the Advanced Mathematics Support Programme (AMSP) is a support programme funded by the Department for Education. The programme aims to increase participation in Core Maths, AS/A level Mathematics and Further Mathematics and to improve the teaching of these Level 3 mathematics qualifications. The programme provides national support for teachers and pupils in all state-funded schools and colleges in England with additional support offered in areas of low social mobility so that, whatever their location, background or gender, pupils choose their best post-16 mathematics pathway and access high-quality teaching. Since the programme began in May 2018, it has reached 86% of state-funded secondary schools and colleges in England, with over 3,000 participating in at least one form of support provided by the programme.

57. Improving access to Level 3 qualifications and in particular Core Maths, is one of the key aims of the AMSP. Core Maths was introduced in 2014 to ensure a range of options for pupils wanting to continue studying mathematics but to provide an alternative pathway to A levels. It aims to develop a deeper mathematical understanding, via the application of knowledge to 'real world' problems and, in doing so, provides the kind of applied mathematics which employers say they need. Via the programme, we have introduced

Core Maths Specialists Leads (CMSL) to help increase participation and to work with schools/colleges to set up their Core Maths provision, provide support and advice on teaching and promoting it to pupils. The goal is to ensure a national spread of CMSL over the country, to facilitate tailored support in every region. The CMSL will be well-placed to gather evidence of effective strategies for introducing Core Maths and the AMSP can then communicate these strategies widely. Schools will be able to develop their Core Maths provision, informed by working with some of the leading Core Maths experts in England. The CMSL will develop their own understanding and practice in supporting collaborative professional development within and beyond school creating better outcomes for pupils and increased uptake of Core Maths.

58. Ensuring there are more girls studying mathematics beyond GCSE will support the Prime Minister's mission on mathematics to 18 and the AMSP already has a particular focus on this. There are a variety of enrichment and engagement sessions specifically for girls within the AMSP, including SUMS (Steps to University for Mathematical Pupils) events, targeted at Year 12 girls.

59. At Key Stage 3, the AMSP supports schools, builds student confidence and implements activities to generate interest in mathematics and engage and enthuse pupils, especially girls, to choose mathematics at post-16. At Key Stage 4, AMSP activities and resources provide information on the value of Level 3 mathematics options to support different post-16 and university degree choices and careers.

60. The AMSP promotes strategies to raise girls' participation, based on research and case studies, via the AMSP website and engagement events.

61. The Careers and Girls' Participation Lead, within the AMSP, oversees work with a target group of secondary schools on activities to increase girls' participation, evaluating their effectiveness from both teacher and student perspectives to inform ongoing work to increase the participation of girls in Level 3 mathematics.

62. Mathematics in Education and Industry (MEI), which leads and delivers the AMSP, along with a key partner, Tribal, has relationships with STEM Learning, Maths Inspiration, UKMT and Maths4Girls, and will work with these and other organisations, to make use of appropriate role models to encourage more girls and underrepresented groups to consider studying L3 mathematics qualifications.

Core Science

63. The Government has no current plans to introduce a Core Science course, given there are already a number of post-16 options available for pupils who want to pursue science. By ensuring that every young person develops fundamental mathematical abilities however, we are equipping them with the skills necessary for the jobs of today and the future. We know that adults with basic numeracy skills earn higher wages and are more likely to be employed than those who fail to master basic quantitative skills. Higher levels of achievement in mathematics are associated with higher earnings and higher productivity, which in turn is a key determining factor of economic growth. That is why we are steadfastly focused on improving the mathematical abilities of our young people to help them with their day-to-day lives and future careers.

Recommendation 5

The careers advice and support pupils receive from the earliest years must promote diverse and inclusive role models. Just as it is desirable for children to see themselves in what they learn, they should also see themselves in who they aspire to emulate. The Government should consider how best to support schools and existing programmes, such as STEM Ambassadors, Speakers for Schools, and the Careers and Enterprise Company, to ensure children access a diverse range of role models from research or industry. Careers advice guidance and support should also be regularly reviewed to ensure they reflect a full range of diverse examples. (Paragraph 44)

64. As mentioned in paragraph 11, the Department for Education recognises that young people of all ages can benefit from seeing role models from diverse backgrounds, from across different sectors and industries. This not only helps to raise aspirations but also increases young people's exposure to the widest possible range of career pathways.

65. The Department's new £2.6 million careers programme will target primary schools in the 55 Education Investment Areas and include a focus on role models from industry. We want to inspire primary aged children by giving them opportunities to meet a wide variety of role models from sectors including the green economy, technology, engineering, aerospace, and construction. The programme will run until March 2025, and we will review its effectiveness, including the impact of access to role models, to inform future policy for careers provision in primary schools.

66. We are grant-funding our delivery partner, The Careers and Enterprise Company (CEC), up to £29.7 million in 2023–24, to support secondary schools and colleges to embed best practice in the delivery of careers information, advice and guidance, including through networks of Careers Hubs and Enterprise Advisers. Young people will be able to see a broad range of employer role models, including in the STEM sector, to help build awareness of the full range of training and careers available to them. Examples include STEM employers funded by the CEC to meet young people include Engineering UK, Greenpower Trust and Manufacturing UK.

67. 90% of secondary schools and colleges are now part of a Careers Hubs, a tried and tested model for partnership and collaboration in careers education. This approach is giving young people more breadth and depth of exposure to employer role models. More than four in five schools (81%) in a Careers Hub since 2018 engage with at least 10 businesses, compared with 48% who are not in a Careers Hub.⁹

68. There are early indications that careers education, including access to diverse role models, is starting to steer young people towards choosing to pursue opportunities in areas of the economy and jobs where the demand for skills are more acute. The top four sectors of choice—including construction and engineering - coincide with those with high reported vacancy rates and skills needs.

9 The Careers & Enterprise Company (2023). Ready for the Future: A review of Careers Education in England 2021/22. London: The Careers & Enterprise Company

69. We are working across Government to identify other career-related programmes that focus on ensuring young people are exposed to a diverse range of role models from research and industry. We want to explore opportunities for the best possible alignment between careers programmes with similar aims, which are currently funded and delivered separately, so that we can retain a strong cross-Government focus on promoting diverse and inclusive role models.

Recommendation 4

All children should be able to see themselves in what they learn from an early age. The National Curriculum and exam subject specifications should be kept under review and updated where it is appropriate to the context to include more diverse examples, such as female scientists. (Paragraph 38)

70. Maintained schools in England are legally required to follow the National Curriculum. Academies and Free Schools have greater freedom and autonomy, particularly in areas such as the curriculum, but they are expected to teach a curriculum that is comparable in breadth and ambition to the National Curriculum, and many choose to teach the full National Curriculum to achieve this. This Government believes that autonomous schools, within a robust framework of accountability, are the best vehicle to support teachers and head teachers to improve pupil outcomes.

71. The National Curriculum helps to foster knowledge and mastery in each subject, including STEM subjects, while also ensuring more pupils can overcome barriers created by disadvantage. The National Curriculum focuses on the core knowledge that should be taught to pupils, and does not set out how curriculum subjects, or topics within the subjects should be taught. The Department believes teachers should be able to use their own knowledge and expertise to determine how they teach their pupils, and to make choices regarding what they teach. Therefore, teachers are free to include more examples of female scientists should they deem it to be beneficial for their pupils and we support them to do so.

72. There are no plans to change the National Curriculum in this Parliament and no plans to reform the qualifications.

Recommendation 10

The Government should tell us whether it has consulted with Ofsted on levels of uptake and attainment among different groups of children, and whether it has discussed an expansion of its inspection criteria to include a more comprehensive picture of subject take-up and attainment across different disciplines and characteristics. (Paragraph 77)

Recommendation 11

Ofsted should, as part of its inspection criteria, gather data and report on levels of subject take-up and attainment among pupils with different characteristics, such as gender, ethnic background and socio-economic background. The latter could utilise Free School Meals eligibility, which is already used in Government education data. Where there are disparities, schools should record and be assessed against the steps they are taking to make subject take-up more representative. (Paragraph 78)

73. As outlined in its equality, diversity and inclusion statement¹⁰, Ofsted considers these issues through its inspection process. For example, inspectors always question whether there is narrowing of the STEM and wider curriculums through how these have been structured. Narrowing of the curriculum affects all pupils, but disproportionately affects those who are disadvantaged. Another key tenet of inspection considers the extent to which pupils have equal access to high quality education. This is an inclusion issue—and one that is explicitly considered through inspection practice.

74. As mentioned in paragraph 12, when evaluating STEM subjects, through inspection, Ofsted considers the extent to which the curriculum is designed and implemented to raise aspirations for a future STEM career. Inspection practice explicitly considers how the curriculum is designed to give all pupils the knowledge and cultural capital they need to succeed in life. This would include looking at any barriers to girls' take up of STEM subjects, and particularly those who are disadvantaged or with SEND. This is discussed in its publication 'Finding the optimum: the science subject report'¹¹. The concept of 'science capital' enables inspectors to review the extent to which pupils' and teachers' awareness of STEM careers is being deliberately considered.

75. While Ofsted should and does look to ensure there are no barriers to diversity and inclusion in STEM (or any subject), Ofsted should not have a role in encouraging schools to ensure certain pupils take certain subjects, as this will likely have much wider unforeseen impact. The focus must be on ensuring all pupils have a broad, ambitious and high-quality, education.

76. During an inspection, if Ofsted finds stark disparities in the take-up of subjects on the basis of gender, inspectors will explore the reasons behind this, and what the school is doing to remove any barriers that prevent higher take-up.

77. Inspectors explicitly consider subject take-up and attainment among disadvantaged pupils. This information is made available to inspectors through the Inspection Data Summary Report. Inspectors routinely consider the approach to disadvantaged pupils through inspection activities. This includes, but is not limited to, academic and vocational outcomes, pupils who go on to become 'NEET' (Not in Education, Employment or Training), retention rates into school sixth form, and subject up-take. Where there is disparity between disadvantaged pupils and others, inspectors ask school leaders for the reasons and seek to understand the steps leaders are taking.

78. Evidence shows that weaknesses in the curriculum tend to have a disproportionate impact on disadvantaged children and those with SEND. Therefore, in exploring the strength of the curriculum on inspection, Ofsted will look at how well schools meet the needs of disadvantaged pupils and pupils with SEND. Seeking to understand pupils through groups, however, tends to assume that pupils from the same group require the same approach, which is not the case. It also tends to assume that one group needs a different approach from another, which is also not the case. All pupils need a well-constructed and well-taught curriculum.

10 Equality, diversity and inclusion statement - GOV.UK (www.gov.uk)

11 Finding the optimum: the science subject report - GOV.UK (www.gov.uk)

Teacher workforce

Recommendation 14

There are clear benefits when children are taught by teachers with qualifications, professional experience, or specialism in those subjects. The Government should set a target for every child to be taught STEM subjects by teachers with qualifications in that subject by the end of the decade. Teachers should be given access to improved, mandatory continuous professional development to ensure their knowledge remains up to date—which is particularly important in STEM subjects where there are new discoveries and developments on a regular basis. (Paragraph 96)

79. The Department for Education estimates postgraduate ITT recruitment targets using the teacher workforce model. This estimates future teacher demand for each secondary subject using pupil number projections and teaching hours data from the School Workforce Census, among other factors and inputs. The recruitment targets are calculated on the intention that the newly trained teachers required for a specific STEM subject should be trained via ITT in that subject.

80. The Department also records the percentage of hours taught by teachers with a relevant post A-level qualification. For a variety of reasons, the value is never likely to reach 100%. Many teachers may have extensive experiences or qualifications that make them suitable to teach specific subjects, but they are not recorded within the school workforce census as having such a qualification. For example, a teacher of French may be fluent in the language without having a post A-level qualification in French recorded in the Census.

81. The latest School Workforce Census (published June 2022) included data on the percentages of hours taught by a teacher with a relevant post-A level qualification:

- General/Combined Science: 95.5%
- Biology: 93.5%
- Maths: 88.4%
- Chemistry: 83.4%
- French: 81.2%
- German: 80.6%
- Physics: 72.4%
- Spanish: 63.2%

Teacher development

82. As set out in paragraph 14, we are creating a world-class teacher development system, building from ITT, through to early career support, specialisation, and onto school leadership. This is creating a golden thread of professional development that teachers can draw on at every stage of their careers. These reforms help teachers and school leaders in every phase, subject and context feel more confident and in control of their careers.

83. The Early Career Framework (ECF) reforms entitle all Early Career Teachers (ECTs) in England to access high-quality professional development at the start of their career. The ECF is a subject-neutral and evidence-based approach. It is designed to ensure ECTs focus on learning through the latest evidence which the ECF provides, in order to make the most difference in their professional practice. The ECF reforms ensure consistent and enhanced professional development and support for ECTs, including 10% off timetable in the first year and 5% off timetable in the second year of induction for all ECTs to undertake induction activities including training and mentoring, freely available high-quality development materials based on the ECF, a dedicated mentor including funding for these mentors to spend with ECTs in the second year of induction - this is based on 20 hours of mentoring across the academic year.

84. Alongside the ECF, we encourage teachers to continue to engage in subject-specific development to improve their continuous professional development. This may include undertaking National Professional Qualifications (NPQs).

85. In Autumn 2021, we introduced an updated suite of NPQs, designed to give teachers and school leaders access to high-quality in-role training and support, both in specialist areas of practice, such as leading the teaching of a subject or phase, and in leadership roles.

86. NPQs are voluntary qualifications which have been developed in collaboration with the sector and are informed by the best available research and evidence which has been endorsed by the Education Endowment Foundation.

87. While not STEM-specific, the NPQ in Leading Teaching will enable professionals to develop expert teaching practice within their relevant context through the use of subject-specific, phase-specific, or domain-specific exemplification materials. An NPQ in Leading Teacher Development is also available to support professionals to create a culture of professional learning and continuous improvement in their school.

88. NPQs can and should be supplemented by a variety of subject-specific professional development, including that which is provided by schools, trusts, subject associations, charities, curriculum hubs, Oak National Academy, and other private training organisations.

89. We encourage all teachers and leaders to consider enrolling on a fully funded NPQ; to do so, professionals should visit: *Professional development for teachers and leaders* ([education.gov.uk](https://www.education.gov.uk)) for more information.

Recommendation 15

STEM teacher salaries must be as competitive as possible with the private sector, and we welcome the new STEM-focused bursaries and wider efforts by the Government to recruit and retain STEM teachers. However, we do not think the amounts currently on offer will prove anywhere near sufficient to address longstanding shortages, particularly in subjects such as computer science and physics. The fact that such a significant proportion of current university graduates in STEM subjects would be needed to address the shortfall underlines the scale of the challenge. (Paragraph 108)

Recommendation 16

The Government should assess the impact of further salary increases on recruitment targets for STEM subjects with particularly acute shortages; and detail its findings in its response to this Report. It should also tell us what further interventions are planned for subjects where recruitment targets are unlikely to be met, whether it has undertaken any assessment of the impact that increased numbers of STEM graduates from university courses would have of teaching workforce shortages, and whether it has any plans to grow the number of STEM graduates entering the teaching workforce. (Paragraph 109)

90. Recruitment has been challenging, across the economy, as we recover from the pandemic. As expected, the unprecedented increase in new entrants to ITT that we saw in 2020/21, because of the COVID-19 pandemic, has declined over the past 2 years. The graduate and general labour markets became more competitive and pay has risen in competing sectors, especially in STEM subjects.

91. As mentioned in paragraph 14, the Department recognises that there are greater challenges in recruiting and retaining teachers in some subjects, including in STEM subjects. Therefore, there is a need for more targeted measures to boost teacher supply in these subjects, and we are already pursuing these.

92. As mentioned in paragraph 15, we have made £181 million available in bursaries and scholarships to attract trainee teachers in high-priority subjects for academic year 2023/24, a £52million increase on the current academic year. These include £27,000 tax-free bursaries and £29,000 tax-free scholarships for mathematics, physics, chemistry and computing trainees. We review the bursaries and scholarships on offer, annually, to ensure we maximise recruitment in the subjects where new teachers are most needed.

93. There is strong evidence that increasing bursaries increases ITT recruitment. NFER (National Foundation for Educational Research) has recently published independent research which corroborates the Department for Education's analysis that a £1,000 increase in bursary value results in a c. 3% increase in applicants, on average, all other things being equal.

94. We are also providing a Levelling-Up Premium, worth up to £3,000 tax-free, for mathematics, physics, chemistry and computing teachers in the first five years of their careers, who work in disadvantaged schools, including in Education Investment Areas. This will support recruitment and retention of specialist teachers in these subjects and in the schools and areas that need them most.

95. The Levelling-Up Premium is also informed by strong evidence that retention payments can increase teacher supply. A UCL (University College London) evaluation of a previous mathematics and physics retention payments pilot found that a payment worth 8% of salary reduced leavers by 23%.

Recommendation 18

The Government should consider what support it could offer to initiatives such as Now Teach, which draw upon experienced professionals to help meet STEM teacher recruitment challenges and to inspire a more diverse range of pupils to continue with STEM subjects. (Paragraph 113)

96. The Now Teach Career Changer Programme is currently a small-scale initiative, with annual recruitment targets of 200–250 participants. The programme has subject-specific targets to recruit into priority subjects with 60% of the 2022 cohort being in STEM subjects. The programme is focused on recruiting experienced professionals with industry expertise and specialist subject knowledge and therefore, by default, supports diversity and inclusion. For the 2022 cohort, 100% of participants were aged over 25, with an average age, on application, of 47. For the same cohort, 43% were male and 25% from a minority ethnic background.

97. At present, due to the small-scale nature of the programme and a focus on meeting recruitment targets, the Department for Education is not in a position to be more prescriptive with the target subjects. However, when considering the future of the initiative and any potential expansion of the programme, consideration will be given to how the programme can align with any ongoing work with regard to gaps in the market, such as shortages in STEM subjects. Evaluation of the programme, including the mark that this specific segment of the career changer market has left in schools and in the classroom is ongoing. We believe that the industry experience, subject specific knowledge and charisma that these individuals bring has the potential to inspire pupils to continue with STEM subjects.

Recommendation 17

We welcome the Government's nationwide roll-out of a scheme with the engineering sector, designed to increase the number of Initial Teacher Training recruits with industry experience. The scheme should, subject to evaluation, be expanded to bring more STEM professionals into classrooms to help teach other subjects where there are shortages. (Paragraph 112)

98. The Engineers Teach Physics programme continues to attract candidates, following its national roll-out from the beginning of the 2022/23 academic year, with 18 providers, across England, now offering it. The Department continues to monitor and evaluate its influence with a view to exploring opportunities to improve the ITT pipeline for STEM teachers more broadly.

STEM research institutions

Recommendation 19

The Government, UK Research and Innovation and other research funders should make funding available for research facilities undertaking reasonable adjustments to ensure they are fully accessible. (Paragraph 127)

99. UKRI's equality, diversity and inclusion (EDI) Strategy¹² sets out the following actions relevant to this recommendation:

- The Engineering and Physical Sciences Research Council Research Infrastructure team will be considering accessibility and the user diversity of their large-scale facilities, exploring how to remove barriers.

12 <https://www.ukri.org/publications/ukris-equality-diversity-and-inclusion-strategy/>

- Science and Technology Facilities Council (STFC) will undertake actions to improve workplace accessibility across its sites for staff and visitors, including:
 - developing guiding principles for STFC's welfare and wellbeing amenities and incorporating these in the design guides and site development plans.
 - developing STFC's accessible and inclusive design standard, driving inclusivity for all site occupants and supporting UKRI's plans for growth.
 - commissioning a Rutherford Appleton Laboratory (RAL) site accessibility audit. This approach will be extended to other STFC sites.

100. UKRI's Workforce EDI plan includes an objective to identify and address structural barriers to staff inclusion within UKRI. This includes a holistic approach to providing reasonable adjustments that ensures colleagues have equitable access to meet their needs. This includes a workplace adjustment passport that will support with identifying and implementing reasonable adjustments. The plan will also enable support through schemes like Access to Work.

In addition, as per UKRI's standard FEC grant costing methodology, UKRI will fund costs for reasonable adjustments for an individual to work on a research grant, that are above and beyond the reasonable adjustments needed for the individual to undertake their normal job. This could include adjustments to support the individual in accessing a research facility as part of their research grant work, as those costs are directly attributed to the needs of the research.

Recommendation 20

Some STEM researchers face a discriminatory working environment. Whilst this reflects inequities that exist elsewhere in society it is nevertheless a source of deep concern. The process of reducing and ultimately ending such prejudice will not be swift but is vitally important. (Paragraph 129)

101. Bullying and harassment within the R&D system, of any type, is unacceptable and must be eliminated. We need a focus on prevention and creating supportive environments in which these behaviours can be tackled at root.

102. Although we do not have representative data on the prevalence across the whole of the R&D sector, bullying and harassment has been reported as a key concern in academic research in particular. This behaviour has serious implications on individuals, on organisations, on research integrity, and on productivity.

103. *The Forum for tackling Bullying and Harassment in research and innovation (FTBH)* launched in November 2020. The FTBH brings together funding, policy and regulatory organisations, in the UK and internationally. The Forum is a place for dissemination, challenge and action. All attending organisations are committed to driving cultural change and creating healthy and safe, world-class research and innovation environments.

104. The strength of the Forum is that it is a shared endeavour, convened by the sector, for the sector. The primary advantage of this model is that it promotes buy-in and ownership, throughout associated organisations. UKRI currently convenes and chairs the Forum on behalf of the sector. To strengthen the Forum's structures and its ability to make decisions and realise its potential, the Forum is exploring the implementation of a leadership group.

105. Membership of the Forum has grown significantly, extending coverage across the research and innovation sector, into industry and higher education. This uniquely broad coverage increases the impact of dissemination within the Forum. The diversity of participation offers opportunity for wide influence.

106. The Forum has created a trusted space for dissemination and sharing of practice. Leading approaches in the sector have been shared and discussed in the Forum, along with leading international research. Networks and collaborations have been built, through this community of practice. Common barriers to preventing and tackling B&H have been identified, such as data sharing limitations, with efforts made to find solutions in such scenarios.

107. A flagship priority for the Forum has been the development of a set of values of good citizenship. The values have been developed collaboratively. It is anticipated that these will be published in the first half of 2023. The values are designed to cultivate and support research and innovation environments.

108. Data and definitions have been highlighted as a priority for the Forum. It is expected that future work plans will focus upon this topic, linking in with activity on evidence and evaluation.

109. As the Good Practice Exchange (GPEx) progresses, the Forum will seek opportunities to support, engage and develop in parallel, creating coherent and complementary resources for the sector.

Recommendation 21

Our inquiry received evidence that highlighted the importance of addressing as a matter of urgency the precarious nature of many contracts in STEM academia. We examined these issues in greater depth as part of our inquiry into reproducibility and research integrity. (Paragraph 132)

110. As mentioned in paragraph 16, the Government is committed to working with UKRI and non-government funders of research to improve the sustainability of roles within STEM academia, whilst recognising that the use of different types of contracts is an issue that rests with employers.

111. The R&D People and Culture Strategy recognises the issue of precarious contracts and sets out our ambition to ensure dynamic, and sustainable career paths in R&D through a range of measures, such as extending pilots of flexible, cross-sector training programmes to encourage more movement and collaboration between academia, industry and the third sector, and driving the adoption of the *Résumé for Research and Innovation* narrative-style CV across the sector.

112. UKRI's 5 year strategy "Transforming Tomorrow Together" supports this ambition. A priority area for UKRI is to make the UK the most attractive destination for talented people and teams from the UK and around the world. This will need a more holistic approach that values the entire workforce and the breadth of skills needed to deliver high-quality research and innovation, and the design of a more flexible and agile system which is responsive to the needs of talented people and teams. This will include redefining outdated views of a 'traditional' research career path, making more visible the full range of careers available in research and innovation and creating exciting new opportunities to attract a new generation of talented individuals and teams.

113. The Government will respond to the inquiry into reproducibility and research integrity once the committee's report has been published.

Recommendation 22

We welcome the move towards alternative processes such as narrative CVs and hope to see them become the norm in STEM research funding calls, subject to evaluation.
(Paragraph 140)

114. UKRI has been supporting the wider community adoption of narrative CV formats through a vanguard R&I community roll out programme. This delivers the Tier 1 commitment of the UK Government's People and Culture Strategy and was developed to reassure the R&I community that aligned approaches would be taken wherever possible, helping minimise confusion and unnecessary bureaucracy, while maximising shared learning, best practice and responsible research assessment.

115. It is made up of two communities of practice; the Joint Funders Group and Alternative Uses group. This includes approx. 60 organisations across a range of disciplines, sectors and countries working together to enable global R&I system wide change through supporting adoption of these culture change tools.

116. Both groups have been co-creating resources to support widespread adoption of narrative CVs across the R&I community. These are hosted in the *Résumé Resources Library* and include training materials and a Shared Evaluation Framework (SEF) to help monitor for unintended consequences and iterative development of the resources accordingly. An Evidence Platform, the first of its kind, is being developed to share evidence from the SEF with the R&I sector, inform iterative development of resources, as well as act as a research-on-research resource.

117. The combination of both group's efforts is enabling a more efficient, cohesive and comprehensive approach to shifting what's visible and valued in a range of disciplines, sectors and roles across the R&I system. The programme's approach is levelling up availability to information and support regarding narrative CVs for everyone working in R&I.

118. UKRI is also a member of the joint funders group and has both contributed to and benefited from the resources produced. So far, UKRI has piloted the narrative CV in over 25 funding opportunities across UKRI's remit.

Recommendation 23

UKRI must use the publication of its Equality, Diversity and Inclusion (EDI) strategy, and the multi-year funding settlement from Spring Budget 2022, as a launchpad to promote diversity and inclusion across the research sector. The final version of UKRI's EDI strategy must set out a timetable to implement processes to determine, monitor, publicly report against, and ultimately meet targets to reduce underrepresentation in funding awards and decision-making bodies, including its leadership and Research Council Committees panels/boards. (Paragraph 142)

119. UKRI's first EDI strategy¹³ sets out its ambition for a more diverse and inclusive research and innovation system.

120. EDI is integral to UKRI's vision and mission. Including and valuing a broader range of people and talent will help UKRI achieve the extraordinary potential of research and innovation to improve lives, promote economic growth, and support a knowledge economy that benefits everyone.

121. The EDI strategy has four objectives that provide a unifying framework for the actions they will take to implement this strategy:

- Foster a world-class research and innovation system, 'by everyone, for everyone'
- Include and support a diversity of people and ideas through our funding and partnerships
- Create a more inclusive and fair organisational culture, where everyone can contribute and participate, and feels valued and respected
- Advance and grow knowledge and capability to support a thriving research and innovation system by being a creative, evidence-based and evidence-informed organisation

122. It is clear that a variety of approaches and interventions will be needed to create a more inclusive research and innovation system, where people, creativity, and ideas can flourish. This is why UKRI Councils have developed action plans to support the implementation of the EDI strategy. Each action plan has an owner, who is accountable for monitoring and assessing progress. Monitoring of these action plans will enable UKRI to manage and evaluate the performance and significance of the strategy and inform future activities.

123. UKRI's EDI strategy and action plans include actions that will enable it to respond to the recommendation. EPSRC publishes data on participation in peer review. We are actively exploring extending and expanding the reporting of peer review data across UKRI, to sit alongside our application and award data publications. Further detail on how individual UKRI Councils are improving the representation on their committees is included below in as part of the discussion of recommendation 24.

13 <https://www.ukri.org/publications/ukris-equality-diversity-and-inclusion-strategy/>

Recommendation 24

Guidance to all Research Council staff should include a specific requirement to ensure representative Committees—for example, greater diversity could be achieved by appointing on potential, rather than on past achievements. (Paragraph 143)

124. The Government agrees that more can be done to make committees in UKRI more representative. The UKRI EDI strategy sets out a commitment to include and value a diversity of people, experiences and perspectives in its governance and accountability structures. The UKRI principles of assessment and decision making—UKRI states that UKRI will take steps to improve the assessment process by utilising the talent and resources offered by assessors from underrepresented groups such as women, early career researchers, and members of all ethnicities. This is supplemented by individual council guidance on peer review. Examples from EDI action plans that support the aim of this recommendation include:

- BBSRC will pilot the use of focused marketing and action around targeted recruitment to stimulate change in the memberships of its committees, panels and boards, within the context of wider UKRI policy, building on the evidence of under-representation. It will develop good practice guidelines and internal training for colleagues involved in building committees and panels, in collaboration with the UKRI Leadership and Learning team.
- EPSRC have improved the diversity of participation in peer review. Since 2016, EPSRC aims to avoid single gender panels and have a target of 30% (which has consistently been achieved and surpassed) for the participation of women in panels. It is also exploring different ways to increase diversity and has set targets for the EPSRC Peer Review College membership of 30% participation by women and 20% ethnic minority (improving, but not yet achieved)
- AHRC will continue to recruit a diverse range of people to its decision-making bodies and offer members of these decision-making bodies appropriate EDI training to inform their work. AHRC aims to see a measurable increase in overall diversity in the membership of boards and panels, with all AHRC-convened committees to reflect Higher Education Statistics Agency (HESA) research communities and UK population demographic data in the data domains it collects
- STFC will improve the diversity of members on its grants and advisory panels, including maintaining the target for at least 30% women and encouraging diversity across all characteristics
- NERC will assess and analyse its expert reviewer diversity data to understand composition of the community and identify targeted action to address under-representation.

STEM workforce beyond academia

Recommendation 25

STEM-related roles are an important part of the UK labour market, and just as is the case in other workplaces, the benefits of improved diversity and inclusion are clear, for employers and employees alike. The path to achieving this is not necessarily STEM-specific, but is rather likely to require a concerted, long-term effort across the entire workforce. (Paragraph 152)

Recommendation 26

In its response to this Report, the Government should detail how the newly-created Department for Science, Innovation and Technology intends to drive greater levels of diversity and inclusion across the UK's STEM sectors. (Paragraph 153)

125. The establishment of the Department for Science, Innovation and Technology (DSIT) is a clear signal of the Government's commitment to ensuring the UK is the most innovative economy in the world and a science and technology superpower. Delivering on this commitment requires that talented people, no matter their background, at the heart of great R&D in the UK, should be able to enjoy rewarding and sustainable careers, working in an environment that truly supports discovery, diversity and innovation.

126. DSIT is committed to working with the sector to implement the R&D People and Culture Strategy, as already set out in this response, to create lasting and positive change, in a number of areas, that will drive greater diversity and inclusion in UK STEM sectors and our wider research, development and innovation system. As mentioned in paragraph 4, the Department is committed to cross-government efforts to deliver the ambitions set out in the UK's Science and Technology Framework, which includes our stated ambition that, by 2030, we will have expanded opportunities for participation in STEM and ensured that a more diverse range of people enter the science and technology workforce. DSIT will work closely with DfE, UKRI, other Departments and wider sector bodies to deliver on this commitment. Government will continue to support STEM Inspiration programmes such as STEM Ambassadors and the CREST Awards with continuing focus on engaging with and inspiring underrepresented groups to aspire to careers in research, technology and innovation. Ensuring that people from all backgrounds have the opportunity to develop a positive relationship with STEM will be important for increasing the level of diversity and inclusion across STEM. Government will continue to support activity that helps with this, for example through British Science Week each March, which coordinates events and activity across the UK, with particular support for schools in challenging circumstances to run their own Science Week events.

127. The Department for Education is also working on a cross-Government action plan to support this. As referenced in paragraph 7, we will learn from examples like AI and data science conversion courses, where we have funded up to £30 million to help people from underrepresented groups join the UK's AI industry. And because 80% of the 2030 workforce is already in work, we will continue to support adult retraining and upskilling to ensure people of all ages have pathways into fulfilling careers made possible by technological change. This includes initiatives like the Lifelong Loan Entitlement. The Department will also continue to support the Apprenticeships Diversity Champions

Network, a network of employers that encourages people from underrepresented groups to consider apprenticeships. The Network's latest annual report includes practical suggestions and case studies from employers to support organisations to increase the diversity of their apprenticeship workforce, including in science and technology sectors.

Recommendation 1 (Cabinet Office response)

The Government should, in its response to this Report, tell us how it plans to monitor, evaluate and report on progress in delivering “in-house STEM capability” across public services, including the NHS and schools. (Paragraph 14)

128. The recently published S&T Framework commits to building the STEM skills and literacy needed to deliver science and technology policy for strategic advantage at all levels of government, and improving knowledge, talent and resource sharing within government, and between the public sector, academia and business. The Government Science and Engineering (GSE) Profession is key to delivering this outcome. The GSE Profession is responsible for developing people capability for cross government scientists and engineers, increasing science skills and capability in government and interchange with wider public sector, academia and industry through the STEM Futures Programme. The GSE strategy on Diversity and Inclusion is focused on helping to ensure the GSE Profession is representative of the community they serve at every level.

129. Progress of this work is monitored, tracked and evaluated by the GSE Profession Strategic and Project Boards, chaired by the Government Chief Scientific Adviser and Government Head of Profession. The Government takes monitoring and evaluation of the impact of the S&T Framework seriously and is considering how it can best evaluate the success of the Framework over time. By the end of 2023, DSIT will publish an update, setting out the progress it has made on delivering the framework.

Data collection (DSIT)

Recommendation 3

Improved data collection and the application of lessons from it are key to addressing under-representation. We welcome the biannual Research and Innovation workforce survey being led by BEIS, and the Government's recognition of the need to better capture the diversity challenge on the basis of characteristics other than gender—such as ethnicity, disability, sexuality, and socio-economic background. A survey can, however, only ever provide a snapshot, whilst concerted, targeted action would be better informed by a longitudinal study. The Government should set out how it plans to make the Research and Innovation workforce survey meaningfully useful across different departments, non-departmental bodies and the wider STEM sector. The forthcoming results must be accompanied by an action plan, and the survey should have the ability to undertake analysis by STEM occupation built in. (Paragraph 33)

130. The Government welcomes the Committee's support for the R&I Workforce Survey. In March 2023, we published a report¹⁴ describing the findings from the 2022 wave of the survey. Anonymised survey data will be made available through the ONS Secure Research Service and the UK Data Archive, which will allow researchers to break down any findings by occupation including STEM occupations.

131. DSIT will repeat the R&I Workforce Survey every 2 years with the next wave's data collection starting in early 2024. We aim to review the questionnaire with our partners before each wave, including questions on diversity and culture. The 2024 wave will include new questions relating to socio-economic background and sexuality to improve diversity data of those working in R&D and STEM for use by government and sector policymakers.

132. The time-series evidence collected by the survey will be key to informing government policy, and wider sector policy, on diversity in STEM, R&D and innovation—including identifying areas for action where we must go further to address underrepresentation in STEM and R&D.

14 UK R&I Workforce Survey Report 2022, <https://www.gov.uk/government/publications/research-and-innovation-ri-workforce-survey-report-2022>