THE ROYAL SOCIETY

# Submission from the Royal Society

## Autumn budget 2025

### Executive summary

- **Science and innovation are central to UK prosperity**
  From vaccine development to artificial intelligence (AI) breakthroughs, long-term investment in research underpins economic growth, public health and national resilience.
- **Protecting R&D investment is vital**
  The Government's £22.6 billion R&D commitment by 2029/30 is welcome but must be protected and balanced across both basic and applied research to maintain the UK's global scientific leadership.
- **University funding challenges put research capabilities at risk**
  Financial pressures on higher education threaten the sustainability of UK R&D. The Royal Society welcomes the Government's commitment to fund maintenance grants to improve access to university for students from disadvantaged backgrounds. However, the mechanism of the proposed levy on international students would worsen these financial challenges and have wider economic implications.
- **Private sector investment in R&D is in decline**
  UK business R&D fell 9% YoY in 2023. Long-term funding certainty and international collaboration, including in the next European research programme (FP10), are essential to attract and to retain global investment. The Government must also urgently address high upfront visa costs, and particularly the International Health Surcharge, which are a barrier to scientific researchers coming to the UK.
- **AI offers transformative potential for science**
  The UK must invest in AI infrastructure, skills and open science to unlock AI's benefits for research and innovation.
- **Education reform is urgent**
  To meet future skills needs, the UK must modernise maths, data and science education, reduce inequalities, and support teacher recruitment and retention.

### Introduction

UK science produces enormous value for our society. The UK led the world in developing an effective COVID-19 vaccine, building on a strong base in biological sciences that was cultivated over decades. It is only through decades of research that we develop the medicines we take, the vehicles we travel in, or the internet and AI capabilities that are revolutionising the ways we live.

The science and technology sectors have strong growth potential. By investing in research, from university labs to routes to market, we can lead the way as a nation in turning early-stage discovery science into life-changing companies and products. The science and technology sector currently employs just under 3 million people, with one of the fastest employment growth rates in the past decade[1]. Scientific development underpins advances across our economy and is essential to delivering the Government's Plan for Change and five missions, from the development of solar cells for green energy to analytics and forensic imaging for crime prevention.

This submission sets out considerations for the UK Government at the Autumn Budget in three areas driving economic growth:

1. Protecting and growing the UK's R&D capabilities in the face of financial challenges;
2. Building on our existing strengths to unlock the transformative potential of AI for science and research; and
3. Urgently modernising maths, data and science education in schools to supply skills for the Modern Industrial Strategy.

1. Employment by Industry, Office for National Statistics, 2024. *Research and Development Expenditure*. Available at: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/employmentbyindustryemp13 (accessed 14 November 2025).

# Protecting and growing the UK's R&D capabilities in the face of financial challenges

Science and R&D are critical to delivering the Government's missions and Industrial Strategy ambitions. Today's investments in basic, discovery scientific research unlock discoveries that deliver long-term prosperity and improve lives.

The Royal Society welcomed the Government's commitment at the Spending Review to increase annual investment in R&D, reaching £22.6 billion by 2029 – 2030. This is vital for economic growth and productivity. However, we await further detail on where and how this funding will be allocated.

## Investment in basic research brings lasting economic and societal benefits and must be maintained

While the Royal Society recognises the importance of investment in applied, missions-focussed research, it is crucial this does not come at the cost of ongoing investment in fundamental, 'basic' discovery-led research. Fundamental or 'basic' discovery-led research is the bedrock on which innovation rests, and it requires long-term funding and commitment. The UK's unique strength in basic research has led to transformative breakthroughs and ensured that UK science and growth sectors have maintained their internationally strong competitive edge.

One of the most significant examples of the UK's strength in basic research is the 1960s work on mRNA that later supported the rapid development of the Covid vaccine. Other examples of where UK-funded discovery research has produced enduring economic and societal benefits include:

- **High temperature alloys**
  Rolls-Royce has partnered with UK universities to innovate for more than three decades, beginning with the development of advanced high-temperature alloys for sustainable aircraft engines in 1989. Government funding that matched Rolls-Royce's significant investment was key to catalysing this long and fruitful collaboration between industry and academia. Enduring benefits of the collaboration include the UK civil aerospace industry being a global leader, with $34.5 billion turnover in 2022 and 70% of production exported; an expanded UK knowledge base and skilled workforce (including more than 500 PhD students across Rolls-Royce's network of funded University Technology Centres) ; and a competitive advantage for Rolls-Royce and its partners, such as the more than 100 patents produced by Rolls-Royce and University of Birmingham.
- **AlphaFold protein folding and DNA/RNA modelling**
  AlphaFold by DeepMind is a neural-network based model that predicts protein structures with atomic-level accuracy. This is highly valuable for drug discovery and the development of new medicines and therapeutic treatments. DeepMind was founded in London in 2010 and has remained headquartered there despite being acquired by US-based Google in 2014. DeepMind has bolstered the UK's AI talent, reputation and investment, with UK-based AI startups raising a record $2.4 billion in venture capital in the first half of 2025[2].
- **Airport scanners**
  The non-invasive scanners now used in airports as well as by police were developed by Cobalt Light Systems, which was formed with the support of Rutherford/STFC funding to set up the company at Harwell. This has resulted in concrete impact for the public, such as the 100ml liquid restriction no longer being required in airports.

In challenging fiscal times, it is crucial to protect this committed R&D investment and to ensure a healthy balance of funding between basic and applied research. Government spending on R&D must keep pace with other nations and continue to be supported by a long-term strategy for science, research and innovation.

2. Q2, 2025. *UK Innovation update*. Available at: https://www.hsbcinnovationbanking.com/gb/en/resources/uk-innovation-update-q2-2025 (accessed 14 November 2025).

## Funding challenges in higher education pose risks to the financial sustainability of UK R&D

Universities are key drivers of UK innovation, powering productivity, investment and high-value job creation. As well as delivering a pipeline of highly skilled people into the labour market, the university sector is the UK's largest performer of publicly funded R&D. Its long-term health is therefore critical to realising Government priorities, set out at the Spending Review, to boost the UK's world-leading status in R&D and pioneer the technologies of the future.

Universities are facing difficult financial headwinds, putting the UK's research and innovation model at risk. While universities channel over 75% of public R&D spending, Full Economic Cost (FEC) recovery rates–a measure of the share of total costs of a research project covered by funding–have declined steadily over the past decade, to 68.1% in 2022/23[3]. The higher education research sector had a deficit of more than £6 billion in 2023/24[4], up from £5 billion in 2022/23[5]. Universities increasingly depend on international student fees to offset shortfalls in both research funding and domestic undergraduate education. The Royal Society welcomes the Government's commitment to fund maintenance grants to improve access to university for students from disadvantaged backgrounds. However, the mechanism of the proposed 6% levy on income from international students could exacerbate financial challenges facing universities, adding an estimated £2.2bn cost to England's higher education institutions over five years[6].

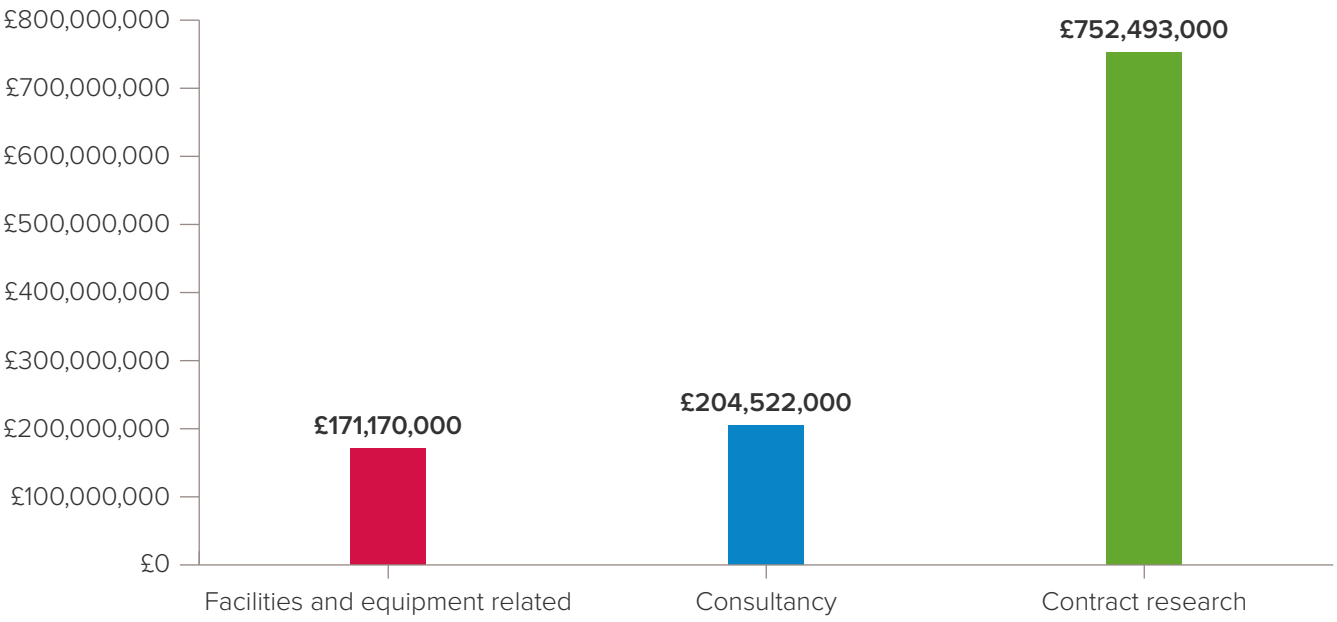
A decline in R&D in universities is unlikely to be replenished by the private sector. Private sector investment in R&D and a sufficiently funded university R&D system are mutually dependent. As figure 1 shows, universities are an important source of R&D for industry, with just over £1bn in investment in R&D in 2023/24 leveraged from academic-industry collaboration. Access to skilled talent and R&D infrastructure in universities and institutes are also a key factor in private sector investment in a region and the development of clusters.

In the short term, universities must be put on a stable financial footing. This includes a thorough consideration of the implications the proposed international students levy, with a full consultation and analysis to assess the potential impact on the financial viability of universities and, specifically, on research and the wider UK economy.

3. Office for Students (2024) *Annual TRAC 2022 – 23 Update*. Available at: https://www.officeforstudents.org.uk/publications/annual-trac-2022-23/ (accessed 14 November 2025).
4. *UKRI Data Pack on Research Financial Sustainability Academic Year 2023 – 24*. Available at: https://www.ukri.org/wp-content/uploads/2025/08/UKRI-05825-UKRI-Data-Pack-on-Research-Financial-Sustainability-Academic-Year-2023-24.pdf (accessed 14 November 2025).
5. *Op. cit*. 3.
6. Public First (2025) *Counting the cost: Modelling the economic impact of a potential levy on international student fees*. Available at: https://www.publicfirst.co.uk/wp-content/uploads/2025/09/ISL-Modelling-Final-Report.pdf (accessed 14 November 2025).

**FIGURE 1**

Academia-industry collaboration through contract research, consultancy, and use of higher education facilities, 2023/24[7].




## Maintaining momentum on long-term funding for R&D is critical for investor confidence

Strategic, long-term funding cycles for R&D are vital to maintain investor confidence in UK science. These must be backed by consistent policy which is essential in attracting talent, enabling the most ambitious research, and creating the predictable investment environment needed for UK R&D. Long-term certainty has been noted recently by leading pharmaceutical companies, including AstraZeneca and Merck, to give investors in high-risk R&D the confidence to commit to funding and research infrastructure. Consistency is key. The publication by the Government of criteria and guidance on R&D activities eligible for ten-year funding in May is a significant and welcome development. However, it will be important for government departments to maintain momentum, with further ten-year funding announced for R&D across a range of disciplines and geographic areas.

## Attracting private-sector investment and making the UK the destination of choice for R&D

The private sector is the largest investor in UK R&D, accounting for roughly 60% of total investment. Maintaining the UK's attractiveness to the private sector is crucial to R&D, especially as private sector R&D investment declined by 9% in 2023 from the previous year, to £41 million, and has been declining since a peak in 2021/22.

While foreign direct investment in UK R&D is a growth opportunity, global competition for investment is intensifying. The current volatile geopolitical climate brings challenges but also an opportunity for the UK to set itself apart as a destination for international private-sector investment in science and technology. More recently, pharmaceutical companies AstraZeneca and Merck were both reported to have paused significant investments in the UK (£200 million in an R&D facility in Cambridge by AstraZeneca, £1 billion in UK expansion by Merck) which is very disappointing.

7. HESA (2025), *Higher Education Provider Data: Business and Community Interaction (HE-BCI)*. Available at: https://www.hesa.ac.uk/data-and-analysis/business-community/services (accessed 14 November 2025).

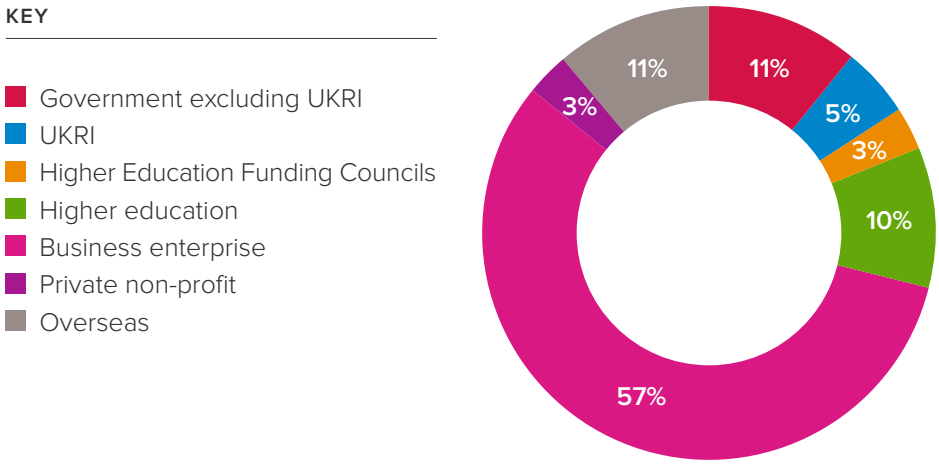
However, there is cause for hope. In 2023, overseas funding (including foreign direct investment) in UK R&D reached £8.3 million, up 46% from 2022 and 24% higher than the 2018 – 2022 average. The commitment in May from pharmaceutical firm BioNTech to invest up to £1 billion in the UK over ten years, backed by £129 million in UK Government investment, demonstrates where concerted and proactive long-term government and industry partnerships can reap benefits for the UK economy.

The Government can and should do more to make the UK an attractive base for R&D activities, including:

- **A partner of choice for R&D**
  International collaboration is crucial for the success of UK science. We welcome the Government's commitment to being a global 'partner of choice' on R&D and the encouraging early success of UK science following reassociation to Horizon Europe, the EU's signature research and innovation programme. We support the UK Government's commitment to seek association to Framework Programme 10 (FP10), the next iteration of this programme.
- **A destination of choice for global talent**
  To make the UK a globally competitive destination of choice for international researchers and investors, the Government must continue at pace with improvements to the Global Talent Visa, which were committed to in the Immigration White Paper. The three-year eligibility period for Indefinite Leave to Remain for Global Talent Visa holders must also be retained, otherwise the UK will lose valuable scientific talent to other countries. The Government must also address upfront visa costs that are 17x higher than those of our international peers. There is growing evidence that the UK's high visa costs and lengthy visa process make it a less attractive destination for top scientific talent, including cancer researchers. Cancer Research UK institutes spent more than £470,000 on visa costs for international cancer researchers alone in 2022/23, funds better spent on frontline cancer research. The Royal Society notes recent reports that the Government is considering how to address the impact of prohibitively high upfront visa costs on its ability to attract international scientific research talent.

FIGURE 2

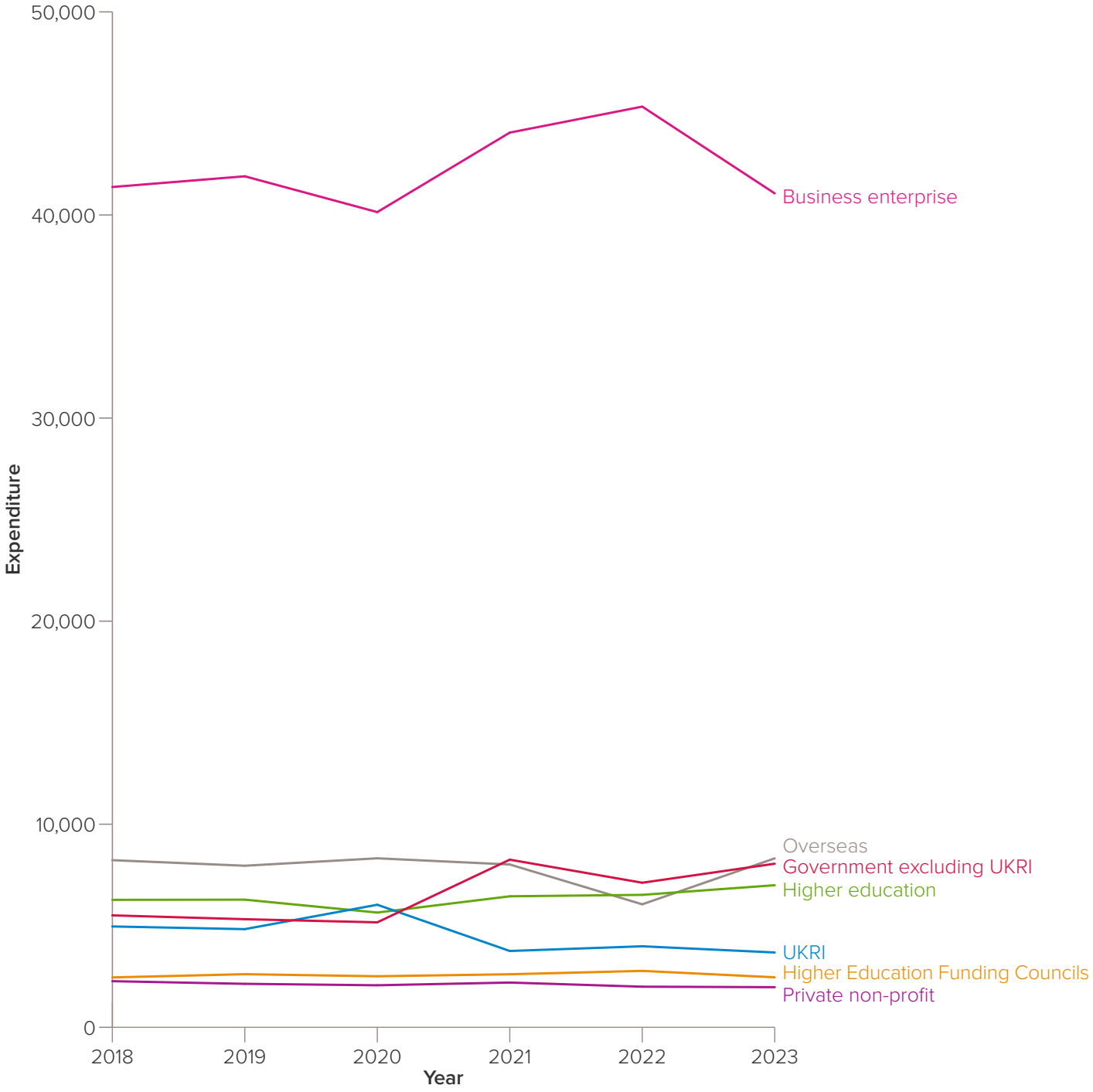
Share of total gross UK R&D expenditure by funding source[8].




8. ONS (2025), *Gross domestic expenditure on research and development (GERD), UK: 2023*. Available at: https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/ukgrossdomesticexpenditureonresearchanddevelopment/2023 (accessed 14 November 2025).

FIGURE 3

Gross expenditure on UK R&D by funding sector (£ millions) in 2023 constant prices, 2018 – 2023[9].




9. *Ibid.*

# Building on our existing strengths to unlock the transformative potential of AI for science and research

Artificial intelligence (AI) has the power to transform how we live and work. A review commissioned for the Royal Society suggests the valuation of the global AI market (as of 2022) is approximately £106.99 billion. Research is fundamental to developing applications for AI that benefit society, as well as to understanding and managing its potential risks.

AI also has significant potential to transform the scientific method, with implications such as faster drug discovery. Investments in AI and data infrastructures will help researchers adopt more complex AI techniques, process higher volumes and types of data, and ensure quality in AI-based research. To ensure the UK can maximise the opportunities from AI, we will need to see actions to make AI tools accessible and usable by researchers across scientific disciplines, which may require further investment in AI and data literacy. Furthermore, it is vital that AI-based research meets open science principles and practices. This will ensure that valuable learnings can be disseminated widely across the scientific community. This may require investment in open science and AI training curriculums, actions to incentivise the adoption of open science practices, and deterrents to the development of closed ecosystems for AI in science.

We welcome the Government's commitments to invest in increasing computing power twentyfold and to invest sovereign AI infrastructure. In addition, the Government's commitment to develop an AI for science strategy is an important step and we look forward to working with them to develop this.

We also welcome the strong signals in support of the use of AI for scientific research outlined in the Memorandum of Understanding signed with the United States of America regarding the Technology Prosperity Deal.

# Urgently modernising maths, data and science education in schools to supply skills for the Modern Industrial Strategy

The success of the Government's Industrial Strategy and AI Opportunities Action Plan hinges on the UK developing a highly skilled and adaptable workforce. For the UK to maximise success in these growth-driving sectors, the workforce will need strong foundations in science, digital capability, and data literacy. However, almost half of working adults in England currently demonstrate numeracy levels no higher than those expected of an 11-year-old[10]. There are also concerning indications of a decline in science education, with persistent gender and demographic inequalities. Without reform to how we teach maths, data and science in schools, we risk falling behind international counterparts and eroding the UK's global competitiveness.

The Government's reviews of the national curriculum and of post-16 education represent a pivotal opportunity to reconsider how these essential skills are embedded and developed. To be effective, any reforms must be ambitious in scope and designed to secure transformative and sustainable improvement.

**Our education system urgently needs to adapt to our increasingly data and technology-rich world**

In maths, there are wide gaps between the lowest and highest achievers, with a long tail of underachievement linked to economic disadvantage. A third of pupils effectively fail maths at 16 every year, and few improve when they retake exams. Only 11% of UK students achieve the PISA higher level 5 (eg modelling complex situations) compared to 41% in Singapore. Socioeconomic status is strongly correlated with mathematical performance and the gap between bottom and top quintiles has not improved in ten years[11].

The Government has a once-in-a-generation opportunity to take a new approach. Every child should leave school with the skills and confidence in maths and data to thrive in work and life, so that they can compete for skilled jobs, start new high-growth companies, or plan well for old age.

Our education system urgently needs to adapt to our increasingly data- and technology-rich world. If we are to compete with our international counterparts, we must reduce the educational inequalities in STEM and raise levels of maths and data education to equip our young people with the skills for the changing world of work.

As part of the Department for Education's Curriculum and Assessment Review, a new approach to maths and data education should be planned and tested over 2 – 3 years, then implemented over the long term (10 – 15 years). As set out in the Royal Society's Mathematical Futures report, a new curriculum for mathematical and data education, beginning in early years, must integrate data, statistics and use of digital and computing tools into mathematics so that young people are better prepared for the workplace in a growing economy[12]. Qualifications and assessment also need to change to demonstrate to employers what young people can do with the skills and knowledge they have. In addition, teachers need to be better supported and trained to embed mathematical skills across a range of subject areas.

10. National Numeracy (2022), *Numeracy levels and attitudes towards maths and numbers*. Available at: https://www.nationalnumeracy.org.uk/news/new-survey-uk-numeracy (accessed 14 November 2025).
11. The Royal Society (2024), *A new approach to mathematical and data education*. Available at: https://royalsociety.org/news-resources/projects/mathematical-futures/ (accessed 14 November 2025).
12. *Ibid*.

## Science education must ensure foundational scientific literacy for all

There are clear and troubling signs that science education is in decline. Student interest and confidence are falling, particularly among younger secondary pupils, with confidence dropping from 56% to 49% since 2019[13]. The gender gap is widening, with girls' interest and confidence in science falling more sharply than boys'[14]. Fewer students now aspire to study science post-16 or progress to university, with overall aspirations down by 6% since 2019[15].

Furthermore, not all schools across the country offer Triple Science as a subject, with lower-income students less likely to have access to this as an opportunity. Around 20% of 'highly able' pupils eligible for free school meals attend schools where Triple Science is not offered[16]. Students taking Triple Science (around 175,000 entries in 2024) are significantly more likely to pursue science post-16 than students who take Combined Science (around 927,000)[17, 18]. The Royal Society therefore recommends the restructuring of the science curriculum to provide universal access to a single, comprehensive science pathway at GCSE. By eliminating the divide between Combined Science and Triple Science, all students, including those from disadvantaged backgrounds, can equally study biology, chemistry and physics, enhancing their potential to pursue science post-16.

Practical science is retreating fast. Only 26% of GCSE students now carry out practical work at least fortnightly, compared with 44% in 2016[19]. Students are now more likely to watch a video of a practical than to carry it out themselves, even though hands-on investigation remains the single biggest motivator for studying science.

The Royal Society believes every student should have the opportunity to undertake an original STEM investigative project during their school career. Pilot programmes, run by the Royal Society and funded by the Department for Science, Innovation and Technology (DSIT), are already demonstrating how sustainable partnerships between schools, universities, employers and STEM professionals can make this possible.

But lasting change depends on a strong and supported teaching profession. The Government's plan to recruit 6,500 new teachers is welcome, given the shortfalls in STEM recruitment. In 2023/24, the Department for Education met just 17% of its target for physics teachers and 36% for computing[20]. Recruitment challenges are particularly acute in disadvantaged areas, and schools often struggle to hire teachers with degrees in the subjects they teach, especially in maths, computing and the sciences.

13. The Royal Society (2024), *Science Education Tracker*. Available at: https://royalsociety.org/news-resources/projects/science-education-tracker/ (accessed 14 November 2025).
14. *Ibid*.
15. *Ibid*.
16. STEM Learning (2022), *Gender, socioeconomic disadvantage and ethnicity shown to affect science attainment and progression*. Available at: https://www.stem.org.uk/sites/default/files/pages/downloads/Science%20Education%20in%20England%20Summary.pdf (accessed 14 November 2025).
17. Ofqual. 2023. *Provisional entries for GCSE, AS and A level: summer 2024 exam series*. Available at: https://www.gov.uk/government/statistics/provisional-entries-for-gcse-as-and-a-level-summer-2024-exam-series (accessed 14 November 2025).
18. Ofqual. 2023. *An exploration of the impact of science stratification in the English school curriculum: the relationship between 'Double' and 'Triple' Science pathways and pupils' further study of science*. Available at: https://doi.org/10.1080/02671522.2023.2283417 (accessed 14 November 2025).
19. *Op. cit*. 13.
20. National Foundation for Education Research (2024), *Teacher Labour Market in England Annual Report*. Available at: https://www.nfer.ac.uk/publications/teacher-labour-market-in-england-annual-report-2024/ (accessed 14 November 2025).

Retention is equally critical. Current estimates indicate that some 40,000 teachers leave the profession in England each year. Evidence shows that access to subject-specific professional development reduces attrition. A 2021 EPI report, commissioned by the Wellcome Trust, found that spending an additional £500 per teacher per year on professional development could prevent up to 12,000 teachers from leaving annually[21].

The Government should therefore prioritise investment in continuing professional development (CPD), including restoring funding for science CPD cut in the last Parliament. For example, funding for training at the National STEM Learning Centre has been reduced by 47%, around £4 million. While reversing these cuts would involve costs, these could be offset by the savings generated through lower recruitment needs as teacher retention improves.

21. Education Policy Institute (2021), *The effects of high-quality professional development on teachers and students: A cost-benefit analysis*. Available at: https://epi.org.uk/publications-and-research/the-effects-of-high-quality-professional-development-on-teachers-and-students/ (accessed 14 November 2025).