



SCIENCE EDUCATION: SUPPORTING THE UK AS A SCIENCE SUPERPOWER



Baroness Brown of Cambridge

If the UK is to remain a “science superpower”, we must invest in world-leading science education for every young person in the UK. As Chair of STEM Learning, Baroness Brown has seen the power of investing in teachers and will share recent evidence on its positive impact on young people. Professional development (CPD) for science teachers is an effective way to ensure great science education is available to all young people – and, as you will read, it pays for itself through reduced need to recruit and train new teachers.

This summer (July 2020), the Government published a Research and Development (R&D) Road Map setting out an ambitious long-term objective for the UK:

“to be a science superpower and invest in the science and research that will deliver economic growth and societal benefits across the UK for decades to come, and to build the foundations for the new industries of tomorrow.”

The Road Map recognises that R&D requires people: researchers, innovators and technicians. Alongside them, a science superpower needs many thousands of people in skilled roles supporting and facilitating their work, managing facilities and projects, allocating finance, assessing intellectual property and so on. Indeed, growth in highly skilled jobs is one of many reasons why the Government is committed to R&D.

However, when it comes to the question of where we will find all these people, the Road Map focuses on the UK’s openness to global talent and smoothing the pathway for those who have chosen a career in R&D. It is silent on the vital question of science education in our schools, on how we nurture our young people so that they can contribute to and benefit from living in a science superpower.

SCIENCE EDUCATION FOR ALL – FOR ALL THE RIGHT REASONS

The UK needs an excellent science education for every young person. As a society we will profit from widening the talent pool, drawing on the talent of all our young people to help us realise our ambition as a science superpower. We must ensure that everyone, regardless of background, has the opportunity to gain the skills needed to reap the rewards that flow from innovation.

Science education has the potential to help us close the gap for disadvantaged communities. OECD research found that “taking more science courses benefits disadvantaged student seven more than it does their more advantaged peers”.

Science education also has wider benefits, including supporting people to make good choices for themselves and their families, for their health and well-being. And to participate as citizens, as the UK decides how to govern new technologies in fields such as geoengineering, autonomous systems and genome editing.

Living in a science superpower, our young people need science education to understand both the potential and the risks of the exciting opportunities created by research. We have a moral duty to ensure our young people have science education to prepare them for the choices they will make as adults, parents and citizens.

THE POWER OF INVESTING IN TEACHERS

At the heart of science education is great teaching from skilled teachers. As a McKinsey report put it: “No education system can exceed the quality of its teachers. The only way to improve outcomes is to improve instruction”.

As Chair of STEM Learning, I have come to appreciate the extraordinary power of investing in teachers. Each teacher teaches many young people, so developing that and supporting them to become a great teacher, who engages and inspires their students, benefits thousands of young people over the course of that teacher’s career. Research consistently shows that quality of teaching has the greatest impact on pupil outcomes.

And we need great science teaching at every level.

The foundations for science are laid in primary schools. This is why science is a core subject in the national curriculum, alongside English and maths. Primary science can and should be engaging, harnessing children’s natural curiosity and imagination to help them develop a wide range of skills, including literacy and maths as well as scientific thinking. However, primary schools need support to teach science well. Very few of their teachers studied science beyond the age of 16, so they need to develop their knowledge and skills to teach science with confidence.

Secondary schools face different challenges. Secondary science subjects include fast moving fields that require teachers to continually refresh their knowledge (biology), teach practical work safely (chemistry) or require substantial mathematical skills (physics).

Moreover, secondary science teachers are often asked to teach physics, chemistry and biology to the younger students, even though these are three very different disciplines and many degree courses concentrate on a specialist subfield. Nonetheless, we expect biology teachers to teach physics and vice versa. One Headteacher likened this to asking a geography teacher to teach history or music – perhaps not impossible, but certainly hard to do well without support.

The challenges grow as you move up the school, due to the difficulty of recruiting and retaining specialist science teachers, particularly in physics. This means that science GCSEs and even A levels may be taught by non-specialists, whose lack of knowledge and confidence adversely affects student outcomes. It is hard for a biologist to teach GCSE - let alone A level - physics.

Research shows that these issues around teacher supply disproportionately affect students from working class and minority ethnic backgrounds. Schools in disadvantaged areas struggling to recruit and retain experienced science teachers.

Fortunately, we know what works – investing in teachers to develop them as skilful, inspirational professionals. Quantitative analysis of national data on outcomes shows STEM Learning’s professional development (CPD) for teachers improves student achievement in science at every level:

- Primary science: schools where teachers engaged with CPD improved their results (Key Stage 2 assessments for science) 50% faster than other schools.

- GCSE: schools utilising CPD saw an increase of over 10% in the proportion of students achieving a good grade in two science GCSEs – more than double the progress of other schools. This means that, in 2018/19, 16,000 additional young people achieved two good science GCSEs.
- A level: entries for STEM A levels have increased by around 8.5% over the past three years. 80% of entries were from schools using STEM Learning CPD – comparing them with schools that did not use CPD, we estimate that CPD accounted for 40% of the overall increase.

The impact of teacher CPD extends beyond attainment. CPD develops inspiring science teachers who understand the real-world context – how science is applied – and use this to enrich their teaching and inspire their students.

This is reflected in evidence from student surveys that, after CPD, teachers inspire more positive attitudes towards science, with more students – girls and boys – aspiring towards STEM careers. Student confidence also grows, with more considering themselves “the kind of person who could have a STEM career”.

A POLICY THAT (MORE THAN) PAYS FOR ITSELF

The UK needs great science education to support its great ambitions as a science superpower. We know how to make that happen – investing in teachers so that every young person can benefit from great teaching in science, regardless of their family background or where they live.

Currently, STEM Learning connects with over 230,000 teachers, reaching every primary and secondary school, and every post-16/FE college in the UK. This provision is supported by a unique collaboration of Government, charities and businesses – but it is Government support through the Department of Education that provides the foundation that unlocks investment from others and enables the whole enterprise.

And this Government investment pays for itself. For, in addition to improving student outcomes and aspirations, CPD for science teachers encourages experienced teachers to stay in the profession, reducing the need to spend money training new teachers (and helping schools solve those staffing shortages that I mentioned earlier).

An independent study by Education Datalab showed science teachers are 160% more likely to remain in the profession if they take part in STEM Learning CPD, rising to 190% for newly qualified teachers. Over the past three years, this support has helped over 1,100 secondary science teachers stay in the profession – around 3% of the total science teaching workforce. Based on conservative (IFS) figures, we estimate this saved the UK at least £58.5m in teacher training costs, a return on investment of 153%.

Of course, the true return is even greater, since this calculation is based simply on savings on teacher training. It does not take account of the benefits of science education, the widening of our talent pool to support our ambition to be a science superpower, the opening up of opportunities this will create, or the intrinsic good of scientifically literate citizens, able to make good decisions for themselves and their country. □