

**A new approach to mathematical and data education: an agenda for change
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Keynote speech by Sir Adrian Smith, President of the Royal Society

I do not need to tell you why maths and data literacy are so important. They support thinking and decisions in government, in industry, finance and business, and in academic research across disciplines. Mathematical skills are vital for most areas of work from engineering to healthcare, and professional sport to achieving a net-zero economy.

But it is more than that – mathematics, in its broadest conception, increasingly influences the day-to-day lives of individuals as employees, as citizens and as consumers of information. Without data literacy we risk alienating millions of people from the national conversation.

The substantial increase in the use and availability of data through digital technologies means that its influence can only grow.

You know all of this – that is, I hope, why you are here. The good news is that appreciation of the need for those skills is growing across all parts of society. Labour market research commissioned by the London Mathematical Society suggests that between 2018 and 2022 there was a 53 per cent growth in the number of job opportunities requiring advanced maths skills. Yet a poll for the Times Education Commission showed that 85% of companies either have or expect to have skills shortages in key sectors of the economy with more than a third saying there were shortages in basic skills including numeracy and literacy.

Two thirds of parents think the education system does not adequately prepare young people for work or life.

And young people are choosing maths A-Levels in ever increasing numbers. There is also a growing political consensus, whether through Rishi Sunak's vision for maths to 18, or the Government's vision for a broader, richer, cutting-edge curriculum that the Curriculum and Assessment Review Panel have been tasked with considering.

We have a moment now, starting with that review, to make a real difference. Not with the tinkering of the past but with a bold ambition and I hope today will help us put the flesh on the bones of that ambition – in this room we have the ideas and commitment to help make real change.

There is much to celebrate in relation to maths in the UK. We have a great many outstanding mathematicians – we have for example the third highest number of Fields medallists. We also have great research strengths in areas such as data and AI, cybersecurity and quantum computing where maths is crucial.

In any reform, we do not want to lose what is excellent.

But....

Government data show that 17 million working-age people in England, equivalent to 49% of the labour force, have a level of numeracy equivalent to that expected of children when they leave primary school.

There are around 175,000 students who 'fail' GCSE maths each year, including 40,000 who are failing it for the second time or worse.

A recent OECD study showed that 15-year-olds in England express greater enjoyment and confidence in mathematics compared to their peers on average across the OECD – but despite that we have low participation post 16 because of the structural and policy environment – in other words, our hopelessly outdated education system forces many young people to give up all maths at 16 years of age.

Worth noting also that socio-economic status is strongly correlated with mathematical performance and the gap between bottom and top quintiles has not improved in 10 years.

I will come back to post 16 but I want to start at the beginning.

The Royal Society's *A new approach to mathematical and data education* report looks across the key stages and highlights some of the ideas that we feel can make a difference.

In early years, the report suggests that we need greater emphasis on conceptual understanding and spatial reasoning, which plays a key role in later development of number, measure, data and geometry skills.

From ages 5-11, the report advocates for a greater emphasis on enabling pupils to think, reason and apply their knowledge to problem solving.

By 11-14 students are really starting to suffer from a shortage of mathematics teachers. We all know the value of skilled and knowledgeable teachers and so, given the challenges, we may need creative deployment of expertise that is available from teachers of other subjects. If that is to happen, we must ensure they have the support to enhance their expertise.

I have already touched on some of the challenges of GCSEs.

And then we get to post -16.

A-levels were introduced in 1951 and have changed very little since then – unlike almost everything else. A-levels and Scottish Highers have served us well in the past and perhaps we have been complacent about them – as long as the UK continued to

produce outstanding mathematicians and scientists, there has been a temptation to think everything was fine.

But we need change. We need something like a baccalaureate style system with maths and science among the subjects continuing to be studied to 18 and a greater focus on technical training.

A-levels are no longer fit for purpose. Scottish Highers offer a bit more breadth, but it is still not enough.

No part of the education system can be deemed too difficult to change and all must be looked at with the same critical eye and ambition for improving the experience and outcomes for young people.

This would be a radical reform of a core pillar of public service but for too long we have been afraid of radical reform.

One area where we have had some change is the introduction of Core Maths. Sadly, too few people seem to be aware of it. Ten years on from its introduction, only around 7% of A-level students who are not taking A-level maths are taking Core Maths. That is no doubt in part because less than a third of state-funded schools and colleges are offering the subject. The lack of awareness is no doubt in part down to a lack of recognition. At present, students who take the qualification do not get the results at the same time as they get their other results – this gives the impression that it is in some way inferior. It needs more respect.

Core Maths, with its focus on understanding maths and data in their broadest sense, is designed to meet the substantial unmet demand from employers for people with quantitative skills. It is part of the solution, and it already exists. We need to give students access to it.

I also want to return to teachers because without them any chance of successful reform is lost before it has begun.

In the 23/24 academic year only 63% of the target number of maths teachers were recruited through initial teacher training.

The uproar caused by proposed cuts earlier this year to the Advanced Maths Support Programme for teachers illustrates how much subject-specific professional development is valued by the profession - we need more of this, not less. There are many changes we can make to the curriculum and how maths is taught but we need to ensure we have enough teachers, and we need to guarantee that they have at least 35 hours of subject specific CPD every year.

I spoke earlier about us having a moment now to make a real difference, starting with the Curriculum and Assessment Review. But that can only be a start, and it must go well beyond content and qualifications to address the wider system. One of the

Government's missions is growth and a second is breaking down barriers to opportunity. Educational reform is central to both. To grow you need to invest and perhaps one of the most important areas to do that is in human capital. We can no longer think that it is good enough for only some people to get a great education. That is neither right nor sensible.

Growth and opportunity will go hand in hand if we get education right and maths and data are perhaps the most important part of that in a world where well-paid jobs and the ability to function as an active citizen are increasingly driven by maths and data and the technologies that they underpin.

That is not to say that maths should be prioritised to the exclusion of other subjects. It needs to be integrated into other subjects and meet the needs of individuals, whether that is as a mathematician, someone working in finance or for those who need maths and data literacy as part of a job in journalism or to understand the deluge of data that is an increasing part of daily life.

The challenge today is to start mapping the path forward. A path that requires working with teachers to create a new curriculum that combines our traditional take on maths education with data, computing and AI. A curriculum that places maths in real world contexts.

We also need to take a serious look at assessment.

There have been false dawns on educational reform – it has often been talked about with zeal but floundered when faced with the scale of the challenges. That has resulted in lots of tinkering, much of which has merely shuffled things around without improving the outcomes for young people.

In large part that is because of the scale of the challenge. I am under no illusion that our task will be easy. It will take time and major investment.

But that cannot be a reason to not take action – if we do not start now, we risk today's young people being ill-prepared for the future and reinforcing the existing regional, gender and socio-economic inequalities.

So now it is time to hand over to you. I hope our new approach to mathematical and data education provides a sound basis on which today's meeting can build and for one last time, can I urge you to be ambitious – our young people deserve that.