

Royal Society - Written Evidence (NUM0045)

The Society's 2024 report '[A new approach to mathematical and data education](#)' includes the Society's evidence on many of the questions raised. The associated research reports which informed the final report (available online) also contain context and further detail.

Where most relevant, pages/sections of the [complete report](#) are signposted in response to questions below.

In addition, the committee may wish to consider the following paragraph included in Sir Adrian Smith FRS (recent past president of the Royal Society) in his reply to the House of Commons Inquiry (2024) into financial literacy:

'The need to be numerate is not, however, limited to financial matters. In an age of misinformation, an informed democratic citizenry needs to be data literate, too, so they are better placed to make informed decisions around policy issues relevant to their day-to-day decision making.'

Questions

Attitudes to numeracy

1. How does the commonly experienced mindset - a level of acceptance, across the UK, but particularly among girls and women, of being "unable to do maths" - impact attaining the necessary numeracy skills? **p8, p81**
2. What needs and can be done to change this mindset, and how might this be implemented? **p82. A curriculum and teaching approach placing greater emphasis on what we have called 'general quantitative literacy' or understanding when to use 'simple maths in complex (and previously unknown) situations'.**

Numeracy skills

3. What are the essential numeracy skills and knowledge needed throughout life?
4. What are the effects of low numeracy throughout life on 1) individuals, including their career, financial and health outcomes, 2) the economy, and 3) society? **p25-26-27-28**
5. How is numeracy likely to change in the future, in particular as a result of technological developments such as AI? How can the curriculum, teaching and maintenance of numeracy skills through life keep pace?

6. What are the greatest challenges to gaining and retaining numeracy skills, and how can these be addressed?

7. Given the importance of the 0-5 years in a child's development and future trajectory, what role might the family environment, parental influence, early years providers and pre-school activities play in the foundation of numeracy skills and confidence? What is the role for government, if any, in supporting the development of numeracy skills in the early years pre-school? **p81**

Numeracy education

8. How effective is the maths education system, both in terms of curriculum and teaching, in providing students with numeracy skills? What are the key barriers to gaining a strong foundation in numeracy at school?

9. How can disparities in maths and numeracy levels across gender, ethnicity, socio-economic background and geographic location be addressed? Is there any evidence of disparities in numeracy skills attainment between different types of schools?

10. Are the Government priorities for maths education the right ones to embed numeracy, and what steps would you like to see the Government make to improve numeracy? **See Recommendations: p80 (Curriculum), p83, 88 (Qualifications and assessment), p84 (Professional development for teachers)**

11. What steps can be taken to improve post-16 maths education and teaching to ensure the necessary skills are acquired?

- The Royal Society's Advisory Committee on Mathematics Education designed a set of **General Mathematical Competences** (GMCs) for T Levels with the purpose of enabling students to engage with mathematics in ways that capture the essence of working mathematically in vocational contexts. They are specifically informed by, and sensitive to, research into the use of mathematics in workplaces. They provide a common structure around which mathematics for all T Levels can be specified whilst allowing for adaptation that ensures authenticity of student experience in each T Level.
- These GMCs incorporate the skills which most learners would find valuable. Inclusion of them across a wide range of post-16 pathways would be an important step to improving numeracy for life. The framework of ten GMCs comprises:

- Measuring with precision
- Estimating, calculating and error spotting
- Working with proportion
- Using rules and formulae
- Processing data
- Understanding data and risk
- Interpreting and representing with mathematical diagrams
- Communicating using mathematics
- Costing a project
- Optimising work processes

See also Appendix: Evidence for Maths to 18 Expert Advisory Group June 2023.

Numeracy for adults

12. What is the current provision of numeracy education and skills training for adults, and how accessible is this? What examples are there of work in this area, particularly since the end of the Multiply programme?

13. What opportunities do people who have left school without numeracy skills for life have to improve their numeracy skills?

14. What are the key challenges in addressing low numeracy in adults and how can adults be motivated and supported to participate in education and training to improve numeracy levels? What role does financial literacy and inclusion play in providing motivation and improvement in numeracy?

15. What steps might be taken to improve adult numeracy?

16. What role could employers play in identifying and addressing low numeracy in the workplace? Should apprenticeships include numeracy skills development? What examples are there of employers actively tackling the low numeracy problem?

17. What role should 1) Government, 2) local government, 3) educational institutions and 4) voluntary organisations play in addressing low adult numeracy, including in specialist settings such as prison?

Learning from others

18. What lessons can be learnt from other countries and the devolved administrations in their approach to numeracy? *See report horizon scanning international initiatives, commissioned by the Royal Society as part of the Mathematical Futures Programme: <https://royalsociety.org/-/media/policy/projects/maths-futures/landscaping-international-mathematics-education-policy.pdf>*

Appendix to **Question 11**. Previously submitted evidence.

Written Evidence for Maths to 18 Expert Advisory Group (EAG) [*edited for length and minor updates*]

Professor Sir Adrian Smith FRS, President of the Royal Society, CEO Alan Turing Institute, June 2023

The Expert Advisory Group has asked ... the following two questions:

- 1. What is the essential content that should be taught as part of 16-18 Maths?**
- 2. What knowledge do young people need to manage their own finances?**

The Royal Society supports maths to 18 for all, and has championed this view for a decade, together with a call for wider reform of UK education that would encourage all students to study a broader range of subjects across the sciences, arts, languages, and humanities. This does not mean that A level maths should be studied by everyone, though an increasing number who pursue data-led careers will wish to do so.

... one of the main challenges for this welcome initiative is how to create a suite of mathematics qualifications post-16 that is relevant to pupils of all backgrounds, abilities and interests. Of equal importance is how our education system equips young adults with the skills they will need to engage confidently and effectively in all aspects of life in a data driven society.

The other main challenge is how to create and sustain the additional teaching workforce that will be required to serve the significant increase in mathematics teaching.

We need to create more routes into science and other STEM careers alongside developing the technical skills that employers are crying out for. Maths must therefore be 'baked in' to our technical education and training system as well. A study by the Gatsby Foundation highlighted how other education systems support young people entering technical training post-education to have stronger mathematical skills through recognising different aims and purposes for mathematics. These skills were seen to improve during technical training.

Confidence in mathematics broadly defined, including statistics and data literacy, is essential if we want our economy to thrive. We need to provide a mathematical education that better prepares young people for their futures,

whether for jobs in sectors being transformed by digital and data-based technologies or to be equipped as citizens to play active roles in wider society.

In nations where the *expectation* is that students study maths in some form to 18, there is an acceptance that it is perfectly normal to take the subject to this level, in the same way that in the current system, compulsory maths and English to 16 are not seen as controversial in England. The obvious benefit is that students in those countries where it is either compulsory or the accepted norm, do not have to make a difficult choice to discard maths, or any other subject for that matter, at age 16.

1. What is the essential content that should be taught as part of 16-18 Maths?

The [Review of Maths 16-18](#) ... suggested that it is not simply the suitability of the curriculum offering alone that has led to lower uptake of mathematics post-16 in comparison to other nations, but there was a strong national cultural dimension in play. This can be characterised by the frequently quoted observation that it is culturally acceptable for individuals to confess that they 'can't do maths', whereas this would less readily be admitted for literacy. Gender has a heavy influence on mathematics participation, amplifying some of these deeply held cultural attitudes towards mathematics. While much good work has been done to tackle gender issues, the situation remains that in 2022, despite performing equally well at GCSE, only 37% of A-level mathematics candidates were female.

All school leavers should have a broad experience of mathematical and data literacy, including computing, since these are increasingly important for their future employment and for participation as engaged citizens. Most will continue to actively study maths up to 18 and some will continue with advanced mathematics leading to further academic studies.

... a comprehensive plan to support the *significantly* greater take up of Core Maths qualifications would be an important first step towards achieving a goal of maths for all to 18.

Many of the recommendations from the [review](#) ... in 2017 remain valid, since the situation it describes has changed little. The most relevant recommendations and an update on progress against them are set out below.

Recommendations from the [review of post-16 mathematics, published July 2017](#)

Recommendation 1: The Department for Education should seek to ensure that schools and colleges are able to offer all students on academic routes and

potentially students on other level 3 programmes access to a Core Maths qualification.

Progress: In 2022 less than one third of schools and colleges with sixth forms had candidates taking core maths qualifications. More than half of these schools and colleges entered ten candidates or fewer and geographically, provision is unevenly spread.

Recommendation 2: The Department for Education and Ofqual should consider how the core maths brand could be strengthened with the aim of improving awareness and take-up of the qualification.

Progress: The Royal Society reiterated this call for support for core maths in a [joint statement](#) with the British Academy in January 2022. However, take up remains low at c.12300 candidates in 2022. Grades for core maths are not reported by Ofqual with GCSE and A level results.

Recommendation 3: The Institute for Apprenticeships should work with the Royal Society Advisory Committee on Mathematics Education to ensure appropriate expert advice is available to the panels of professionals developing technical routes.

Progress: The RS ACME post-16 expert group has since developed a set of [general mathematical competencies](#) that can be applied to a range of technical routes, but are currently not widely used.

Recommendation 5: In view of the low GCSE success rates and new GCSE requirements, the Department for Education should review its 16-18 re-sit policy with the aim that a greater proportion of students without a grade C or equivalent attain appropriate mathematical understanding by age 18. Specifically, there should be fresh consideration of appropriate curricula and qualifications for these students and the extent to which current policy incentivises these to be offered.

Progress: RS ACME has proposed a [framework for qualifications](#) to support the challenge of developing suitable alternatives to GCSE resits, including consideration of a modular approach.

Recommendation 9: The Department for Education should continue to fund a central core maths programme until the qualification becomes embedded and enhance this to upskill large numbers of teachers of other quantitative subjects to teach core maths.

Progress: There is significant 'churn' in the schools and colleges offering core maths from year-to-year, partly because of their reliance on a limited number of suitably trained staff.

Recommendation 14: The Department for Education should seek to improve the evidence base on the role and effectiveness of technology in the teaching of 16-18 mathematics.

Progress: The RS ACME Mathematical Futures Programme has conducted research into this area, across all age groups, and recommends greater adoption ([see p 14](#)).

Recommendation 18: The (then) Department for Education and the Department for Business, Energy & Industrial Strategy should commission a study into the long-term implications of the rise of data science as an academic and professional field, looking at skills required for the future and the specific implications for education and training in mathematics and quantitative skills.

Progress: RS ACME Mathematical Futures Programme has found evidence supporting greater emphasis on understanding data science, statistics and computing alongside, and intersecting with, elements of the existing maths curriculum. This should be across a young person's entire school education.

Many of the most relevant Recommendations from the 2017 Review refer to **core maths**, the content of which is widely recognised as [valuable and practical](#). Significantly higher take up of core maths among the 150 000+ students who study A levels but do not choose subjects with a quantitative element would be a very positive step towards the goal of maths for all to 18. This requires significant investment and appropriate incentives.

2. What knowledge do young people need to manage their own finances?

It is increasingly important to empower young people by strengthening their numeracy skills so that they understand how to manage their finances, so they can budget, save or where necessary, challenge false claims when making purchases, large or small. The risks to individuals who lack knowledge are heightened by the move away from cash to 'virtual money', where quantities are far less tangible.

The need to be numerate is not however limited to financial matters, but in an age of misinformation, an informed democratic citizenry needs to be data literate too, so they are better placed make informed decisions around policy issues relevant to their day-to-day decision making.

The charity National Numeracy have identified the [essentials required for adult numeracy](#). These include many references to personal finance and to which are relevant in answer to this question.

To manage their finances, young people need a level of numeracy suited to the complexity of the task but also an age-appropriate awareness of how to apply numeracy 'tools' to a problem involving money.

Examples of specific knowledge to be acquired by school-leaving age to support effective management of personal finances would include:

- understanding tax calculations and how the government spends money from taxation
- understanding discounts and rates of interest when shopping/saving
- understanding inflation
- understanding exchange rates
- knowing what to do with gifted or inherited money, property etc
- understanding risk – eg related to betting/investment

23 April 2026