

Editorial

For centuries, mathematics has been described as the queen of the sciences. Yet contemporary educational discourse increasingly treats mathematics as something rather different: a servant of science, engineering, technology, finance and, more recently, artificial intelligence (AI). Last issue's Think Education piece, *Let's Talk About Generative AI*, eloquently highlighted the challenges facing the sector, and indeed how technologies have disrupted the status quo in the past.

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Discussions within the media or within education settings often state that students need mathematics because employers demand it. For example, society needs more engineers, AI requires quantitative skills, economic productivity depends upon STEM graduates. All these statements are true, but they are also incomplete.

The question facing mathematics education today is not simply what mathematics can do for society. It is what mathematics can do for the human mind.

Recent debates surrounding the Curriculum and Assessment Review in England, together with Hannah Fry's proposal for two mathematics GCSEs, provide a timely opportunity to revisit this question. The Review has sought to explore how curriculum and assessment can become more inclusive while maintaining high standards and preparing young people for a changing society [1]. This raises a deeper issue: What do we believe mathematics education is for?

Hannah Fry and the two-GCSE proposal

This question underpins Hannah Fry's recent proposal to split GCSE Mathematics into two separate qualifications.

Giving evidence to the House of Lords Numeracy for Life Committee, Fry argued that the current qualification attempts to do too many things simultaneously. It seeks both to provide essential numeracy for all students and to prepare the next generation of mathematicians. She suggested a model analogous to English language and English literature, with one qualification focused on numeracy and data skills and another focused on more advanced mathematical thinking [2].

There is undoubtedly a strong case for greater emphasis on statistical reasoning, risk, data interpretation and quantitative literacy. These skills are essential for democratic participation and economic life.

However, there are reasons for caution. Mathematics has traditionally served as a common intellectual language. Early separation of students into different mathematical pathways risks reinforcing existing gender and other inequalities. More fundamentally, the debate exposes a tension that runs throughout mathematics education. Should mathematics primarily serve practical needs, or should it cultivate mathematical ways of thinking?

A healthy education system must surely do both. Yet current policy discussions often focus overwhelmingly on utility. The risk is that we begin to value mathematics only for what it contributes to other subjects. In doing so, we lose sight of the nature of mathematics itself.

One reason many students abandon mathematics after A-levels is that they rarely encounter its true nature. School mathematics often presents the subject as a finished product. Definitions are provided, algorithms are demonstrated and questions have predetermined answers. Professional mathematics looks very different. In *A Mathematician's Apology*, G.H. Hardy wrote 'A mathematician, like a painter or a poet, is a maker of patterns' [3, p. 24]. This description is striking because it places mathematics alongside artistic creation rather than mechanical calculation.

Mathematicians in research ask questions, formulate conjectures, recognise patterns and construct explanations. William Thurston similarly argued that mathematics should be understood as a human activity rather than simply a collection of formal results [4]. Yet many students complete school believing that mathematics is neither creative nor imaginative. This is perhaps one of the great failures of mathematics education. The problem is not mathematics itself; mathematics is taught as if creativity were an optional extra rather than its central feature.

Another factor to consider is the recent closures of mathematics courses in higher education, with 34% of mathematical sciences offerings at low-tariff providers discontinued, compared with just 4% across the rest of the sector in 2025 [5]. These universities often serve an important purpose, giving access to higher education through non-traditional routes, and so these closures are putting the inclusivity of the subject at risk.

The power of mathematical thinking

The arrival of increasingly powerful AI systems has sharpened the debate. If a student can obtain an instant solution to an equation, generate a proof outline or receive a worked example from an AI assistant, what remains uniquely valuable about learning mathematics?

One response is that mathematics has never been primarily about arriving at single answers. George Pólya and many others argued that the aim of mathematical education is to develop the ability to think [6]. Mathematical activity involves experimenting, testing ideas, finding patterns, conjecturing and solving problems. Mathematics is not a body of facts to be memorised; it helps us to understand the world around us by developing habits of the mind.

Mathematics teaches abstraction. It teaches us to look beyond surface appearances and identify underlying structures. Henri Poincaré famously described mathematics as 'the art of giving the same name to different things' [7, p. 34]. The mathematician's intuition is to ask: what is the common structure behind these apparently different situations?

Mathematics teaches logical reasoning. In a world increasingly populated by persuasive algorithms, misinformation and synthetic content, the ability to distinguish evidence from assertion becomes essential. It teaches precision and rigour, with professional mathematicians trained to detect ambiguity, question assumptions and identify hidden weaknesses in arguments.

Mathematics teaches resilience. Every mathematician knows the experience of failure, confusion and intellectual struggle. Much mathematical work involves becoming stuck and remaining productive despite uncertainty.

Perhaps most importantly, mathematics cultivates the habit of asking: How do we know that something is true? This may become one of the most important intellectual skills of the AI era. The true value of mathematics education therefore lies not merely in producing future users of mathematics, but in developing individuals capable of independent judgement.

Returning mathematics to the throne

Mathematics has historically enjoyed a particularly close relationship with philosophy. For much of human history, the two subjects were inseparable. The ancient Greeks saw mathematics not simply as a practical tool but as a means of cultivating reason and understanding the underlying order of the world. According to popular legend, Plato had the inscription ‘Let no one ignorant of geometry enter here’ above the entrance to his Academy. Mathematics was regarded as preparation for philosophical thought because it trained the mind to reason carefully, distinguish truth from opinion and seek universal principles behind examples.

In this sense, mathematics is not merely about numbers. It is about learning how to think. Both mathematicians and philosophers share a distinctive intellectual disposition. They ask: What assumptions are being made? Why should this be true? Does the conclusion really follow? Can a counterexample be found? What lies beneath surface appearances?

At a time when information is abundant and AI can generate convincing answers within seconds, these habits become more important than ever. The challenge facing future generations may not be obtaining knowledge but judging its reliability, coherence and truth. Mathematics and philosophy together cultivate precisely these capacities.

Perhaps this is one reason why some of the greatest mathematicians have also been profound philosophers. Bertrand Russell,

who contributed to both mathematical logic and philosophy, argued that mathematics possesses not only truth but also a form of beauty. Gödel’s work demonstrated that mathematics raises deep philosophical questions about knowledge and certainty. The boundary between mathematics and philosophy has always been more porous than modern educational structures sometimes suggest.

This is why mathematics should remain the queen of the sciences. The future of mathematics education should not be defined solely by economic productivity, technological change or labour market demands. These matter, but they are not enough. If we reduce mathematics to a service subject, we risk reducing education itself to training.

The true purpose of mathematics education is far more ambitious. It is to cultivate people capable of recognising truth, understanding structure, questioning assumptions and imagining possibilities that do not yet exist.

In the age of artificial intelligence, that mission has never been more important. It is the duty of the mathematical community to face these challenges and promote the benefits of mathematics beyond a service to the sciences, not only in our communities but in the minds of the public.

Matt Tranter CMath FIMA and Zuzana Hucki FIMA
Nottingham Trent University

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