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Addressing workplace skills needs in Scotland through reform of mathematical and data education

Summary of roundtable held in Glasgow on 18 June 2025

Our thanks to all participants who attended the Royal Society and Royal Society of Edinburgh's roundtable on how mathematical and data education must change to meet the shifting needs of the Scottish industrial landscape. This event was not aimed at education experts, but rather representatives from industry who could speak to the changing skills requirements in their respective sectors.

The discussion took place under Chatham House rule, so the comments summarised below will not be attributed. They reflect the views and opinions of attendees and not necessarily those of the Royal Society or the Royal Society of Edinburgh. We would also like to thank the individuals who were unable to join us on the day but participated in the creation of this document.

Background

The Royal Society of Edinburgh's *Education and skills 2050*[1] proposal, published in September 2024, articulated a vision for Scottish education that delivers economic development, meets climate ambitions, and promotes human dignity. This vision challenges parliamentarians, government, employers, the teaching profession, school leaders, parents, carers, learners, and society at large to ask fundamental questions about what is wanted and needed from a modern Scottish education system in the next decades to inform profound, long-lasting change. One key learning from the work of the Royal Society of Edinburgh's education committee, reflected in the document, relates to the importance of parity of esteem in the skills system, including enhancing societal recognition of the different educational pathways available for learners at all ages. This is critically important as Scotland is in the process of major educational reform, and the school curriculum for mathematics is currently under review.

In September 2024, the Royal Society launched a major new report[2] that makes the case for a new approach to mathematical and data education, in which the scope of mathematical education needs to change from 'mathematics' to a combination of mathematics, statistics and data science, underpinned by the use of computational tools and technologies. The report offers recommendations for system reform which will provide a better mathematical education for everyone, from the everyday needs of citizens to the brilliant academic mathematicians of the future. It proposes a greater focus on using and applying mathematical concepts and digital tools to solve real-world quantitative problems – from making sense of finances, to understanding statistics in the media and recognising misinformation. Alongside all this is awareness that developments in AI are likely to have important consequences for education, and mathematics education in particular, and that these need urgent consideration.

1. The Royal Society of Edinburgh, 2024, Education and skills 2050: Future proofing Scotland. See https://rse.org.uk/programme/advice-paper/education-and-skills-2050-future-proofing-scotland/ (accessed 4 August 2025).
2. The Royal Society, 2024, A new approach to mathematical and data education. See https://royalsociety.org/news-resources/projects/mathematical-futures/ (accessed 4th August 2025).

All citizens need foundational mathematics skills and general quantitative literacy for their daily lives. Individuals in vocational and technical roles often need domain-specific competences particular to those occupations, while roles traditionally seen as non-quantitative now require increased mathematical and data skills. At the same time, the demand for employees with advanced levels of mathematical and data skills is already high and is certain to increase substantially.

This roundtable brought together a select group of representatives from Scottish industry to gather their views on the needs of a wide range of industry sectors. Participants were asked to reflect upon the following questions in advance of the discussion:

1. Would a greater emphasis on everyday maths and data skills in the education system be of benefit to the future workforce?

2. What are the current and projected needs for a mathematically and data literate workforce in your industry?

3. What workplace provision currently exists to address any skills gaps? To what extent would mathematical and data education remove the need for remedial workplace training provision?

4. To what extent would you agree that the maths taught in school is less important, in a workplace context, than leaving school with the ability to solve problems, be persistent, think critically, and learn new skills?

5. What would you like to see included in a mathematical and data curriculum?

6. Do you think greater links between schools and industry would be of mutual benefit? If so, how?

7. How can industry help to make the voice for change stronger? How should we be connected across government departments?

8. Do you feel confident that existing qualifications are reliable in demonstrating to you what a young person's skills are?

9. Are qualifications more useful to you in demonstrating someone's cognitive potential and ability to persist to high standards, than as a demonstration of the exact skills required for a job?

The value of mathematical and data education in Scotland

There was a clear recognition amongst participants that Scotland's two most prominent policy priorities are addressing poverty and the climate emergency, and that mathematical and data skills are at the heart of both. Though the government has established a series of sustainability targets[3], its ability to meet these is limited by the availability of a suitably skilled workforce. One participant estimated that almost every new home in Scotland will need to be rebuilt by 2045 due to failure to meet the energy performance standards of the Sustainable Housing Strategy[4]. This effectively means that due to inefficiencies that better modelling could prevent, one home is effectively "thrown away" for every ten Scottish homes built. Another participant, who was a civil engineer, echoed these sentiments in their explanation that there are a variety of different dashboards that are integral to engineering work, but that the inability to gauge whether they are right, or to understand what information they are displaying, has the potential to trigger severe consequences including safety threats and potential bankruptcy.

It was also agreed that improved quantitative literacy would unlock progress by facilitating social mobility and public engagement in critical debates. Without quantitative literacy, Scotland's changing socioeconomic challenges, and the solutions proposed by policymakers, can neither be appropriately understood nor appropriately critiqued. The aim of mathematical and data education, as one participant said, is "to ensure that everyone has the confidence and capacity to engage with the modern world – to ask questions, analyse information, and take part in shaping society".

Mathematics and data in context: ethical reasoning

Participants argued that for this level of public engagement to be possible, mathematical and data education must be better contextualised in schools. Mathematics taught without connection to social context offers insufficient preparation for employment or for active participation in society. One participant from the field of AI even stated that they would hire a social science graduate over a graduate from a technological degree for this reason. They felt that they could teach a social science graduate the technical skills required for the role "on the job", confident in the knowledge that they already understood the wider sociopolitical contexts in which AI operates. A mathematics or data graduate, on the other hand, was considered less likely to have the same appreciation for social context. Compared with technical skills, the ability to appreciate the place of AI in society, including the ethical responsibilities of the data scientist, cannot be comprehensively taught in the workplace.

This fed into a wider agreement that ethical reasoning should be an obligatory component in mathematical and data education. One participant explained that it is essential for AI "makers and users" to understand ethics, otherwise "we risk misaligning technology with societal values". It was pointed out that ethics are a central and consistent component of a medical degree in reflection of a medical practitioner's capacity to harm. Decisions made by data scientists can carry equally significant social consequences, even if unintentionally, and yet ethical reasoning is absent from almost all mathematical and data courses at both school and university.

3. The Scottish Government, 2025, New climate targets set. See https://www.gov.scot/news/new-climate-targets-set/ (accessed 4th August 2025).
4. The Scottish Government, 2013, Scotland's Sustainable Housing Strategy. See https://www.gov.scot/publications/scotlands-sustainable-housing-strategy/ (accessed 4th August 2025).

Cross-curricular mathematics and data

Teaching mathematics and data 'in context' would require what participants called a 'rebranding exercise' to solidify their status as inherently interdisciplinary skills that are essential across the curriculum. While cross-curricular interaction is a longstanding principle in Scottish education (numeracy, literacy and health and wellbeing are recognised as shared responsibilities by teachers in its Curriculum for Excellence) it was pointed out that this strategy can result in a blurring of accountability.

Participants agreed that grounding mathematics in real-world scenarios and connecting it to other subject curricula would help change a culture in which it is seen as binary (you are either "good" or "bad" at maths) and disconnected from real life. This argument was reinforced by a participant with experience in computing education who highlighted that, while computing is often considered the domain of a male-dominated minority, when it is combined with other disciplines like climate science, this dynamic shifts and we see strong engagement across the genders.

Curriculum and assessment

It was therefore concluded that changing the culture around mathematics and data will require reform to outdated frameworks which currently leave students underprepared for qualification demands.

One participant proposed that we redefine the notion of mathematical success by promoting the notion of "mathematical fitness". He argued that, just as we accept that physical fitness varies by job role, mathematics education must generate a culture in which being mathematically fit for a job or for everyday life is a valid goal. This was reinforced by other participants, who agreed that the preconception that one is either mathematically inclined or not is a root cause of confidence issues and gender inequalities in the maths classroom.

Another participant highlighted that curriculum and assessment must provide a better introduction to the mathematical ideas that students will encounter later in their lives. He argued that if we introduce some familiarity with these concepts into the school syllabus, at even a rudimentary level, they will appear far less strange when encountered again later. For example, some familiarity with the fact that not all geometry is Euclidean could be imparted to pupils if they are asked to draw triangles on inflated balloons, or to work out that the sum of angles of a triangle is not always 180 degrees. It will then not seem strange when they encounter non-Euclidean geometry in computer graphics or when analysing data clustering. This could be supplemented by, for instance, an introduction to 'big data' and neural networks, as well as school visits to aerospace and technology companies.

Pathways

Another proposed solution to the inadequacy of the existing curriculum was to launch appropriate technical skills courses designed to teach the content required for particular careers. This would provide alternative routes for students who, not intending to go to university, drop the mathematics qualifications that are tailored towards higher education. Ensuring these qualifications are of an equivalent level to the more traditional courses would mean that applied maths (like Applications of Maths in Scotland or Core Maths in England) is valued equally alongside the qualifications already held in high esteem by universities and employers. This would open up access to mathematics by reinforcing its relevance and accommodating students of varying levels.

In addition to multiple educational pathways, participants supported the idea that lifelong learning is critical for social mobility and a responsive workforce, and is essential for building a resilient, skilled economy. They called for a greater appreciation of the necessity of reskilling, upskilling and switching disciplines at multiple stages within a career and highlighted that mathematical and data skills underpin these capabilities.

Key points

To achieve Scotland's ambitions for net-zero and data-driven economic growth, the education system needs a cohesive strategy to ensure quality, consistency and equity. This discussion indicated that such a strategy would need to include:

1. **Redefining mathematical success:** Expanding and elevating applied qualifications as credible alternatives to traditional maths routes. Offering diverse and valued pathways will shift the emphasis to ensuring appropriate content and allow for an approach that supports reaching a "mathematical fitness" for work, life, and informed citizenship alongside the provision for progression in mathematics related careers.

2. **Cross-curricular integration:** Contextualising mathematics in terms of climate change, health, economics, and AI could help to break down confidence and gender barriers and reinforce its necessity in practical terms. Using signage, vocabulary changes and lesson design to make maths visible everywhere will reiterate its role as the bedrock of most school subjects and everyday life skills.

3. **Making ethics part of the equation:** Embedding ethical reasoning into mathematics and data education will enable students to understand the social implications of their work, especially in fields like AI. This will ensure the workforce of tomorrow have the skills to grapple with the rapid changes in technology for which the current education system is ill-equipped.

4. **Empowering teachers:** If we want to encourage the recognition of maths and data skills across the curriculum, teachers will require the training and resources necessary to enable them to share responsibility without removing accountability. As one participant argued, addressing the question of an adequate supply of suitably trained mathematics teachers is as important (possibly more so) than the current review of the syllabus which Scotland's Curriculum Improvement Cycle[5] is now undertaking. We must enhance the facility for teachers to update their knowledge and competence, for instance by establishing refresher courses in applications of mathematics in computing and programming languages.

5. **Research:** Further research is needed to identify and evaluate the suitability of the existing mathematical and data education system in Scotland, especially in relation to the changing needs of industry and meeting governmental targets.

   The OECD's 2021 report on improving schools in Scotland[6] recommended that policymakers "continue building curricular capacity at various levels of the system, using research by developing the environment of curriculum design support around schools, including in supporting exchange and collaboration between practitioners for curriculum design and experimentation within and across schools; and collaboration between schools and universities" (p 13).

   Steps towards this goal have been scarce since the government's launch of the *Education Research Seminar Series* in 2022, reinforcing the necessity of investment in an education system which is increasingly inadequate in preparing young Scots for financial independence, employment and informed societal engagement.

5. Education Scotland, 2024, The Curriculum Improvement Cycle. See https://education.gov.scot/curriculum-for-excellence/about-curriculum-for-excellence/the-curriculum-improvement-cycle-cic/ (accessed 4th August 2025).

6. OECD, 2021, Scotland's Curriculum for Excellence. See https://www.oecd.org/en/publications/scotland-s-curriculum-for-excellence_bf624417-en.html (accessed 4th August 2025).

Acknowledgements

Participants attended this roundtable from the following organisations.

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The Royal Society
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