Curriculum and assessment review and reform: evolution or revolution?

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The government's Curriculum and Assessment Review

In July 2024, the government commissioned Professor Becky Francis CBE to convene and chair a panel of experts to conduct a *Curriculum and Assessment Review (CAR*).

> *The CAR Group were asked "to undertake a review of the existing national curriculum and statutory assessment system, including qualification pathways.*
>
> *"The Review will seek to refresh the curriculum to ensure it is cutting edge, fit for purpose and meeting the needs of children and young people to support their future life and work.*
>
> *"The Review will ensure that the curriculum appropriately balances ambition, excellence, relevance, flexibility and inclusivity for all our children and young people, and it will ensure meaningful, rigorous and high-value pathways for all at 16-19."*

In 2013 I had the opportunity and privilege of becoming involved with national education policy for post 16 mathematics, including A levels in Mathematics and Further Mathematics, and Core Maths. Since then, I have, in effect, also been conducting my own personal 14-19 curriculum and assessment review, albeit subconsciously, in my extensive engagement with many agencies and stakeholders, many of whom I highlighted in the June 2025 edition of Mathematical Angles. This includes many learners, teachers, lecturers, educators, and employers, as well as much review work on 14-19 reforms to mathematical and data education in the UK.

In light of this, I am sharing my own thoughts on what the current *CAR* should be recommending for: follow-on activity, more detailed review work, and consequential evolution/ reform. I am not, however, advocating for an overnight revolution! I do believe, though, that we must be much more agile and ambitious in our approach to *evolving* mathematical and data education, for the benefit of us all, than the current *system* allows for.

None of my views are based on personal preference or ideology – these are all informed by the many stakeholders I have had the benefit to learn from who have an informed understanding of their current and future needs, and those of learners, employers, business and industry, and citizens more generally. It is also critical that the needs of our world-leading research activities are very well-served, many of which are central to the advancement of mathematical sciences for discovery, innovation and the economy. Many of today's cutting-edge discoveries and innovations are driven by mathematical sciences research, including artificial intelligence, climate modelling, cryptography, data science, quantum computing, and much more.

Royal Society's report on Mathematical and Data Education

Once the final *CAR* report is published, the government should look to the outstanding Royal Society report *Mathematical and Data Education (MDE)* published in September 2024, which is the culmination of extensive research undertaken as part of their Mathematical Futures programme, to inform their priorities for mathematical and data education in the medium to long term. The report sets out several reforms necessary to develop the mass mathematical, quantitative and data skills needed for our future knowledge economy.

The President of the Royal Society Sir Adrian Smith is clear in his foreword to the report that:

> *"Reforming the education system will take time and major investment. However, if we do not start now, we risk today's young people being ill-prepared for the future, and the exacerbation of existing regional, gender and socio-economic inequalities."*

While there is much to do, the *MDE* report notes that there have been recent successes in improving mathematical education, and we must ensure that we do not lose any of this in any changes that emanate from the *CAR*. In the meantime, we must also not be reticent in making changes that are relatively straightforward to implement, some of which I mention below.

I am also confident that a future mathematical and data education that would result from the full implementation of the recommendations in the *MDE* report will embrace all the very best that we have currently, while also seizing every opportunity to learn from experiences in reforms to mathematics education in the last decade, and previously.

It is also clear to me that, in respect of mathematical and data education, if we genuinely want to ensure that the curriculum:

> *"is cutting edge, fit for purpose and meeting the needs of children and young people to support their future life and work", and*
>
> *"appropriately balances ambition, excellence, relevance, flexibility and inclusivity for all our children and young people, and it will ensure meaningful, rigorous and high-value pathways for all at 16-19",*

as stated in the Terms of Reference for the *CAR*, we must make the large-scale changes envisioned by the *MDE* report.

Current provision – A levels in Mathematics and Further Mathematics, and Core Maths

The appetite for mathematical skills is reflected in the recent growth in A-Level entries for Mathematics and Further Mathematics – 104,580 and 18,434, respectively, for 2025 in England.

No one could be more delighted than me with the increasing number of students taking A level Mathematics and Further Mathematics. It is essential for all our futures that more students pursue mathematical and data education to ever increasing higher levels to bring benefits to their further studies, careers, and for the impact it will have on business, industry, research, and addressing the global challenges we all face. A level Mathematics is at the heart of much of this.

A level Mathematics is a compulsory or preferred requirement for many university undergraduate degree programmes – and rightly so. It is also a subject that universities will look to as demonstrating high levels of achievement in problem-solving, and as a demanding discipline it is held in high esteem by many other stakeholders too, including parents, carers and supporters of school and college students.

A level Mathematics is well regarded, both as preparation for mathematically-demanding courses in higher education - mathematics, science, engineering etc, and as a course of study in its own right.

That's not to say that A level Mathematics shouldn't evolve – while fundamental advanced knowledge, understanding and skills at this level will always be needed, we need to keep pace with future needs of students, ever-increasing use of technology, reliance on and use of large quantities of data, and the needs of a global society.

Many universities welcomed the 2017 reforms to A level Mathematics and Further Mathematics, which were primarily designed to better support transition to further study of STEM subjects. Like it or not, high-stakes assessment often drives teaching and learning behaviours. Some of the issues that were evident with the pre-reformed qualifications were the variation in the nature of the assessment. The reformed A levels were designed to avoid these issues through common and compulsory detailed subject content and overarching themes to drive expected behaviours in teaching, learning and assessment for the benefit of learners, and to support their transition to further study. While the reformed A levels represent a significant improvement compared with their immediate predecessors, there remain variations in the nature of assessments, in assessment outcomes, and in the implementation and realisation of the intended outcomes for learners.

As highlighted in the *MDE* report:

> *"Mathematics, as currently taught in schools, is missing out on extensive opportunities to transform understanding and learning through use of computing technology and tools."*

In part this is due to the nature of the current A levels in Mathematics and Further Mathematics curricula and their associated high-stakes, terminal assessments.

The current A level Mathematics curriculum, and the associated assessment and guidance, has the declared intention that the Use of *Large Data Sets (LDS)* should permeate the teaching and learning of statistics, with considerable opportunities for the use of technology and associated tools for handling, interrogating and analysing data. Unfortunately, this intention has not been realised fully, or uniformly, for all learners, in part because of the nature of the assessment.

Given that the scope and application of mathematics has undergone significant expansion, partly driven by an unprecedented surge in data availability, computing capabilities, and statistical methodologies, with data playing a pivotal role in both employment and everyday life, it is vital that learners have the opportunity to use relevant tools in their mathematical education throughout their studies.

This also includes study that is not associated with data – computational and graphing tools, dynamic geometry tools, symbolic manipulation software, programming, are also important in higher level study and in business and industry.

The requirements of learners and the development of mathematics and its applications, including into areas such as data science, also evolve. Recall that the subject content for the current A levels in Mathematics and Further Mathematics was published some 11 years ago.

Further revisions to A levels in Mathematics and Further Mathematics, and their associated assessments, would offer learners the opportunity to make better use of available technologies to improve their learning, and to support their future study and careers.

Consequently, it would now be appropriate for the current A levels to be reviewed and evolved with a view to supporting learners even better for their future needs. Given their knowledge, expertise and experience with the design and implementation of the 2017 reformed A level qualifications in Mathematics and Further Mathematics, The Royal Society's Panel of Experts and Ofqual's Panel of Subject Matter Specialists for Mathematics, along with support from the Department for Education, are well-placed to be front and centre of this review and consequent evolution of these qualifications.

Core Maths was introduced by the Department for Education in England in 2014 as an additional Level 3 advanced mathematics qualification for students not taking A level Mathematics but for whom study beyond GCSE would support their transition to further study in higher education and for their future careers. Much of the *MDE* report focusses on the importance of quantitative skills throughout the curriculum. The report includes strong references to Core Maths and the importance of building on this in the future as part of a broader curriculum post 16.

The responses to the 2023 government consultation on *The Advanced British Standard (ABS)* from: The Royal Society, the Institute of Mathematics and its Applications and the London Mathematical Society, and the Mathematical Association, all included strong support for Core Maths, and what Core Maths represents with a focus on developing fluency and confidence in using and applying mathematical and statistics skills to address authentic problems, drawn from study, work and life, with a strong emphasis on contextualised problem-solving. The *ABS* proposals included much emphasis on mathematical and quantitative skills for citizens and their day to day lives, and well as in their work, which the *MDE* report addresses.

The current Core Maths Level 3 qualifications were first offered for study in schools and colleges some 11 years ago. It is essential that these continue to meet the needs of all learners with prior attainment of GCSE Mathematics ranging from grade 4 through to grade 9, and for those destined for a wide range of degree programmes in universities with mathematical or quantitative content. In common with A level

Mathematics, the requirements of learners, the development of the applications of mathematical sciences, the ever-changing nature of current real-life contexts, and the opportunities afforded by existing and emerging technologies, means that it would now also be appropriate for Core Maths to be reviewed and evolved with a view to supporting learners even better for their future study and careers. As with A levels, given their knowledge, expertise and experience with the design and implementation of Core Maths, The Royal Society's Panel of Experts and Ofqual's Panel of Subject Matter Specialists for Mathematics, along with support from the Department for Education, are also well-placed to be front and centre of this review and the consequent evolution of these qualifications.

When post 16 students were funded per qualification they were studying there was the opportunity in year 12 to choose to take AS level Mathematics, and in years 12 or 13 to take AS level Further Mathematics alongside AS level Mathematics, or to accompany a 'full' A level in Mathematics, or to take Core Maths (which is equivalent to an AS, although it is designed to be studied over the two years 12 and 13).

When the change to funding per qualification was removed and with the 'decoupling' of AS and A level, many learners were no longer offered the opportunity in their school or college to gain a qualification in AS Mathematics only, or in AS Further Mathematics only; it also made Core Maths more challenging for schools and colleges to the offer as they resorted to a '3 A level' model for post 16 students on an A level programme.

Reintroducing the study of 4 AS levels or their equivalent as the 'norm' would be of benefit to all learners for whom mathematical study is of interest or highly desirable. I also believe it is worth considering including an element of assessment from year 12/AS Mathematics which contributes to the overall assessment for A level Mathematics. Take the study of mechanics, for example, which represents around one sixth of the subject content. Students study this for two years and are then presented with some excellent questions which assess this. However, they only have a meagre one hour in total at the end of those two years of study to demonstrate what they know and can do in this topic, and to do themselves justice. This certainly does not do justice to the importance of the subject content. Full implementation of the MDE report would secure the much-needed broader curriculum, qualification pathways and associated assessment that learners and society will need in the coming years.

During the 14 years prior to the announcement of the *CAR*, successive governments have been committed to significantly increasing the proportion of post 16 learners studying some form of mathematics which is relevant to them. The current government simply must continue to support this mission. To not do so would be a dereliction of their duty to secure the future prosperity of the UK.

Equally, if the *CAR* does not make any recommendations for a review of A levels in Mathematics and Further Mathematics, and Core Maths, then we must assume that they remain:

> *"cutting edge, fit for purpose and meeting the needs of children and young people to support their future life and work",*

and if that is the case, when will they be reviewed again – another 5 or 10 years hence? That seems unimaginable to me!

Current provision – GCSE Mathematics

Reforms to GCSE Mathematics in 2015 have driven up standards for many students. But as these have now been in place for 10 years the qualifications and associated curriculum are in need of review and reform.

The 11-16 curriculum, GCSE Mathematics and its assessment, serves quite well students who attain grades at the upper range of the grades 1-9 and who go on to study A level Mathematics. It is less clear that this curriculum and assessment serves as well mid to lower attaining students.

The 11-16 national curriculum and GCSE Mathematics do not include much emphasis on data education, which is in stark contrast to the need for this which is identified in the *MDE* report.

The *CAR* offers the much-needed opportunity to consider all available evidence on the current 11-16 mathematics curriculum, and GCSE

Mathematics and its assessment, with a view to reforming this to serve all learners better in the coming years, and to fully address the observation in the *MDE* report that:

> *"Modern data and computational concepts and tools are largely absent from mathematical education as it is currently practised, while problem solving and application of mathematical learning in meaningful contexts are not given high priority."*

which is at odds with the current and future needs of learners, and the workforce.

A broader curriculum and additional qualification pathways for mathematical and data education to incorporate the *equivalent* of two GCSEs should be considered. For example, one could focus on more traditional 'pure' mathematics and the other could focus on 'applications' and include aspects of data education. Both qualifications would be available to all students. Equally, it is imperative that, like with A levels in Mathematics and Further Mathematics, and Core Maths, use of relevant technologies should be integral to 11-16 mathematical and data education.

Such reforms would also allow for much better transition to the current Level 3 advanced mathematics qualifications – A levels in Mathematics and Further Mathematics, and Core Maths. This would also allow learners to study a broader range of mathematics and its applications providing them with pathways to suit their interests and career paths, including those interested in data science. These reforms could include a modular structure where students take enough modules to gain credit for the *equivalent* of either one or two GCSEs. The principle of having two GCSEs has been developed and trialled in the recent past through the linked pair pilot that some readers will be familiar with.

Last, on the current assessment of GCSE Mathematics qualifications – these are not " criterion-referenced" which is problematic as the *MDE* report identifies:

> *"That GCSE Mathematics is not criterion-referenced is also unhelpful for learners and other stakeholders. In practice, those attaining the highest grades demonstrate that they have mastered the majority of the curriculum, whilst those with the lowest grades have mastered very little of it. For those with the middling 'good grades' that are considered key to entering university and many professional and vocational roles, GCSE provides little information about what those learners can and cannot do."*

I am hopeful that the *CAR* will have something concrete to recommend in respect of GCSE Mathematics, although I doubt it will be anywhere near what I hope for, and is needed.

And finally

We have so much to celebrate in our mathematics education in the UK, including all the fantastic practitioners who we ask to provide this education through their teaching, support, and assessment of learners, and those who support them through professional development activities.

But we should not be shy of looking to the future and to act, as the Royal Society's *MDE* report and their President, Sir Adrian Smith urges us to. I share Adrian's vision and passion on this in equal measures.

As the work of The Royal Society, it's Advisory Committee on Mathematics Education (RS ACME), and ACME's Expert Panels, moves forward on *MDE*, our practitioners need to be included in this, and in the work which will be needed to shape and develop the future of mathematical and data education. This includes many of you who are members of the MA, and who, along with members of AMET, ATM, NAMA, NANAMIC, will come together as a new, unified organisation in AMiE (Association for Mathematics in Education). AMiE's wide membership will have many years of experience, and much expertise, to draw upon. Therefore I will be urging AMiE and its members to lend their support to this important work.

> *"The longer you can look back, the farther you can look forward." Winston Churchill, 1944.*