MEI response to Professor Sir Adrian Smith’s Post-16 Mathematics Review

Charlie Stripp, MEI’s Chief Executive, has met with Adrian Smith to discuss his review, and MEI has separately submitted data relating to uptake of the mathematics A levels and the work of the Further Mathematics Support Programme.

1. What is your view of the post-16 maths pathways/qualifications currently available to students?

- AS and A level Mathematics offer a suitable pathway for students who have succeeded at GCSE Mathematics. They support progression to higher education and employment in a wide variety of fields and are vital for students who are interested in STEM subjects or other disciplines that make significant use of mathematics, such as economics. AS and A level Further Mathematics provide an excellent preparation for students intending to pursue a highly mathematical programme in higher education. AS/A level Mathematics and Further Mathematics qualifications are highly valued by universities and employers.

- Core Maths offers a suitable alternative pathway for those who have succeeded at GCSE but for whom AS/A level Mathematics is not suitable. Core Maths allows such students to build on the mathematics they learnt at GCSE level to develop mathematical skills valuable for life and work, and for study in less mathematical fields. The newness of the Core Maths qualifications means they have not yet established currency with universities and employers.

- The International Baccalaureate programme, which is available to some students, also offers suitable pathways for all students who have passed GCSE Mathematics.

- Some students study mathematics units as part of BTEC qualifications and these may contain some aspects AS/A level Mathematics content, particularly calculus, which are not included in Core Maths. It is not clear to us whether the mathematics embedded within these qualifications provides an effective preparation for higher level study.

- Students who have not obtained a level 2 pass at GCSE are not well served by the GCSE retake option. It may be suitable for some of those who have narrowly missed a level 2 pass, but for most students it merely reinforces their negative feelings in relation to mathematics and does little or nothing to enable them to use mathematics effectively in their future life, work and study. A ‘mature’ GCSE, specifically designed for post-16 students, would provide a more suitable pathway.
2. What can be done to get more students choosing maths post-16?

- We need to overcome the widespread view that ‘maths is hard’, and/or is only important to nerds. This requires a cultural change and will take time. Teachers at all levels of education and across all subjects need to project a positive view of mathematics and promote a ‘growth mindset’ attitude to learning it.

- The importance of mathematical skills and the opportunities available to those well-qualified in mathematics should be promoted to young people in a positive way throughout their education.

- Higher education and employers must make it clear that they really value higher level mathematics qualifications, beyond GCSE level.

- Many schools impose high entry requirements for students to progress to the mathematics A levels, often asking for A grade GCSE Mathematics for progression to AS/A level Mathematics and A* for progression to AS/A level Further Mathematics. The linearisation of A levels has the potential to make this problem worse, as does the new GCSE, with its 9 point grading scale. It should be the norm that a student with a good pass in GCSE Mathematics (grade 5+ on the new higher tier) would be considered eligible to begin AS Mathematics/Further Mathematics and schools and colleges should recognise all pass grades in AS/A level Mathematics as successes, not just the higher grades. Other subjects routinely admit any student with a level 2 pass at GCSE onto their A level programmes and mathematics should not be different, particularly now that the demand of the new GCSE Mathematics has been explicitly increased, whereas the new mathematics A levels are intended to be at the same level of demand as the current ones.

- School accountability measures should include a measure of the proportions of students that progress to AS/A level Mathematics and Further Mathematics, and to Core Maths.

- Core Maths early adopters, supported through the Core Maths Support Programme (CMSP), have worked hard to introduce the new qualifications with their students; their success stories should be widely shared in order to encourage more schools and colleges to offer Core Maths and more students to take it.

3. What are the main challenges to increasing provision of post-16 mathematics in schools and colleges? How can these be addressed?

The main challenges are funding and staffing.

- If increasing numbers taking mathematics post-16 is a national priority, then funding needs to be allocated specifically to that purpose. It is senseless to try to increase uptake in a climate where there are schools and colleges which have students who want to take mathematics and teachers who want to teach it, but lack of funding prevents the course from being offered. This is a serious threat to both Further Mathematics and Core Maths, and it is already happening.
• The increase in uptake of AS/A level Mathematics and Further Mathematics over the past decade is a tremendous success story, in which the Further Mathematics Support Programme (FMSP) has played a significant role. These qualifications should have special status to ensure that the current changes to qualification structure and funding do not result in reductions in uptake, which could undo years of progress. The introduction of Core Maths is a very positive development that could easily fail if it is not adequately funded. AS qualifications in Mathematics and Further Mathematics should be recognised as important qualifications in their own right and uptake should be strongly encouraged – they should have a different status to AS qualifications in other subjects. **Students studying for mathematics qualifications at beyond GCSE level should attract enhanced funding to their school or college.**

• The shortage of specialist mathematics teachers nationally has been an issue for many years. Retaining and upskilling existing teachers to teach the mathematics A levels and Core Maths is part of the solution. High quality programmes are needed – MEI’s ‘Teaching Advanced Mathematics’ (TAM), ‘Teaching Further Mathematics’ (TFM) [both offered through the FMSP] and ‘Teaching GCSE Mathematics’ (TGM) programmes show what can be done – and incentives are needed for schools and colleges to allow teachers to take these programmes, and for teachers to choose to enrol on them.

• MEI has pioneered the use of online professional development for teachers of mathematics, often employing blended online and face-to-face programmes. These approaches have proved effective and, because online sessions can take place outside of timetabled teaching time and without the need for travel, they save significantly on costs.

• Existing teachers of other numerate disciplines, such as the sciences, psychology and economics, should be encouraged to train to teach Core Maths as part of their teaching role. Core Maths teaching could also form part of teacher training for teachers of such subjects.

4. What more can be done to improve student achievement in post-16 maths where it’s offered? (of all kinds)

• There is a useful summary of the research into the effectiveness of various strategies for teaching students aged 5 to 16 at [https://educationendowmentfoundation.org.uk/evidence/teaching-learning-toolkit](https://educationendowmentfoundation.org.uk/evidence/teaching-learning-toolkit)

It would be useful to have a summary of effective practices for teaching mathematics post-16. The ETF has reported on effective practices in teaching post-16 vocational mathematics; this work could be extended to other pathways.

• Professional development of teachers is key to improving student achievement.

• It would be useful to investigate whether there is any international evidence about this.
5. How strong is the case for all students continuing to study maths post-16? How feasible is this in the medium and long term?

- It is important that young people are able to use mathematics effectively in their adult lives. There is a broad consensus that this supports both individual and national economic success. However, it does not follow that compelling all students to take mathematics post-16 will result in improvements in their ability to use mathematics. Attitudes to mathematics must be addressed, as discussed in question 2. Evidence from those currently being required to re-sit GCSE Mathematics suggests that compulsion could be counter-productive, particularly if there is a lack of effective provision in schools and colleges. Ideally, all students would choose to study mathematics to age 18 because they would see that it is to their advantage to do so. This means they should have an entitlement to do so, and our education system must have the capacity to offer it.

- Many other countries either make mathematics compulsory to age 18, or have very high levels of participation, so it is clearly feasible for us to do this in the longer term. It is inevitable that the transition will be difficult and serious investment will be needed to increase the capacity of schools and colleges to provide good mathematics teaching to all students post-16.

- A Baccalaureate system that required students to choose a spread of subjects, including from an appropriate range of mathematics options, could be an effective way to increase participation. This would make taking mathematics the norm for everyone, which would be less likely to provoke resentment from students.

6. What potential is there for different delivery teaching models in post-16 mathematics?

- The FMSP has already developed different delivery models for teaching AS/A level Further Mathematics taking advantage of online technology. There is scope for exploring different models for AS/A level Mathematics, Core Maths and level 2 mathematics courses, but the types of delivery which are suitable will depend on both the nature of the mathematics being taught and on the students.

- Given that effective maths teachers are a scarce resource, using technology to extend the reach of such teachers should be explored seriously. The FMSP’s experience suggests that technology can widen access to mathematics teaching, but 16 – 18 year olds need considerable face-to-face support alongside use of technology.

- Incorporating aspects of Core Maths into the teaching of other subjects, particularly social sciences.
7. What more could be done to improve mathematics teaching capacity and professional support for post-16 maths teachers?

Our answers to questions 3 and 6 are relevant here. The following points should also be considered.

- Schools/colleges are increasingly reluctant to release teachers for professional development. Maths teachers should have an entitlement to take part in high quality, accredited professional development and this should be properly funded.

- Reliable data on qualifications and experience of all those teaching mathematics are needed, so that suitable, funded, professional development can be made available.

- Improving mathematics teachers’ pay and conditions would help to attract people to become mathematics teachers and to retain mathematics teachers in the classroom.

- Further professional development is needed to ensure mathematics teachers in 11-16 schools do not see GCSE Mathematics as the ceiling and are able to inspire their students to study mathematics post-16. The FMSP offers such programmes and they are highly appreciated by teachers.

8. Any other comments

- The work of the Further Mathematics Support Programme, the Core Maths Support Programme, the National Centre for Excellence in the Teaching of Mathematics and the Maths Hubs already makes very a valuable contribution to support increased participation in mathematics education post-16. They are coordinating their efforts to ensure they work together effectively. These programmes should continue and be expanded.

- Post-16 mathematics education would benefit considerably from closer cooperation and coordination between DfE and BiS.