

14- 19 Education and Skills

A response from the Association of Teachers of Mathematics, the Mathematical Association and the National Association for Numeracy and Mathematics in Colleges

Introduction and executive summary

We welcome this White Paper as another initiative that underlines the importance that the government attaches to mathematics. We are delighted that the White Paper designates mathematics as a core subject for this important group of students.

We fully support the continued commitment to the on-going implementation of the Smith report and in particular, the establishment of a new National Centre of Excellence in Mathematics Teaching. We look forward to the enrichment, support and training available to teachers of mathematics that will ensue.

The White Paper seeks the views of all involved with the education of this group of students. On behalf of the professional bodies that represent the teachers of this group we wish to comment on some of the important issues that are raised in the paper.

In particular we wish to raise the following concerns:

- **functional mathematics** - whilst supporting the emerging definition of this concept as a means of helping young people become 'mathematically literate' rather than a focus on a minimal set of skills, it is still unclear how 'functional mathematics' can be separated from mathematics as a whole;
- **providing greater stretch and challenge** - the mathematical community is united in the view that the best way to stimulate and stretch young mathematicians is through enrichment, enabling them to develop a deeper understanding of basic mathematics, before they progress to more advanced ideas. In particular, we strongly endorse recommendation 4.5 of Smith;
- **pathways for 14-19 mathematics** - work is currently underway in this area. We believe that the outcomes must be opportunities tailored to meeting the specific needs of teaching and learning mathematics;
- **assessment** - it is unclear how the burden of assessment is to be reduced despite the overwhelming evidence of the damage to mathematical education that results;

We would be happy to discuss these concerns with you and your colleagues (together with the supporting detail that follow) so that the aspirations of the White Paper can be realised as an effective and coherent policy supported and welcomed by the teachers who will deliver it. We look forward to that opportunity.

Functional mathematics

We agree with the overall direction and aims for this critical concept developed at the QCA/ACME workshop held in March. We would like to add some additional comments.

If a functional mathematics course concentrates on the ability to carry out calculations, then the higher-order skills associated with mathematical literacy will remain beyond the grasp of many young people. In order to be able to use and apply mathematical knowledge and skills and be 'mathematically literate', young people need to have confidence in their own ability. This confidence does not develop automatically. Teachers have to pay attention to it, by finding ways of capturing the interest of their students and hence motivating them to work on the knowledge and skills that are to be taught. In brief, it is *how* students are taught mathematics rather than *what* they are taught that is the key to helping young people develop into adults who are confident about and competent at mathematics.

Those of us with experience of working with the Key Skills qualifications and the Skills for Life standards do not agree with the White Paper's assertion in paragraph 5.10 that these 'qualifications provide a good starting point' for defining what is meant by functional skill in mathematics. Level 2 standards for adult numeracy are not appropriate for students aged between 14 and 19: by seeking to assess skills in context you are as likely to end up testing pupils' experience of the contexts as you are their functional skills - there are no contexts which are relevant for all students between 14 and 19 or for all adults. The proposition that applications to real world contexts is inherently motivating is not self evident - good mathematics teachers at all levels use a wide variety of problems, puzzles and open-ended tasks as a valuable source of stimulus and motivation as well as a means to develop fluency, understanding and problem-solving skills.

Furthermore, the way in which these level 2 standards are currently assessed through written tests and assignments set in contexts which ostensibly relate to the real world but are not actually in it does nothing to address the real needs of the workplace. While e-assessment of functional mathematics will make it easier for young people to take the test at the point of readiness, it may restrict the quality of the assessment items.

In summary, the notion of functional mathematics must be interpreted as a means of helping young people to become 'mathematically literate', so that it is inclusive and enabling. We must ensure it does not become focused on a minimal list of skills practised and assessed in artificial real-world contexts, which would be restrictive, demotivating and unhelpful.

Providing greater stretch and challenge

The mathematical community has consistently argued that able students require a programme which deepens their understanding and challenges them to solve demanding problems, rather than accelerating them along a path through more content. This view was strongly endorsed in recommendation 4.5 of the Smith Report: 'This extension curriculum should be firmly rooted in the material of the current Programmes of Study, but pupils should be presented with greater challenges.' The White Paper seems to imply that greater stretch and challenge for KS4 students would be achieved by moving on to material required for advanced level and that schools will be encouraged to do this if AS results are included in the pre-16 league tables. This is precisely the acceleration model that the mathematical community has argued against so strongly.

The proposal to introduce A+ and A++ grades into A level seeks to address the very real problems of discriminating between the ablest students at A level and challenging them suitably. However, extending the grade range in this way is likely to devalue the lower grades. Further detailed debate is needed to find a sensible way forward so that all students can demonstrate mastery at some level and so that the ablest students can demonstrate their skill at solving demanding problems rather than their ability to score high marks on what to them should be routine tasks.

We believe that AS- and A-levels are failing to assess the analytical, problem-solving and critical-thinking skills sought by the top universities. The proposal to incorporate the Advanced Extension Award into A-levels as optional additional questions could favour students from top-performing schools which are more likely to encourage their students to answer them - and to prepare them better to do so. One way of guarding against this is to set open-ended questions, which test ability to reason and to apply mathematical knowledge and which have to be answered by all students.

Pathways for 14-19 mathematics

We are disappointed that the White Paper has rejected much of the Tomlinson report and it is not clear how the government will overcome the problems of the poor take-up and inadequate recognition of vocational qualifications, and the low level - compared to most similar countries - of participation in post-compulsory education.

In responding to Adrian Smith's report *Making Mathematics Count* the government said that 'we will ... secure the engagement of all learners through increased pathways, better vocational options, and stretching curricula for the most able. This will be integrated with our approach to broader curriculum reform to ensure consistency and portability of skills across the whole 14-19 curriculum.'

There does not seem to be much opportunity in the White Paper proposals for portability of skills and there are fewer mathematical pathways than are envisaged in the Smith report. However, we are aware of the work currently being done on mathematical pathways and hope that this further advice will be carefully considered.

We are concerned that there does not appear to have been much discussion about the mathematical pathways available to post-16 students who have not yet achieved level 2. As the White Paper suggests in paragraph 2.18, offering such students more of the same is likely to be ineffective. Many of our members have experience of teaching post-16 students working for Level 2 and we would be pleased to discuss possibilities with you.

We welcome the proposal that students who have not achieved level 2 will be entitled to continue studying mathematics post 16. Indeed, many believe that mathematics should be a compulsory part of the curriculum post 16.

Assessment

We note the White Paper's suggestion that 16 should cease to be a fixed point at which all young people take qualifications (paragraph 3.19); this will enable them to progress at a pace appropriate to them. However, we would not want to see this flexibility used to promote acceleration through the curriculum, at the expense of enrichment of the curriculum.

We welcome moves towards a two-tier GCSE: this needs to be thoroughly piloted and we believe this development should be linked to a carefully considered double-award GCSE.

We do not believe that the White Paper has done anything to address the 'overall burden of assessment' (paragraph 10.9) and indeed in mathematics it may have increased it through the introduction of separate assessment for functional mathematics. The section *Reducing Assessment* in Chapter 8 refers only to GCSE coursework. Students will still be taking examinations in mathematics twice a year for at least four years if they study for a modular GCSE and then continue with AS and A2 mathematics.

For us, the 'burden' of assessment derives from the Achievement and Attainment Tables, which will place an even higher premium on achieving a grade C or better in GCSE mathematics by including this as a measure of performance in the Tables at age 16. We have made it clear in the past that the current high-stake assessments distort the way in which the curriculum is taught and we fear that this will be even more the case in the future. We welcome the decision to make key stage tests optional in Wales and urge the Government to consider this for England also.

We would welcome further discussion about the difference between the mathematical requirements for a general (GCSE) diploma (paragraph 6.16) and those for a level-2 diploma (paragraph 6.12) and about whether these diplomas will be given equal recognition by employers and HEI.

Conclusion

As subject associations representing teachers of students aged between 14 and 19 in schools and FE colleges, we feel we have much to offer in working with you on these areas of concern. We look forward to being involved closely in these vital reforms.

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