The Mathematical Association
Supporting Mathematics in Education

Evidence on the National Curriculum Review

A comprehensive analysis of the National Curriculum from a mathematics perspective has been produced by the Advisory Committee on Mathematics Education (ACME). The Mathematical Association endorses the approaches detailed by ACME to building a revised National Curriculum that will serve mathematics learners and their teachers well over the next decade. It is not the intention of the MA to repeat the arguments put by ACME, but to focus on a small number of points, especially in relation to:

Section 10 a) What knowledge do you regard as essential to include in the Programme of study for mathematics?

1. We would wish to see a focus on skills and deep understanding for transfer, alongside mathematical content. It is the ability to tackle problems in the real world, at levels appropriate to the learner, which characterises mathematical activity. Young mathematicians need to tackle closed problems in which short sequences of logical steps are required to produce a solution. But they also need to experience open-ended or extended tasks that require a more detailed understanding of the context of the question, the ability to research, to access information, to sift and to select. They need to encounter the frustration of going down a blind alley, to demonstrate resilience in the face of a challenge and to experience the satisfaction of making a breakthrough. These are the skills needed by employers and for higher study.

2. Calculation is an important aspect of mathematics particularly in KS1 and KS2. Mention of calculation is therefore necessary, though with careful consideration of why particular skills might be important. We do not need the same efficient complex numerical skills that were needed 50 years ago. Thought needs to be given to what needs to be taught and why rather than assuming that what was appropriate continues to be so. Understanding rather than simply following particular algorithms is of importance here.

3. We would argue for the revised National Curriculum to have a greater focus on algebraic mastery than at present. International comparisons suggest that young people in some other countries are significantly stronger in algebra than their British peers. A fluency in describing a situation concisely in symbols and an understanding of the power those symbols then assume by admitting of manipulation, provide the foundations upon which logical reasoning in mathematics rests. A greater fluency with algebra would benefit a sizeable proportion of pupils. This should be achieved through deeper and wider experience with the current content, leading to robust and fluent algebraic skills, rather than superficial acquaintance with more algebraic topics.

4. If there were to be such a focus on algebra it might be thought necessary to reduce the statistical content of courses. Of course, data handling skills are considered to be something of a strength in England and Wales, so we should not rush to throw the baby out with the bath water. Indeed, caution should be taken because statistical literacy is important for an understanding of the modern world; notable in this regard is an appreciation of how statistics can be used to exaggerate or confuse. However, there could be a move away from both the manual representation of data and the computation of measures of location and dispersion (computers can do these with ease) and towards the interpretation of data, their associated tables and representations, and also towards the comparison of data sets from summary statistics. The understanding of risk, recently incorporated into the Scottish 'Curriculum for Excellence' would be wholly appropriate. And we must remember that the calculation of probabilities provides a suitable context to develop fluency in fraction manipulation.

Section 10b) Should the Programme of Study for mathematics be set out on a year by year basis or as it currently is, for each key stage?

Such an approach would likely lead to greater rigidity. On the other hand it might be easier for non-specialist teachers to keep on track, it could reduce the amount of time spent drilling pupils for end of Key Stage assessments, it would likely reduce the disadvantage to students who change schools in the middle of a Key Stage and it might deter schools from accelerating pupils in KS3 and KS4. There may be some merit in this at Primary school, though we have known for three decades, right back to the Cockcroft Report, that there is a substantial range in performance at the point of transfer to Secondary school. Measures should be taken to minimise this: prompt funded small-group intervention has been shown to be highly cost-effective.

The Mathematical Association argues that detailing a curriculum narrowly by individual year or slightly more broadly by individual Key Stage should not be an overwhelming consideration. It would be far better to focus on concept development, issues of continuity and progression, of interconnectedness within mathematics itself and with other areas of study. This requires creative approaches to the presentation of the curriculum.

Assessment, however, continues to be an area of significant concern for The Mathematical Association. It is an old adage that just as a baby does not increase in weight as a result of being weighed, a youngster does not become more accomplished by being assessed. In recent years pupils have spent too much time being measured, too little time learning; teachers have spent too much time measuring, too little teaching. And in the process of ensuring that school performance statistics are as good as they can be, learning and teaching is distorted. The Mathematical Association believes that the only realistic way forward is to reduce formal summative assessment. Among other things, this will remove the temptation to 'teach to the test', help skirt the inadequacies of judgements and labels created on the basis of a snapshot, ease pupil stress and, crucially, improve learning.

Section 23 a) Do you think the NC should continue to specify the requirements for each of the 8 levels of achievement?

The idea that a pupil is at a discrete level in mathematics at any particular point in time is an oversimplification of how young people learn, even across mathematics. Schools often identify the level achieved by each pupil to within a third of a grade each half term. The pupils tend to know what label has been attached to them, though not always what that means in terms of what mathematics they should be learning. Perhaps the enhanced freedom that teachers would have from a lower level of specificity would allow for mathematical growth in individuals and produce a greater number of highly competent pupils ready for the rigours of university mathematics and other future paths.

Section 23 b) What alternatives do you propose to replace Attainment Target level descriptors?

The Mathematical Association suggests that it might prove useful to teachers to have concepts and skills listed / detailed in terms of development of a particular area of mathematics, though recognising the need also to draw out the links between different areas of the subject. Identifying strengths and areas for development would assist the learner and his/her teacher to decide what next steps should be taken. (It is recognised that the secondary mathematics framework objectives which show clearly progression **with examples** is useful, particularly to non-specialist teachers.)

Section 24 Within each Programme of Study, how should the curriculum and attainment targets be defined to ensure appropriate education for pupils in a wide range of circumstances as learners?

As with school schemes of work, the ALL, MOST, SOME classification should work well. A threefold division is the most teachers can reasonably handle.

Section 25 a) How do you think the needs of low-attaining pupils should be addressed through the National Curriculum?

The key is to err on the ambitious side; aim high but understand that you might have to accept something short of the target. Furthermore, seek paths that foster continuity and progression (for all learners). It is particularly important here that it is easy for teachers to track back in curriculum documents and resources to earlier stages, e.g. frameworks.

Section 25 b) How do you think the needs of high-attaining pupils should be addressed through the National Curriculum?

The Mathematical Association has published policy on enrichment (not wholly the right of the most able) at www.m-a.org.uk/resources/Policy_on_Enrichment.pdf This explains in detail why, in

general, we would support enrichment rather than acceleration as providing a foundation on which more young people will continue to study mathematics and with greater effectiveness.

Section 31 What are the most important factors to consider in developing the National Curriculum for key Stage 3 to ensure a smooth transition from Key Stage 2?

National Tests at the end of Key Stage 2 hinder the smooth transition to Key Stage 3 as many learners spend much of Year 6 being coached for these examinations instead of deepening their mathematical skills further. The emphasis should always be on teaching children mathematics rather than teaching them to pass mathematics examinations.