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# An extension pathway for more able students 14-19

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Brief paper presented at the second Science Council Colloquium on School Mathematics, in response to the Inquiry Report into School Mathematics, 'Making Mathematics Count'.

This presentation concentrates on recommendation 4.5 of the Inquiry report, namely

*The Inquiry recommends that the QCA and its regulatory partners should be funded to develop an extension curriculum and assessment framework for more able pupils at Key Stages 3 and 4. This extension curriculum should be firmly rooted in the material of the current Programmes of Study, but pupils should be presented with greater challenges. These should involve harder problem solving in non-standard situations, a greater understanding of mathematical inter-connectedness, a greater facility in mathematical reasoning (including proof) and an ability to engage in multi-step reasoning and more open-ended problem solving.*

One of the further recommendations of the Inquiry report (Recommendation 4.11) is that a number of distinct pathways are developed in the mathematics programme of students across all abilities in the 14-19 age range. It presents a number of tentative models, but, rightly, leaves the detailed work on this idea for others to follow up.

*The Inquiry recommends that funding be provided to the QCA and its regulatory partners to commission, through an open bidding process, up to three curriculum and assessment development studies of variants of these pathway models and approaches, including trialling, feedback and modification and an assessment of the workload implications.*

The idea that the development of various pathways models is put out to tender is novel and welcome, and I am sure that it will provide interesting possibilities for us to consider. However, from a teaching perspective I would ask only that these are realistic and manageable pathways, not so many and various that we simply can't staff them-particularly at sixth form level. School and College Sixth Forms vary considerably in size, some will have as many as 250 students, while others will be very much smaller. Greater variety of provision in mathematics post 16 should encourage more students to continue with mathematics into the sixth form-that is its rationale. However, it may simply deflect current students onto other courses which become available, making class sizes small and uneconomic. In increasing recruitment onto mathematics programmes post-16, the provision of appropriate courses will matter, but crucially, *so also will the experience pre-16*. We should also keep in mind the comment in paragraph 4.21 of the Inquiry report, that the mathematics curriculum at KS4 is overloaded. This problem will not be eradicated by simply providing a 'double award GCSE' for mathematics. Without committing more time to mathematics in the curriculum, which is hardly realistic, the only way to deal with this is by reducing some content.

Following the publication of the Inquiry report, ACME, jointly with QCA, ran a workshop considering both the 'double award' idea for mathematics, and the provision of an enrichment curriculum for more able students. I will focus on issues relating to the provision for more able students, the *Extension Pathway* described briefly in the report. The Inquiry mentions the figure of 10% of the cohort as suitable for this route. I believe this to be too small a group, and for practical reasons feel that we should be considering enhanced provision for around 20% of the GCSE cohort. In most schools, and depending

on intake of course, this would allow for a manageable class. Anything much smaller would have to be managed by various ad hoc arrangements, and would be difficult in practice. We are talking here about stronger provision for a largish group, and not simply the smaller proportion designated as 'Gifted and Talented', for whom much provision is currently available. Perhaps more importantly, I believe that the higher proportion would *benefit from* such an enhanced programme.

For more able students at GCSE, the problem of curriculum overload within mathematics, mentioned in the inquiry report, is not so acute. However it *does* exist, to the extent that time does not permit for the more challenging curriculum envisaged. *Some of* the content of the present KS4 curriculum is inappropriate for this cohort. There is far too much emphasis on data handling, especially the coursework requirement; and the weighting of this component of the curriculum (25%) is far too high for *this* group. Consequently I would remove the data handling coursework altogether, and reduce the weighting of this component in the teaching and assessment overall. I would not otherwise reduce content, although I would for other pathways. This would make more time available to get across the greater range of mathematical skills which we would wish for this group, and to concentrate and improve skills required for further study of mathematics in the sixth form.

Quality of teaching, and of resources, is crucially important. We are providing for a regular diet, part of the proper teaching of this group, and not just bits and pieces added on to spice things up. Resources and texts with more challenging material, harder unstructured problems, and a greater emphasis on presenting full and rigorous solutions and on proof will be needed, and must readily available.

Assessment will play a crucial role. However, we have to be realistic about what can be achieved on the assessment front initially. At present, even better candidates get A grades on relatively low marks on the GCSE examination papers. *Most* students, even in this group, do *not* find GCSE mathematics easy. Quite the opposite in fact. They see mathematics as a hard subject in relation to other subjects they study. The situation has become worse at AS and A2 with the

advent of Curriculum 2000, not because mathematics has become harder (it has not), but because many other subjects appear to have drifted yet further away from us and appear easier. Market forces are operating in a significant way in post-16 choices for many students and their teachers! To make the subject even harder too quickly, even for the better students we are talking about here, will be counter productive, and we must proceed with some caution. Appropriate rewards will be very important, and such a curriculum certainly merits the double award GCSE as highlighted in the report.

The Inquiry describes briefly one model of the Extension Pathway post-16, where the GCSE course continues into the Extension Mathematics programme, with a 1.5 weighting -equivalent broadly with A Mathematics plus AS Further Mathematics. I feel we could get this through the Tomlinson proposals, even allowing for a broader based programme for students which it seeks as the norm. This course would be completely new, a hybrid, taking current A level material, and appropriate material from Further Mathematics, combined with a teaching and assessment flavour of the AEA (Advanced Extension Award). It seems to me that this is a very exciting possibility, a single coherent and challenging programme which would deliver the sort of skills which Higher Education in mathematics and other mathematically related courses demand. This is some way from the current fragmented diet currently available, and I would expect that such a course would be well received by Higher Education - they could and should help to design it! Schools should foster the expectation that able students, whatever their final perceived destination, should take this course, because of the sheer intellectual challenge that it would provide.

This is a very important cohort of students. They will become the teachers of the future, as well as future scientists, technologists, engineers and financial wizards. We must nurture their talent carefully, and, at the same time, have high expectations of them.

### Reference

- [1] *Making Mathematics Count*. The report of Professor Adrian Smith's Inquiry into Post-14 Mathematics Education. HMSO 2004