

MEI Commentary on *Evaluation of participation in GCE mathematics*

Introduction

In 2000 teaching began on new AS and A levels in all subjects, under the curriculum 2000 programme. The mathematics syllabus proved highly unsuccessful and there was a large fall-off in uptake. As a result new mathematics A levels were introduced, with first teaching in September 2004. The Smith report was published earlier in 2004 and recommended that the impact of the planned new mathematics A levels should be monitored. This work was carried out by QCA, culminating in a report entitled *Evaluation in participation in GCE mathematics*, published in January 2008.

Considerable research went into this report and it makes interesting reading. However, the recommendations section in the Executive Summary would seem to be a non-sequitur from the rest of the report. There are four recommendations and they would seem to be unrelated to the report's findings; it is hard to believe that they were written by the report's authors.

This paper comments on the four recommendations made in the executive summary.

Recommendation 1

Formally separating the requirements for an A level in mathematics and an A level in Further Mathematics would simplify the structure of A level in general. By designating particular units to each award, the peculiar 'least-best' relationship would be severed, and there would be more clarity – both for the student and for those selecting students for higher education – about what is being studied for each award.

While the structure may seem strange to those coming on it for the first time, it has been in place for some 17 years in much the present form, and has worked well over that time. We should not be in a hurry to change it without very good reasons. It is well understood by students and teachers, and higher education institutions are provided with full information about the units that each student has taken and the results obtained.

If Mathematics and Further Mathematics could easily be separated, it would have been done long ago. The difficulty in doing so is caused by the fact that mathematics is taken by students with a wide variety of aspirations, supported by different applications units. (For example a student going on to read mechanical engineering at university will benefit from mechanics units while someone destined for medicine will be best served by statistics.) At the same time a Further Mathematics student will benefit from the breadth of studying more than one application area.

A particularly dangerous idea is that A level might be served by a general applications unit, covering elements of mechanics, statistics and decision mathematics. This would lead to a very fragmented provision with students learning how to do certain questions but never coming to terms with the principles underlying the various strands. There would be a real loss of intellectual rigour.

Recommendation 2

The perception among teachers and students that the different combinations of core and optional units result in different levels of difficulty should be considered further in the light of discussion about the students for whom the A level is intended.

Since the 4 core units are the same for all A levels in mathematics, the supposed differences can only occur in the 2 applied units.

When setting grade thresholds at the time of the awards, the awarding bodies look carefully at subject pairs data for those candidates who have taken each pair of units (e.g. Mechanics 1 and Statistics 1). If there were a consistent difference in difficulty, it would show up at this stage, and that information would be fed into the examination setting process. It would also result in different thresholds for the units; typical thresholds show no consistent differences.

That does not, however, mean that particular students will find all units equally easy. That will depend on their aptitude and on what other subjects they are taking. Their intended careers will also affect their motivation.

Recommendation 3

The issue of whether the A level teaching is geared to the right level to encourage participation and achievement by students who are not high-flyers is something that may merit further investigation. It also needs to be considered in terms of how teachers see mathematics A level's ability to challenge those who are more able.

This recommendation touches on the negatively skewed distribution of mathematics students. About 40% currently obtain grade A; on the whole the same students get grade A in their other subjects – they are talented individuals. The problem with mathematics is that there should be many more grade C to E students taking it than is currently the case. The recommendation seems to point the finger of blame at teachers but this is probably not justified. It is more likely that school/college policies, often motivated by performance tables, are responsible.

There is a serious national need for increased uptake of mathematics post-16. The present grade distribution shows that there are large numbers of students who could obtain middle grades on mathematics at this level if they took the subject. The various reasons for their not doing so need to be properly understood; then it will be possible to work towards removing the barriers that currently deter them.

As is noted in the Smith report, many teachers make Further Mathematics available as a way of stretching and challenging their higher attaining students. With the Further Mathematics Network up and running, this course of action is open to every school and college in England. The recommendations do not recognise that Further Mathematics solves the problem of providing for the most able students.

Recommendation 4

A clear statement about the expectation and purposes of mathematics provision at A level is needed, so that there is less division of opinion about how far it is fit for its purpose.

Depending on the outcome of this, there are two choices:

- *develop a qualification that meets the needs of the 'clever core', accepting that you are building an exclusive route*
- *revise the A level to be a qualification that is well aligned to the demands of other A levels, but design some form of supplementary stretching qualification that is accessible only to very able mathematicians; this – of course – raises the issue of what level this new qualification should be pitched at, since it seems unlikely that it could be easily encompassed within 'A level'.*

A level Mathematics specifications already contain statements, approved by QCA, relating to the purpose of the qualifications. Now that the Further Mathematics Network is a reality, it would be helpful for these statements to be updated and to include information about the relationship between Mathematics and Further Mathematics. Changes to GCSE should also be taken into account.

This recommendation then says that there are two choices. There are, of course, many more options than that, including the very important one of leaving A level Mathematics just as it is. That would be consistent with the generally positive findings of the report in terms of improvements in uptake of both Mathematics and Further Mathematics, retention and conversion rates from AS to A level.

Neither of the bullet-pointed suggestions is to be recommended. The first feels as though it is based on a caricature of an identifiable '*clever core*'. Actually there is a continuum of ability. The idea of providing mathematics for only the most able runs against the national interest; we should be aiming to develop mathematical skills in the large number of people who will need to use them later in life.

The second bullet point suggests that A level Mathematics should be revised so that it is '*well aligned to the demands of other A levels*'. It is unclear what this means; it could be taken as a call for A level Mathematics to be made significantly less demanding. The changes made in 2004 were a measured step in this direction and should be allowed to settle down for much longer before any further diminution in demand is considered.

Another interpretation of '*well aligned*' is that the second proposal is based on an underlying assumption that it is possible to design A levels in different subjects so that they are all perceived by students to have the same pattern of demand. This is just not the case. Wherever mathematics is pitched it will be found very hard by some students and trivially easy by others; in contrast, the perception of subjects like history and media studies will be much more uniform. In the assessment of most subjects discrimination is based on students' responses to readily understood questions. By contrast, in mathematics discrimination is built into the questions themselves; a 'hard' question can be one where some students cannot even get started. Consequently many students' experience in mathematics is quite different from that in other subjects.

Conclusion

The report's recommendations would seem to say more about the pre-suppositions of whoever wrote them than about the research upon which they are supposedly based.

*Roger Porkess,
Chief Executive,
MEI.*

*Charlie Stripp,
Programme Leader,
Further Mathematics Network.*