Sequential models for double award GCSE in mathematics

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Summary

- This paper follows on from the Background paper in which several models for a double award for Mathematics GCSE were outlined.
- There is a mismatch between the reality of the present GCSE mathematics and the aptitudes and aspirations of many students.
- The need for a double mathematics award at GCSE derives from the very wide spread of attainment in the subject among 16-year old students.
- All students are entitled to a GCSE system which provides opportunities for them to work roughly at their own level, neither being required to operate far beyond their understanding, nor to be bored by work which is too easy.
- Current GCSE Mathematics students cover very different amounts of content; some learn enough mathematics to justify a double award while others only learn enough to merit a single award.
- The present GCSE provision could be much improved by the introduction of a double award, provided the second award is based on the additional content studied by some, but not all, candidates.
- There are various possible models for a double award, but only those with a sequential element will improve the present situation.
- In the simple sequential model proposed here, Basic Mathematics GCSE would be taken by virtually all students, and would be designed to allow significant success at an appropriate level for a majority of them.
- The second GCSE, Higher Mathematics, would be taken by some but not all students.
- Basic Mathematics would be the gatekeeper qualification for many employers, and would provide a platform for non-numerate AS and A Levels and for many FE vocational courses.
- Basic Mathematics would support the delivery of Functional Mathematics
- Higher Mathematics would be a mathematically richer and more abstract course; it would provide a platform for AS and A Level study in numerate disciplines.
- The move to a sequential double award system may present challenges to the existing culture. Such challenges can be overcome provided those responsible show sufficient leadership.

1. Designing sequential GCSE syllabuses

1.1 Design considerations

The sequential model requires the current content to be divided between the Basic GCSE and the Higher GCSE. There are three different factors to be considered when deciding how this should best be done.

- Mathematical aims
- Assessment
- The percentage of students expected to take the Higher GCSE.

All three are important. However, it is the first that must provide the starting point.

1.2 Mathematical aims

1.2.1 The Basic Mathematics GCSE

The Basic GCSE would be taken by virtually everybody. It must be a worthwhile qualification in its own right, which serves as a passport for everyday life. It would be the gate-keeper mathematics qualification for many careers and would be that required in the new league tables. Consequently, it should include an emphasis on:

- solving problems in context
- some use of IT
- basic techniques.

The content, and the associated teaching, should make it easy to answer a student who asks *"Why am I doing this?"* In practice this will mean that the content of the Basic GCSE will tend to be predominantly concrete, with most abstract work left to the Higher GCSE. So, for example, while there might be plenty of work on financial calculations and measures, as well as some data handling, the algebra could well be restricted to the use of formulae.

1.2.2 The Higher Mathematics GCSE

The Higher Mathematics GCSE will cater for the students with greater attainment. So it would be designed for those who are likely to use mathematics at a more advanced level, either in its own right (e.g. at AS and A Level and beyond), or as a service subject. The content will be different in spirit and style from that for the Basic GCSE with more emphasis on abstract thinking (e.g. algebra and formal geometry).

1.3 Assessment range

The designs of the two GCSE specifications reflect the needs of different groups of students. They will thus allow students with a wide range of attainment to be assessed on material that is appropriate to them.

Recommendation 4.5 of the Smith report called for the development of *"an extension curriculum and assessment framework for more able pupils at Key Stages 3 and 4"*. If such work were to be incorporated in both GCSEs, perhaps with the award of A* dependent on extra assessment of suitable material, it would be much easier to ensure that the standard assessments were suitably inclusive for other students.

1.4 Percentages of students

The Basic GCSE would be taken by virtually all students. For most it would be a Year 11 examination, although some might take it earlier.

At present about 50% of students achieve grade C or better. However, some schools deemed to have a *normal* intake achieve a rate in excess of 70%. It is not unreasonable to hope that, with a syllabus that is better suited to many candidates, the overall percentage gaining grade C or better on the Basic GCSE might be comparable to that in successful schools at the moment (i.e. about 70% of the cohort).

One approach would be for the Higher GCSE to be designed so that the target students are one of the following two groups:

- those who attain grade C or better on the Basic GCSE (about 70%);
- those who have a reasonable chance of a Basic GCSE grade C or better (rather over 70%).

However, a possibly more realistic definition of the target group might be

- those *aspiring to* grade B on the Basic GCSE; this would reduce the figure to perhaps 50-60%.

The target group for Higher GCSE affects the design, so considerable care is needed in deciding on the group being targeted. Making the target group for the Higher GCSE **too large** presents dangers.

- Too large a group would inevitably include some weak students whose needs would be in direct conflict with those of more able students; there would consequently be a danger that the more able students would not be presented with sufficient challenge.
- If the group were too large, some students would inevitably be demoralised by being expected to tackle abstract work far beyond their understanding.
- A culture in which a large majority of students were expected to take the Higher GCSE might undermine the value of the Basic GCSE which should be regarded as an important and valuable qualification in its own right.

There are also dangers in making the target group **too small**.

- If only a small minority of students took the Higher GCSE, it could be easy for some schools to avoid offering it all (as happens currently with Higher Tier GCSE); if, on the other hand at least 50% of students took the Higher GCSE nationally it would be almost impossible for any school not to offer it.

The Higher GCSE can be designed to accommodate any reasonable target percentage of the cohort. However very considerable care will be needed when setting this figure.

2. A framework for learning

The simple sequential model divides the content into Basic Mathematics and Higher Mathematics, as illustrated in Figure 1. This presents no problems for those taking Basic Mathematics only. It allows a syllabus to be defined that will support appropriate teaching and learning.

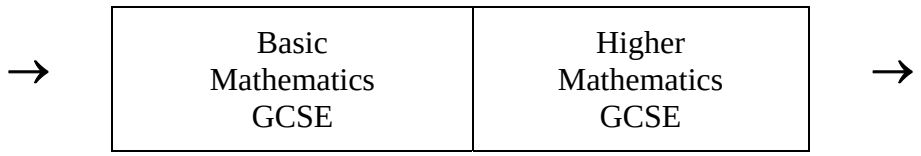

Fig. 1 The simple sequential model: content and assessment

By contrast, the situation of those taking both Basic and Higher GCSEs requires considerable thought. Because of the linear nature of the subject, Figure 1 provides a sensible representation of how the content and assessment could be organised. However, it is not necessarily the case that a particular student's learning always follows quite the same pattern.

The Basic GCSE will consist largely of concrete mathematics but the Higher will contain a significant amount of abstract work. However, students do not conveniently develop the ability to think abstractly at just the point when they reach the end of the available concrete work. That ability is built up over time and a good teacher will foster it by providing talented students with increasing amounts of suitable work over a prolonged period, often starting in a small way at quite an early age. So while Figure 1 is a good representation of the content and assessment model, Figure 2, below, is more appropriate for the associated teaching and learning.

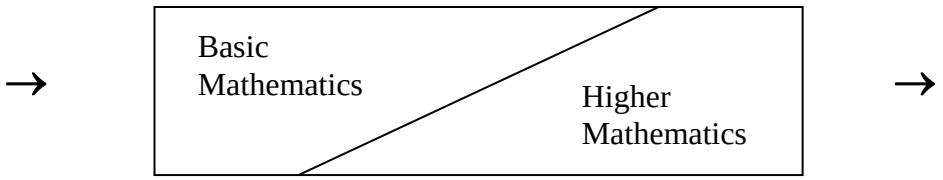

Fig. 2 The simple sequential model: teaching and learning

The allocation of material to the Basic and Higher GCSEs will clearly require very considerable thought. There will be a temptation to equate the Basic GCSE to a particular Level of the existing National Curriculum (for example, up to Level 6). That could be unsatisfactory. National Curriculum Levels were devised for a different purpose; they may, by chance, be appropriate in these new circumstances but we should be prepared to accept that this may not be the case.

What about Functional Mathematics ?. The demand for it stems from the perception that many students taking the present GCSE are not functional in mathematics. A well-designed Basic GCSE should overcome this problem and so eventually remove the need for Functional Mathematics as a separate entity. This is a worthy aspiration and, if achieved, would constitute a genuine gain. In the short term, however, the same teaching will support the Basic GCSE and the Functional Mathematics qualification.

3. Issues raised by a sequential model

This section addresses a number of issues that have been raised about sequential models. A common feature of all of them is that they are products of the present culture in which school mathematics is taught in a generally unhelpful environment. With the double award, we will have an altogether better provision and with it will come an improved environment in which such issues can be expected to disappear.

3.1 Some schools will only run the Basic GCSE and not the Higher

It should be national policy that every student who would genuinely benefit from Higher GCSE should have the opportunity to take it; failure to offer it (and it would be the standard route to AS and A Level) should naturally contribute to a bad Ofsted report. However, if Higher GCSE is taken by enough students nationally it will be unacceptable to the community it serves for a school not to offer it anyway (see Section 1.4).

3.2 Some students will take Basic GCSE early and then give the subject up

It is hard to see how this could arise, since there is a statutory requirement for students to continue mathematics up to the age of 16. The fact that such concerns have been raised indicates the need to work towards a culture where this practice would be unthinkable in England, as it would be in many parts of the world.

3.3 The teaching time for students doing only the Basic GCSE will be reduced

Absolutely not. Those who take only the Basic GCSE will on the whole be weaker students who need to spend as much time as possible on mathematics. To give less time to such students would be unfair both to them and to their subsequent employers.

3.4 On this model one GCSE will be harder than the other

Of course! Everyone knows that some subjects are harder than others and that some qualifications, even if nominally at a given level, are actually harder. A mathematics degree is, by the nature of the subject, harder than one in many other subjects. This is a fact of life. The important thing is that end-users know what each qualification means; and they will soon learn the meanings of the Basic and Higher GCSEs.

We need a system that meets the mathematical needs of students rather than one that is constrained by the myth that all subjects are equally demanding.

4. Conclusion

The introduction of a GCSE double award in mathematics provides a window of opportunity, with the possibility of a much improved mathematics provision in our schools and colleges. However, this will only happen if the design of the double award is properly thought through, and the model is adequately tested before its adoption.

The alternative is to rush something out that is little or no improvement on the present unsatisfactory provision. In that case we will be seen as those who had the opportunity to make a real difference to mathematics education in this country, and squandered it.