Issues and possible models for double award GCSE

Background

Tony Gardiner & Roger Porkess

1.   Rationale for a double award

The idea of a double award GCSE in mathematics is not new, but was brought to prominence in 2004 when it was raised in the Smith report. The idea is important because it has the potential to overcome serious shortcomings in the present GCSE.

The fundamental problem is that, because of the huge spread in attainment, a single award cannot meet the needs of the complete cohort of 16-year olds.

- *For Higher Tier students a single award fails to reflect or reward the amount of work required, which is greater than for most other subjects.*

- *For those going directly into employment or vocational training, the present GCSE fails to provide them with the skills they need.*

So the present GCSE Mathematics is unfit for purpose at both ends of the spectrum. It does not provide a basis for employment and vocational study, nor does it produce a sufficiently large pool of well-motivated and well-prepared students to move on to AS and A Level Mathematics. These are consequences of trying to cover the complete attainment spread in the one award.

Once we recognise that the fundamental problem is the spread in students' attainment, it is not difficult to see that a suitably designed double award provides the key to an altogether better mathematics provision.

2.   The spread in attainment

The spread of attainment is illustrated in the table below, which gives the approximate attainment profile for the 2005 GCSE cohort expressed in terms of National Curriculum Levels. As a rule of thumb one Level corresponds to about two years of study for a middle-attaining student; the range between the 10th and the 90th percentile thus corresponds to the equivalent of about 10 years' learning.

Attainment (N.C.)	≤ 3	4	5	6	7	8	9	10
Candidates (%)	4	3	8	23	31	18	9	4

Approximate attainment profile for 16-year olds in mathematics, 2005

There is thus a vast difference in attainment across the age cohort at age 16. Those at the upper end operate in a totally different intellectual world from those in the middle, while those at the lower end struggle to perform the most elementary of concrete tasks.

It is not just that those with high attainment are better at the subject; they have also learnt and know much more mathematics, including topics which others are not even ready to begin to understand. Crucially, they have developed the ability to think abstractly.

It is important to seek improvements in teaching that will reduce the extent of the lower tail, but it would be unwise to imagine that this will be easy, or that success will

be dramatic. So we must devise an assessment regime that is appropriate for the young people we actually have, measuring what they know, and how well they can use it.

What happens in our classrooms is strongly influenced by the imposed assessment regime. We need a curriculum and assessment system in which students are faced with work that is both appropriately challenging and in an appropriate form. The dissatisfaction shown by end-users, for example employers and those in Higher Education, is symptomatic of the fact that we do not have such a system at the moment.

3. Entitlement

Attempts to define what mathematics is appropriate for particular groups of students can easily founder if the word *entitlement* is used without sufficient clarity. In this context, it can take two quite different meanings.

- *All students have an entitlement to be taught the full GCSE Programme of Study*

- *All students have an entitlement to be taught content that is consistent with their level of understanding, and in an appropriate style.*

We all expect to have to face some lessons where we have to struggle. However, by forcing young people, in the name of entitlement, to sit through endless lessons which they have little prospect of understanding, we undermine both their confidence in the mathematics they genuinely know and can use, and the way they approach the subject.

Providing a system in England for anything like the full range of attainment remains an unsolved problem. Until about 50 years ago, most children left school long before 16. Since then there have been various attempts to serve the full range of attainment, starting with O Level & CSE and then a variety of GCSE formats. None has been successful for the complete cohort. However, the prospect of a double award GCSE holds out genuine hope, provided it is properly thought through.

4. Amount of content

It is undoubtedly true that Higher Tier GCSE students learn much more mathematics content than those at Foundation (or Intermediate) Tier. It is not difficult to argue that the excess content that such students learn is equivalent to a GCSE in many other subjects.

However, that is not the same thing as saying that *all*, or even most, students learn enough mathematics to justify the award of two GCSEs. So we need to be very critical of the following argument.

- *The amount of content in GCSE mathematics justifies two GCSEs. Therefore we should have a double award for everyone.*

For many students, this is simply not true.

Different students are taught, learn and are assessed on very different amounts of mathematics. There is no single block of mathematics that all GCSE students are expected to know. Thus, to state the problem in terms of the amount of content in GCSE mathematics invites a "solution" which treats the symptoms rather than the

disease. If a double award based on this argument were to be adopted, it is entirely predictable that students would learn no more mathematics than at present.

A double award will not in itself address the fundamental problem of assessment across the full range of attainment. That requires not just a double award, but a double award based on a model which recognises the extra content covered by more able students.

5.   Types of model

The fact that higher attaining students learn more content than others suggests a model in which one GCSE subject, the Basic GCSE, could be based on the content that almost all students learn, whilst a second, or Higher GCSE, should be based on the extra material covered by those with greater attainment. This is a *sequential* model. (The names "Basic" and "Higher" are temporary labels used to avoid ambiguity here. If such a model is adopted, better names may well be invented.)

The most obvious alternative model for a double award is the *parallel* model. In this, the content of GCSE Mathematics is split into two strands, according to some criterion. This model was used for some A Level syllabuses 30 years ago, in the form of Pure Mathematics and Applied Mathematics. The two English GCSE subjects, English Language and English Literature provide a modern-day example of parallel syllabuses.

6.   Sequential and parallel models

In this section the simplest versions of the sequential and parallel models are contrasted.

6.1   The simple sequential model

In its simplest form the sequential model may be represented by this diagram.

$\rightarrow$

Basic Mathematics GCSE	Higher Mathematics GCSE

$\rightarrow$
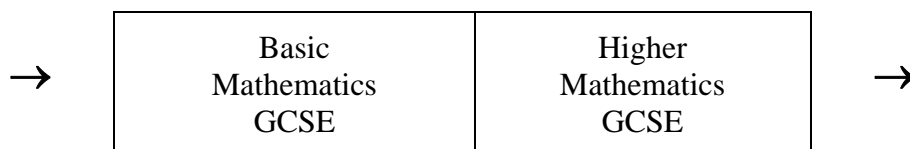
The simple sequential model

Built into the sequential model is an expectation that some students will take both GCSEs but others will take only the Basic.

The sequential model is based on the assumption that the total GCSE subject material can be divided into basic and more advanced parts in a way that is mathematically coherent. This is reasonable because of the linear nature of mathematics. However, considerable thought would be required to obtain the most suitable allocation of material. (There is a similar structure for Mathematics and Further Mathematics at A Level.)

The two GCSE Subjects represented in this model would both be based on clearly defined syllabuses and so the certification would be intelligible to end-users.

The syllabus for the Basic GCSE would be assumed knowledge for the Higher GCSE.

This model addresses the fundamental issue of the range of students' attainment.

Both GCSEs would carry the full range of grades. This would end one of the bizarre features of the present GCSE grading whereby grades are related to content with, for example, some topics defined to be "A grade". In all other examination systems, including A Level Mathematics, grades are based on how well the set questions are answered.

6.2 The simple parallel model

The diagram below illustrates the simple parallel model with the two syllabuses designated A and B.

$\rightarrow$

GCSE Mathematics A
GCSE Mathematics B

$\rightarrow$
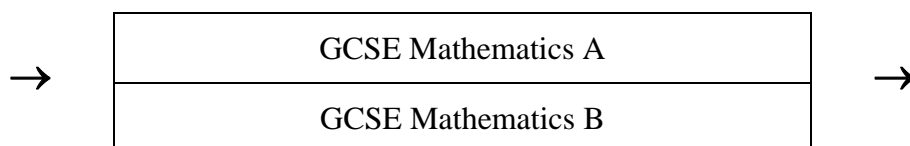
The simple parallel model

Since neither strand is identified as more elementary, an expectation is built into the parallel model that almost all students are expected to take both GCSE A and GCSE B.

The parallel model is based on the assumption that the subject matter can be divided into two strands of comparable size in a way that is mathematically coherent. While this is often the case with more advanced mathematics courses (for example Pure Mathematics and Statistics at A level), it is by no means clear that there is any such natural division at GCSE level.

Any split must make sense not just to the mathematical community but to the wider public. Unless the syllabuses for the two GCSE subjects are widely understood, it will be hard for end-users to interpret them. (It would not, for example, be clear what to infer about a job applicant with, say, grade B on GCSE Mathematics A and grade D on GCSE Mathematics B.)

The simple form of the parallel model does not address the fundamental issue of the range of students' attainment.

7. Models to avoid

There are two other models that have been suggested, but which appear to be manifestly unsuitable.

7.1 The doubled-grade model

In the doubled-grade model, the material is not divided into separate syllabuses. Candidates are assessed much as at present, but are then awarded a doubled grade, from A*A* to GG.

This model can be seen as a response to the superficial claim that the amount of content in GCSE mathematics is greater than that in many other subjects but it does not incorporate the fact that this is not uniformly true for all candidates.

It also fails to address the need for a more compassionate and informative way of certificating across the whole range of student attainment. Those who currently fail would simply fail twice, achieving, say, GG instead of G. It is hard to see what such a model would achieve, other than to double the stakes for an already high-stakes examination, and to make failure even starker.

7.2   The parallel model (with compensation)

As noted above, the parallel model appears to assume that almost all students will take both GCSEs. Unless both are made considerably easier than at present, it is inevitable that many would fail both GCSEs. Sheer humanity suggests the need for the model to be adapted to include the possibility of a compensatory award. A candidate who takes and fails both Mathematics GCSEs would then be eligible for the award of a compensatory single GCSE.

The doubled-grade model can also be adapted to include this feature.

These modified models would appear to have the same flaws as the simpler models from which they are derived. In particular, they fail to address the problem of certificating reliably and meaningfully across the whole range of students' achievement. They also have two additional problems.

- *There is no obvious rational basis on which to award the compensatory grade and this would cause problems for Awarding Bodies when trying to make a valid award.*

- *They guarantee that the single mathematics GCSE would be seen as a certificate of failure and so would quickly come to be regarded as valueless by end-users.*

8.   Unitised models

An alternative way of incorporating a compensatory single award is by introducing an element of modularisation into GCSE Mathematics. A conventional GCSE Mathematics candidate takes 2 papers. This raises the possibility that the double award GCSE might be divided into 4 separately assessed Units, with 2 Units per Award. The basic division of material is represented in the diagram that follows.

Unit 1	Unit 3
Basic Mathematics GCSE A	Higher Mathematics GCSE A
Unit 2	Unit 4
Basic Mathematics GCSE B	Higher Mathematics GCSE B
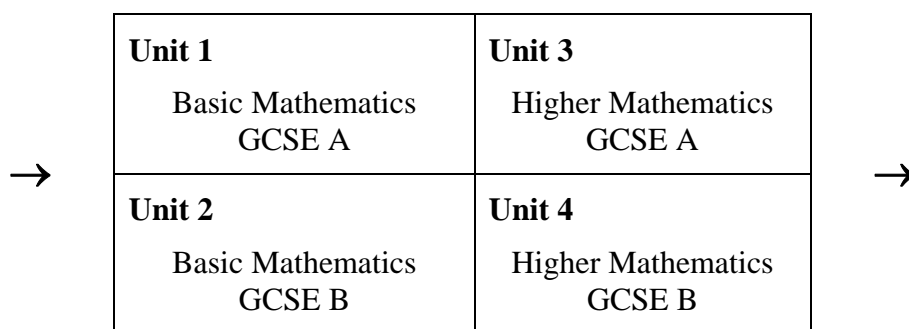
Unitised GCSE

Unitisation in this way requires a horizontal division of the material into mathematically coherent parallel strands (something that has already been questioned earlier in this paper). It also requires a vertical division of each strand into Basic and Higher Mathematics.

In theory this structure could support up to four GCSE certificates, with each candidate claiming one or two of them. These certifications can clearly support either the sequential or the parallel model.

Basic Mathematics	Units 1 & 2	Higher Mathematics	Units 3 & 4
Mathematics A	Units 1 & 3	Mathematics B	Units 2 & 4

They also allow a parallel model with compensation, overcoming the problem with the simple parallel model that there is no basis on which to award a compensatory grade to someone who does badly on both parallel GCSEs. In this unitised version, a single subject grade could be given on the basis of the marks on the particular pair of Basic Units, namely 1 & 2.

Thus a candidate who takes Units 1, 2, 3 & 4 could be awarded

either   GCSE Mathematics A (1 & 3) and GCSE Mathematics B (2 & 4)

or   GCSE Basic Mathematics (compensatory award based on 1 & 2).

This model would produce dilemmas and would require careful regulation. As an example, it would be unclear what award to give a candidate scoring well on Units 1, 2 and 3 but badly on Unit 4. The candidate could be eligible for either GCSE Mathematics A or Basic Mathematics but might not have done enough successful mathematics to merit two GCSE passes. The technical aspects of grading would be feasible but the Awarding Bodies would need to develop new mathematics-specific systems to implement them.

9.   In conclusion

This paper outlines a variety of models for double award GCSE Mathematics, some of which are more realistic than others.

The double award has the potential to improve the standard of mathematics attained by our students very substantially. However, this will only happen if the model ultimately selected requires significant changes to current practice.

It would be irresponsible to decide on any particular model at this stage, without detailed further work. In particular, draft syllabuses and assessment materials need to be produced for at least two of the models. Only then, when we know what they will really look like, will it be possible to be sure that we are likely to obtain the best possible outcome from this much needed development.