

The effects of 2-tier GCSE Mathematics on transition to AS and A Level

Executive Summary

- In September 2006 first teaching began on a new 2-tier GCSE Mathematics. The students who have just taken AS Level were in the first cohort.
- Many teachers have commented that these students were much less well equipped for the transition from GCSE to AS Level. The Pathways evaluation also raised concerns about this.
- It is possible that we are heading for a national disaster; the situation needs to be kept under careful and ongoing surveillance.
- This report describes the outcomes of a survey of AS and A Level teachers conducted at the MEI conference at the end of June 2009.
- Most of the teachers believed that many students are having a less good experience of mathematics as a result of the change.
- There is insufficient A and A* material in GCSE to provide better students with challenge.
- Typical Higher tier grade B and C students cannot attempt many of the questions on their GCSE examination papers and so become demoralised.
- Many students with very weak algebra are now getting GCSE grades B and C.
- Most of the teachers said that the transition to AS Level is now more difficult.
- However, there was an increase in uptake for AS Level in 2008.
- Many teachers expect that the proportion of these students going on to the full A Level in Year 13 will be lower than usual.
- The fear is that such a high drop out rate will lead to a perception among students that mathematics is a hard subject and that this will cause a subsequent reduction in uptake.
- If this happens, the government's target of 80,000 A Level students is unlikely to be met.
- Some schools and colleges are already adopting coping strategies to help their students.
- Others are increasing their entry qualification for AS and A Level, a policy that if widely adopted would set the government's target at risk.

Recommendations

- 1. The DCSF should set up a programme to monitor the situation.**
- 2. Reports that many students now find GCSE Mathematics demotivating should be investigated, including the effect (if any) that this has on their likelihood to take AS Level Mathematics.**
- 3. Particular attention should be given to the pattern of AS Level uptake among students with different GCSE grades.**
- 4. The examination performance of AS Level candidates should be monitored and analysed according to their GCSE grades.**
- 5. Retention rates should be monitored including, crucially, the conversion rate from AS Level to the full A Level.**
- 6. The coping strategies adopted by schools and colleges should be evaluated and advice given regarding best practice.**
- 7. The DCSF should draw up a contingency plan in case the present design is found to be fatally flawed; this should include an appraisal of other 2-tier models.**
- 8. Any plan to improve the 2-tier structure should take teachers' views, including those expressed in this report, into account.**

Background

The cohort of students taking AS Level in 2009 is the first to have taken the 2-tier Mathematics GCSE; this was introduced for first teaching in September 2006 and had its first awards in August 2008.

A number of teachers have expressed serious reservations about the effects of this change, saying that students are now significantly less well prepared for the transition from GCSE to AS and A Level mathematics. If they are correct, there could be very serious national implications, with the possibility of reductions in mathematics uptake beyond GCSE and knock-on effects for other STEM subjects.

The situation was identified in the most recent Interim Report of Evaluating Mathematics Pathways (May 2009)¹. Recommendation 10 in the Executive Summary says:

The impact of the two-tier GCSE should be examined in more depth to establish the impact on various groups of learners and their mathematics learning trajectories.

Further investigation is clearly needed and so MEI conducted a survey in June 2009 at its annual conference. There were 67 responses, all from AS and A Level teachers.

Related issues

Before coming on to the main findings of the survey, it is appropriate to mention two confounding issues that have been identified in recent discussions about the effects of the change from 3 tiers to 2 tiers.

Early entry

Some schools are now entering students for GCSE at the end of Year 10 hoping to obtain a grade C. This practice is new and seems to be, at least in part, a response to the accountability requirement for mathematics to be included in the 5 A* to C grades. It is being discouraged by QCA².

Candidates who take GCSE early and achieve a lower grade than A are less likely to continue their study of mathematics post-16 than students who achieve their full potential in mathematics at age 16. In other words, for candidates who may achieve lower grades through early entry, it would be better to delay entry and give them a richer experience of mathematics and the opportunity to achieve a higher grade.*

No respondents to this survey commented on it, although some do enter those aspiring to grades A and A* at the end of Year 10. So, while no doubt serious when it occurs, it does not seem to be the main issue and so is not considered further in this report.

Change to modular GCSE syllabuses

By contrast several of those responding to the survey wrote about the effects of either their own institution or feeder schools changing to modular GCSEs. Some people clearly found it difficult to distinguish the effects of the move to 2-tiers and of modular syllabuses. The issues raised by modular syllabuses are discussed in a separate section later in this report.

The main issues under investigation

The survey was designed to investigate the following extended sequence of events.

- Stage 1 Students have done less of the mathematics that provides essential preparation for further study in mathematics.
- Stage 2 Consequently they will encounter greater difficulty with the transition to AS and A Level Mathematics.
- Stage 3 As a result there may be a reduction in uptake at AS Level.
- Stage 4 In addition, more students will give up mathematics at the end of Year 12.
- Stage 5 Younger students will hear that mathematics is a hard subject at AS and A Level and will therefore avoid it.
- Stage 6 There will be a consequent decrease in mathematics uptake post-GCSE.

In the next three sections of this report, there are commentaries about Stages 1 to 4 of this sequence and a summary of relevant responses. The last two stages are, of course, still some time into the future. The aim of this piece of research is to avoid their ever happening.

Some care was taken when designing the questionnaire to ensure that it was as neutral as possible and did not lead respondents into particular answers. A consequence of this was that the responses brought out other issues as well and, where it is possible to do so coherently, these too are collated.

Stage 1 Students' mathematics under the new GCSE

The first question was designed to find out people's views about the mathematical competence and other attributes of students who have just taken the 2-tier GCSE and might or might not go on to take AS Level.

What are the effects (positive and negative) of two-tier GCSE Mathematics on students who are expected to get around grade B and C? Do you have any explanations for your observations?

In answering this question, many respondents also wrote about their experience of teaching it, their views on the change from 3-tier and the examination papers. There is further discussion of some of these comments later in the paper.

It was possible to identify 28 out of the responses as positive, neutral or negative about the experience of grade B and C students.

Positive	3
Neutral	4
Negative	21

The most common observation among the negative responses was the demoralising effect on students of being prepared for examinations where much of the material is beyond them.

Entering borderline students for the higher paper has an extremely negative effect on the students' motivation and confidence as there is so much on the paper that is beyond their grasp. Some students get so psyched out by this that they can't even answer the questions they should know.

Pupils expectations and self esteem suffer due to expecting to score poorly on higher paper yet still attain target grade – Helps to perpetuate the "I can't do Maths" myth.

Those who would have done Intermediate Maths now had to cover the harder topics and found these very difficult. It did not do their confidence or enjoyment of Maths any good. Some of this group have opted to take AS level Maths but they will then struggle.

Grade C pupils, taking the higher tier now are finding it incredibly hard to do a paper which contains A/A material. It is having a very negative effect on some pupils confidence.*

We have found some students with a B have not really studied some of the Higher Tier material. They have been shown it briefly before the exam but have followed the foundation syllabus for most of their GCSE. So they are poorly prepared for A-level Maths even though, on paper, they are not.

The few positive comments referred to the increased opportunities and challenges for B and C grade students.

Many students will raise their game and many will understand some Higher topics and may enjoy them.

In addition two responses considered late developers.

Some late developers who would have been taking Intermediate now get an A.

A few respondents took the opportunity to point out that A and A* candidates were also less well prepared than their predecessors.

More able seem to be unchallenged and many Grade A students struggle at AS level.

Higher paper now becomes less challenging.

Getting an A is a bit more of a lottery and the top ability students are not as challenged as there are fewer, harder questions.*

A number of respondents pointed out the advantages to students at the new Foundation Tier (and their teachers).

Allows lower ability to aim for C so more motivational for these students.

The 2 tier structure has eliminated the depressing sink classes where students switch off because there is no possibility of a C.

Foundation students who used to be disheartened realising at start of Y10 that they didn't have opportunity of getting a C. It makes that C a realistic possibility (and a few have achieved it).

Commentary

The overwhelming conclusion is that teachers believe that the students they were being asked about, those expecting to get grade B or C, are having a less good experience of mathematics. Many are being demoralised.

However, answers to later questions indicate that so far this has not resulted in a decrease in the numbers seeking to go on to take AS and A Level, even though they may be less well prepared to do so.

Stage 2 Transition to AS and A Level mathematics

The next question asked teachers specifically about the transition to AS and A Level.

Do you think the two-tier GCSE Mathematics has made the transition to AS and A Level easier or harder for students?

It was possible to identify 37 unambiguous responses to this question.

Much harder	2
Harder	24
No difference	9
Easier	2

The most thoughtful replies were largely from those who said the transition would be harder. It was clear that many of these were thinking in terms of students with A and A* GCSE grades, and were concerned at the lack of challenge for them in the 2-tier GCSE.

Harder because there is not enough A/A material on the exam. Therefore there's a bigger jump to A level.*

Definitely harder because the weighting of the harder topics in the Higher tier has decreased meaning students start A level with a much lower level of algebra than previously.

Harder as most of the questions on the papers at B or lower level. Will find the difference between GCSE and AS levels harder.

Judging by how straightforward this years' papers were (examination board named), they are not preparing them for the jump to AS. There were very few questions which really tested those of a high ability.

Others, however, were thinking about those with lower GCSE grades, particularly B.

It seems that grade B students in this system (needed for AS level at our College) are less able to cope with AS than the grade B students under the old scheme.

Students who get a B on higher that would have got a B at Intermediate seem to find the A/A algebra work covered in C1 harder – they have struggled with it at GCSE so have the mind frame that it is too hard.*

Many more of our L6 have struggled with AS this year – all GCSE grade B students but also some grade A students. ... They then think they are better than they really are and are shocked by the challenge of AS.

Only a few of those who said “No difference” elaborated on it.

I have not noticed much difference. Boards make a much bigger difference than tiering of GCSE.

There were also some who thought it was too soon to tell.

Commentary

It is clear from the responses that many teachers believe that the transition from GCSE to AS Level has been made more difficult for all students. Since this transition was already seen as difficult for many mathematics students, this could have serious implications.

Two factors would seem to be involved: the weakness of students’ algebra and the structure of the examination papers.

There is nothing new in complaints about students’ weakness in algebra on entering sixth form. The question is whether the problem has become significantly worse.

There were many comments about the structure of the examination papers, each of which covers a large range of grades. It is clear from the responses that many people regard this as the root of the problem. There were many comments to the effect that the examinations, and the grades awarded, gave the students a false impression of their preparedness for AS and A Level.

Stage 3 Uptake of AS Mathematics

The next question came in two parts, covering first the uptake of AS Mathematics and then the level of retention.

*Do you think the two tier GCSE Mathematics is likely to affect
(a) the uptake of AS and A Level mathematics?*

It was possible to identify 51 responses to this question.

Increase	20
Decrease	5
No change	19
Don't know/not able to say just yet	7

The numbers of those who thought the uptake would be unchanged and those who thought that there would be an increase were almost equal. Few of those who said there would be no change to the uptake offered an explanation. By contrast those who said the uptake would be affected and, specifically, those who said there would be an increase provided interesting comments.

In the vast majority of cases, those who indicated that there would be an increase also said that this increase would be likely to produce issues. These stemmed mainly from the idea that students will have a false confidence from doing well at GCSE and start AS level without the underlying mathematical skill and knowledge needed for it.

This may actually increase because students will think they are good at maths when they are not.

More students will think they are good enough to study A level.

More students feel successful and get A at GCSE and go on to A level really without the firm basis needed and struggle from day 1.

However, other respondents commented positively on the change in the students' knowledge and specifically that of grade B students who have studied the Higher tier.

May increase uptake as many more 'B' Higher candidates instead of 'B' from Intermediate.

Better quality candidates for A level as all will have done some Higher work.

Don't know. May depend on how many 'good' Intermediate students are now doing Higher and therefore meet higher level skills earlier.

One respondent contrasted the likely effects on different types of students.

It may increase uptake at B/C level – but make less difference at A/A level.*

Most of those who said there would be a decrease in numbers gave no further comment. One who did focused on the disparity in what tier grade C students may have studied.

It may reduce the uptake as some C pupils, who may have done an AS may now do Foundation and so will not choose to study maths further.

Commentary

Many schools and colleges saw an increase in uptake at AS Level in September 2008 and this may have influenced some answers to this question. Whether or not this is the case, half of the responses predicted an increase in uptake at AS Level.

This was a surprising outcome in view of the earlier response that students were being demoralised during their GCSE years. This disparity requires further analysis.

Those respondents who did say an increase could be expected, on the whole, went on to emphasise that they thought students may go on to study AS level with a false expectation of their mathematical ability, due to their GCSE course. This is a serious point and obviously leads on to the issue of retention.

An important indicator of how these students have fared will be their performance in the C1 and C2 examinations. However, further information will be needed if valid conclusions are to be drawn from the results. If, for example, those with grades B and C at GCSE have done less well than before, this may not be apparent from the overall mark distribution because they are a relatively small proportion of the overall candidature. The awarding bodies do have the information that would allow the performance of these candidates to be isolated but extracting it would probably be time consuming for them.

It is probably students with grade B at GCSE who will be critical to meeting the government's target of 80,000 taking A Level. These students need to be nurtured. It is really important to know whether some or most of them are being put off mathematics by their GCSE experience, and what happens to those who do progress to AS Level. A recommendation of this report is that these issues should be investigated. At the moment very few A Level Mathematics students have a GCSE grade C and only between 10 and 15% grade B.⁴

Stage 4 Retention at the end of Year 12

The second part of this question asked about retention. The word ‘retention’ can have two meanings in this context: not dropping out in the course of the AS year and continuing the subject to the full A Level. It is clear that nearly all responses were mainly about the second.

Do you think the two tier GCSE Mathematics is likely to affect (b) the retention level?

It was possible to identify 49 responses to this question.

Yes – more will drop out	36
No change	5
Don’t know/not able to say just yet	8

These figures show that a large majority of respondents thought that the two-tier GCSE Mathematics will have a negative affect on retention. As in previous questions, few of those who indicated that no change, or that they were unsure, gave any further comment.

Those who cited a reduction in retention mainly highlighted students as being weak when they started as the reason and so finding the transition too demanding.

With (even) weaker students taking on A level, they are unlikely to cope and may drop out during the AS course.

It may decrease retention as some attempt it after Higher tier who do not appreciate the height of the gap to A2 level.

Retention could be less from average ability pupils.

Lower levels staying on as they find it too much of a jump.

Retention poor as maths is harder than expected. In the past we rarely had pupils drop maths.

Many commented further as to why they thought students were weaker. In many cases this was due to the backgrounds of students starting with a grade B or less.

Retention yes, many can’t cope if they only have a B.

Yes, more will drop out. Where few with B at intermediate tried to start AS level more students will and have started with that level of ability.

The retention level maybe will decrease if students who embark on A/S level at grade C foundation GCSE would struggle to complete the course.

One respondent commented that if students had taken the FMSQ Additional Mathematics then the retention would not be affected, but that it would without it.

No, with Add Maths. Yes without Add Maths

Among the few who indicated that there would not be a change, some related this to a policy of not allowing 'weak' students enter in the first place.

Might increase retention level as the weaker candidates won't have taken it in the first place.

Retention level good as only committed students do maths.

Commentary

Information about the retention level will become available in September as students begin Year 13.

Most respondents believe that there is likely to be a reduction in the proportion of students proceeding to the full A Level. There were many expressions of concern that students are not suitably prepared for the step up to AS and A Level. This was particularly so for those a GCSE grade B or below.

In today's world many grade B students should be taking A Level Mathematics, both to open up opportunities for themselves and to ensure that the education profile of our adult population is consistent with our national needs. However, if such students embark on an A Level Mathematics course and then drop out, they are likely to develop a negative attitude towards mathematics which will then stay with them into the future, and which they will transfer to other students.

If this happens, it is likely to have serious knock-on effects. Consequently the retention rate needs to be monitored and analysed carefully. It will be important to know how many and what sort of students are dropping out of mathematics.

Stages 5 & 6

The last two Stages of the sequence could be described as the Doomsday scenario.

Stage 5 Younger students will hear that mathematics is a hard subject at AS and A Level and will therefore avoid it.

Stage 6 There will be a consequent decrease in mathematics uptake post-GCSE.

The questionnaire did not ask about these two Stages. To do so would have been asking respondents to look into a crystal ball and it might have prejudiced their responses to the other questions.

However, one teacher did look ahead and express fears that these Stages will come about.

Initially more took AS as they had done well at GCSE. Word will get out that AS is hard and then numbers will drop.

Commentary

These two Stages are what everyone wants to avoid happening. They would be a national disaster.

The recommendation of this report is twofold:

- that the monitoring suggested elsewhere really does happen;
- that outline contingency plans be drawn up as a precaution.

Teachers' observations

Throughout the questionnaire many respondents wrote comments on various aspects of the 2-tier GCSE:

- what it is like teaching it;
- deciding students' tier of entry;
- how it compares with the 3-tier.

These are collected together in this section.

Teaching the 2-tier GCSE

Some teachers welcome the fact that students who would formerly have taken Intermediate and Foundation tiers are now given access to parts of the syllabus they would not have met before.

I taught them topics such as quadratic formulae, sine and cosine rules that previously they would never have met. I am expecting at least some of my "Intermediate" group to gain A and A grades this year.*

Other comments, however, were more reserved.

Weaker C grade candidates cover less ground than previously, doing new Foundation rather than old Intermediate. Stronger C and weaker B grade probably do about the same as teachers actually focus on content from the top end of the old Intermediate tier.

Not covering all Higher syllabus for C/B candidates leaves you open to accusations of poor teaching – not "covering syllabus".

A number of respondents expressed the view that it is no longer possible to provide as good a course for B and C grade students who would formerly have taken Intermediate tier.

Having to take a paper which includes material they cannot do. This is demotivating. The intermediate paper was ideal for these students.

They preferred the Intermediate tier as a 70% paper is better than a 40%ish paper.

Many respondents regretted the lack of challenge for A and A* students.

Much of the assessment on the Higher papers is D/C/B material. The course is stultifyingly boring for bright candidates. A is for accuracy not flair.*

A/A candidates disadvantaged as fewer questions at this level. On one paper you had to get 95% to get an A*.*

Tier of entry

The most common theme was the difficulty of deciding the tier of entry for students who were likely to get grade C. 17 of the 67 responses made reference to this. Reference was also made to the high level of accuracy needed to gain the top grade at each tier.

We find it very difficult to move students to Foundation level as they have no chance of high grades and parents don't like that either! So we 'risk' majority of students by entering Higher level and worry they might not perform well enough on the day.

For C/D grade students (our GCSE target) it was extremely difficult to gauge the appropriate level to enter students (went for higher in first 2 modules and Foundation in core) but grade C rate not that good.

Disadvantages – tend to get entered at foundation level unless certain to get B meaning less students access the higher syllabus → less go on to further study of A level. Less challenge for these students. If they do get entered for higher immediately find it hard and offputting therefore less likely to take A level.

Students who come into college with D, hope to resit to get grade C (or B) we put them in for Higher, but there is lots of work they can't access, but Foundation requires v. high % in the exams to get grade C – a difficult choice (most sit Higher at our college).

Comparison with 3-tier GCSE

Teachers recognised the motivational advantage of the availability of grade C at Foundation tier.

Main advantages: lower ability pupils now have the opportunity to get a C.

Positive – The fact that all students enter an exam in which a grade C is available.

However, one respondent highlighted the difficulties now faced by very weak students.

The weakest students get demoralised by content way beyond their level. F and G grade candidates are severely disadvantaged by the new system.

The greater range of content in a tier and the knowledge that the hardest content would feature less in the examinations were generally viewed as disadvantageous.

Potential grade B students lose out as the risk of not getting a C or Higher means teachers play safe and enter them for Foundation. It's the battle of do an exam they feel confident in or do one where they know they will not be able to answer a number of questions.

Level 6 (at KS3) students (of which some can achieve grade B) we are finding often it is safer to enter them at foundation tier, so as to secure a grade C, rather than Higher and risk not getting a C grade. The old O level/CSE was much fairer as you could double enter. The 3 tier wasn't bad, but the 2-tier is proving not to be the best solution as it currently is for fairness in middle ability students.

Weak B/Strong C grade students end up feeling they are weak at the course at times as they find the A/A material too difficult.*

Pupils are no longer being educated – they are being taught to pass the exam. Higher students now not well prepared for AS level.

Not sure about effect of extra breadth in Higher. More able students may have spent less time in higher level skills.

The Higher does not stretch the more able students to the same extent as before.

Not all topics can be tested as only 25% available for the top grades.

Commentary

The availability of grade C for all students was viewed positively but teachers are often finding it harder to make decisions about which tier to enter “grade C” students for in order to ensure that they achieve their potential. This is clearly source of considerable anxiety for many teachers.

Although some students now have access to a wider curriculum, some of them are finding some of the material too difficult and this is affecting their confidence. Accuracy in doing examination questions has become more important in order to achieve the highest grade at each tier.

These comments from teachers are important as they cross the transition from the 3-tier GCSE regime to the 2-tier GCSE. They encapsulate the changes in a way that future teachers will not have the experience to do. Overall they, and other comments quoted elsewhere in this paper, show concern that the provision for many (but not all) groups of students is less good.

Many of the concerns derive from the wide range of grades covered by any examination paper and this is a feature of the particular 2-tier model that was chosen for mathematics. A recommendation of this report is that any contingency plan to improve the 2-tier structure should take teachers views, including those expressed here, into account.

Strategies

The final question invited teachers to describe the strategies their schools and colleges are adopting for dealing with the situation.

Please include anything else you would like to write about the situation, including any strategies you have developed for dealing with it.

The strategies fall into three broad categories: changing their admissions criteria for starting AS Mathematics (3 respondents), providing remedial support in Year 12 (5 respondents) and doing additional work during the Key Stage 4 course (6 respondents).

Change in admissions policy

Some centres had changed their admission policies to make it harder for students to start A Level Mathematics.

We have had to change our criteria for doing A Level from B at GCSE to A at GCSE.

Start the year with proof. Go above and beyond C1/C2, so unsuitable candidates realise their mistake and change to a course they can cope with before it's too late. Suitable candidates respond well to 'raising the bar'.

Encouraging students to study for AS/A2 Use of Maths if grade C/B.

Remedial support

The support offered to AS students often included additional practice of algebraic skills.

There appears to be a weakness in general algebraic skills from B grade students (we don't accept C grade for AS) but maybe that was always the case.... My colleagues and I are working on booster sessions for these students for early in the Autumn term.

We are issuing more 'Transition + Preparation to AS maths' booklets to foundation tier applicants for AS maths. They seem v. keen to prepare properly – a good thing.

Our main strategy is to use the FAM lessons to give students thorough algebra practice.³

Additional work at Key Stage 4

The new practice of entering a wide range of students for GCSE Mathematics early in order to maximise the number of C+ grades was discussed briefly earlier in this report. No responses referred to it. However, some schools are entering their better students early in order to allow more time to prepare for A Level, a long established practice.

Using Additional Maths for top students in Year 11. Introducing GCSE in Year 9 leading to GCSE in Year 10.

We have a top set that takes higher tier at the end of Year 10. They then go on to start AS level in Year 11, effectively giving them three years to study.

We will go beyond GCSE into AS work in Year 11 in preparation for Year 12.

We've tried to compensate for this by offering Additional Maths for our top set with the result that these A students find transition very easy but A and B students find it harder.*

Commentary

The main specific weakness identified in students starting AS Mathematics was insufficient algebraic fluency to allow them to succeed at A Level (11 respondents). Three broad strategies were identified for addressing the problem.

Some schools and colleges are providing additional support in Year 12. This is targeted particularly on the weaker AS Level students.

Other schools are teaching additional content during Key Stage 4. This is targeted on students likely to obtain A and A* at GCSE.

Evaluation of these coping strategies is recommended with promulgation of advice about those that are found to be effective.

A few institutions are increasing the entrance requirements for AS Mathematics some in terms of GCSE grade attained, or adopting a “sink or swim” approach early in the course or by directing students away from AS Mathematics. If these policies were to become widespread, many students would miss out on the opportunities that A Level mathematics makes available to them; in addition, the government’s target of 80,000 A Level students would suddenly look very distant.

The survey asked respondents about the type of institution where they worked. This information was not used in compiling this report but it is clear that the experiences of sixth form colleges, with no control over the prior education of their entrants, and of 11-18 schools are different, as are the coping strategies available to them.

Modular GCSE syllabuses

Several respondents wrote about the impact of modular GCSEs. It would appear that some schools adopted such courses at about the same time as the switch to 2-tier GCSE, making it hard to separate out the effects of the two changes. The comments were very similar.

Modular maths passes can give students 'false hope' with AS.

Since all the Mathematics GCSE specifications in 2010 are expected to be modular, the authors of this report would like to add some comments. These are not based on any responses to the questionnaire.

If a modular structure enables some students to do better at mathematics at GCSE, and to feel more confident in the subject, this has to be a good thing.

However, modular syllabuses do require careful design and this should include some synoptic elements. At A Level the pure mathematics unit C4 builds on C3; C3 builds on C2 which in turn builds on C1. This ensures that the work in C1, C2 and C3 is kept alive and not forgotten. GCSE specifications which allow students to learn topics and then forget them should as far as possible be avoided.

The AS and A Level qualification criteria require:

... sufficient synoptic assessment at A2 to test the candidates' understanding of the connections between the different elements of the subject and their holistic understanding of the subject⁵

There is no requirement for any synoptic assessment in either the general GCSE qualification criteria or in the criteria for Mathematics GCSE. Draft GCSE Mathematics specifications for teaching from 2010 became available on awarding body websites on 15 July 2009. They are all unitised. The effects of these specifications on students' understanding of mathematics should be monitored and a contingency plan drawn up for introducing a requirement for synoptic assessment in GCSE Mathematics.

In conclusion

There are broadly three ways of looking at this situation.

- There is nothing wrong with the 2-tier GCSE and teachers are worrying unnecessarily.
- There are teething problems but these can be sorted out using suitable strategies.
- The present design of the 2-tier GCSE is fatally flawed and needs to be changed.

Teachers' concerns

The survey clearly tapped into many teachers' concerns. These were often expressed in terms of students not being up to the required standard.

We expect more drop outs because students are thinking they are great mathematicians when their algebra skills are not good enough for success at AS/A2.

A casual reader could interpret many of the comments as respondents' reluctance to accept new challenges but that would be completely wrong. They were rather an expression of teachers' reluctance to see their students embark on a course, in this case AS Mathematics, on which they are doomed to do badly before they have even begun.

Teething problems

Undoubtedly the first year of a new course, or in this case a new type of intake, causes difficulties which are overcome in subsequent years because of the experience gained. Several strategies were identified for overcoming the perceived problems. It is too soon to judge whether any of these will allow any problems there are to be overcome.

Faulty design

Many of the problems identified by the respondents to this paper are direct consequences of the 2-tier model adopted in 2006. There are other possible models; indeed it was a surprise to many that this model was chosen and many of the problems now being encountered were predicted at the time.

Final thoughts

The scale of the survey described in this report was such that it is not possible to distinguish between these positions. However, it would be prudent to carry out a study of other possible models. If it were decided now that a change of model is required, it would still take some years for the necessary procedures to be completed for its introduction.

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References and notes

1. Evaluating Mathematics Pathways, Stage 5 Interim Report, Executive Summary; Noyes, Murphy, Wake & Drake; QCA; May 2009
2. QCA's statement may be found at http://www.qca.org.uk/libraryAssets/media/Maths_Factsheet_v0.3.pdf
3. FAM (Foundations of Advanced Mathematics) is a level 2 FSMQ designed by MEI and administered by OCR to help less strong students make the transition from GCSE to AS Level.
4. Data from the National Strategies for A Level Mathematics in 2007

A Level Mathematics grade	Number of candidates
A	24036
B	11732
C	8491
D	5766
E	3241
U	1150
Total	54416

GCSE Mathematics grade (where available)			
A*	A	B	C
15447	5058	368	25
3731	6108	955	31
1246	5018	1545	78
428	3185	1653	99
130	1565	1264	89
23	422	554	65
21005	21356	6339	387

Note These figures are for A Level and not AS Level. The certification arrangements make it virtually impossible to obtain reliable and meaningful data for AS Level candidates at the end of Year 12. However, the percentage of candidates with grades B and C would be expected to be higher than at A Level, with disproportionately many of them dropping mathematics after completing AS Level.

5. GCE AS and A level qualification criteria, QCA Sept 2006