
AS/A Level Mathematics modules and the UCAS tariff

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In the proposed new UCAS tariff, no credit is to be given for individual AS/A Level modules. The purpose of this paper is to argue that in the case of mathematics this position is contrary to the interests of those most concerned.

- It is not uncommon for courses in Higher Education Institutions to be undermined by the inability of their undergraduates to use mathematics as a service subject.
- Many school students, including those in identifiable groups, take one or two mathematics modules but not the three needed for AS certification. The number of these students is likely to increase.
- Students who have taken such modules are better placed to meet the demands of particular Higher Education courses. Information about these modules is relevant to admissions tutors and should be part of any overall profile.
- The effect of giving credit for individual modules would be to increase the numbers of students doing some mathematics (as opposed to none) post-GCSE.

The needs of Higher Education

There are some subjects, such as engineering and physics, where the need for mathematics as a service subject has long been recognised. This paper is not only about them, but also about the many other disciplines where it is now impossible to design undergraduate courses which meet the necessary academic standards but make little or no mathematical demands of the students.

Each year universities need an adequate supply of new undergraduates with sufficient skill and confidence in mathematics in addition to their main subject requirements. At the moment the school curriculum is not providing them. The number taking AS/A Level Mathematics (around 60 - 70 000 a year) is nowhere near sufficient. The remaining new undergraduates have done no mathematics for the last two years and so arrive with the qualification of GCSE Mathematics (*Forgotten*). This is a particularly English & Welsh problem; almost everywhere else in the world all school students continue with mathematics to the age of 18.

Two factors have made the situation worse in recent years. The first is the decline in the numbers taking A Level Mathematics, by about 40% since the early 1980s. The second is the increasingly mathematical nature of most academic work.

The new AS/A Level curriculum

This September students started on new AS/A Level courses and they are embedded in a new curriculum. Sixth form students are expected to take 4 or 5 subjects to AS Level in the first year and then concentrate on 3 in the second. At first sight it would seem that this opens the door to much wider participation in mathematics with many students taking it as one of the extra AS subjects.

We will have to wait some years before we know whether that actually happens, but there are reasons to question whether it will.

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Mathematics was the first subject to adopt modular A Levels. The MEI syllabus has now been running for some 10 years and the changes for this September are almost non-existent. Although there is to be a new AS standard, no reduction in content has been allowed (by QCA) for the early modules (if anything the reverse), and no change in the standard of the module examination papers. While this policy would be perfectly reasonable if mathematics were to be taken in isolation, it seems set to cause two major problems in the context of the whole new curriculum.

The first of these is that in most other subjects the AS Level has been made distinctly easier. There is plenty of evidence that mathematics is already harder than other subjects at A Level, and this difference is now to be increased in the new AS Levels.

The other problem arises from the expectation that students will take AS Level in one year. With up to ten years of experience of running modular mathematics courses, schools have had time to find the best pattern of entry. With average students, it has turned out to be 2 modules in the first year and 4 in the second. Mathematics departments are now being told by their senior management to do 3 modules instead of their normal 2 in the first year. Furthermore, because most schools are planning a curriculum with 4 or 5 subjects rather than 3 in the first year, the time for each subject is often being reduced.

It is thus predictable that there will be a reduction in the quality of learning in mathematics, and in the grades students obtain, as they are rushed through the early A Level work. Students will see mathematics as harder than other subjects, and they will know that they can expect poor results if they are brave enough to take it.

If so, we can expect no great increase in numbers taking the subject post-16, and quite possibly the reverse. To base policy on the idea that the new curriculum will improve the situation in mathematics would involve an act of faith that it would be hard to justify.

Groups of students

Since it is at the least open to question whether the new curriculum will, in itself, bring any significant increase in mathematics uptake, it is going to be important to encourage students to take at least some mathematics post GCSE. Clearly giving UCAS points for individual modules would do just that. There are in fact two groups of students who are likely to find themselves with one or two mathematics modules.

The first group are those who take GCSE a year early at

the end of Year 10 and then do one or two AS/A Level modules along with the rest of their GCSE subjects in Year 11. Some of these will of course go on to do A Level Mathematics but others will switch to other A Levels being left with modules which, it is proposed, will carry no credit. The practice of entering GCSE early, or of taking another qualification alongside it, is of course long established.

The second group are those who set out to do AS in mathematics in the first year of sixth form as a fourth or fifth subject and find that their overall workload is such that their main subjects are suffering. For example a student intending to read medicine would almost certainly give a higher priority to obtaining grade A in each of physics, chemistry and biology than to completing AS in another subject. Since the final A Level standards in all subjects will be the same as at present, any extra AS Levels that a student takes involve work that is entirely additional to the existing sixth form requirements. Many students who would have coped with the present curriculum will find themselves over-stretched by the new one.

Information for admissions tutors

The modules involved will inevitably be the early ones in any of the strands of mathematics and as such cover the basic ideas upon which the later development of the subject depends. It is perhaps worth noting some of the many topics covered in the early modules of, for example, the MEI syllabus.

- *Pure Mathematics 1* includes the early work on calculus (both differentiation and integration).
- *Statistics 1* includes all the concepts and terms involved in formal hypothesis testing.
- *Mechanics 1* includes a thorough grounding in Newton's Laws of Motion.

Such topics take students a long way beyond GCSE. Those who have a good grasp of them will be much better placed to understand the mathematics they are likely to meet and need while at university. This in turn will affect their degree prospects.

It is thus the case that information about such modules is relevant to admissions tutors when they are trying to assess whether particular applicants are likely to make successful undergraduates. It follows that they should be given credit in the new tariff.

The effect on student uptake

Underlying this paper is a recognition that as a nation we need more students to study more mathematics, and that this is of crucial importance for Higher Education.

Schools are not able to compel students to take mathematics in the sixth form. Rather it has to be sold to students, competing in the market place against other subjects. Failing to give credit for individual modules on the UCAS tariff will make that process all the more difficult. Students will be asked to take on an AS course which is harder than others knowing that they will receive no UCAS credit if they do not complete it.

Many of the target students will have done Intermediate Tier GCSE. These students face a problem that is particular to mathematics. Although AS and A Levels are supposed to be available for such students, the syllabuses in mathematics are in effect based on the assumption that they have done Higher Tier GCSE. The Subject Criteria (formerly Subject Core) include a list of Assumed Knowledge, much of which is in the Higher Tier syllabus. As a result those coming in to AS or A Level from Intermediate Tier have to do an amount of work that is comparable to a whole module before they even start on the syllabus proper. For them AS Level is equivalent to 4 modules rather than 3. It is thus unlikely, under the proposed arrangements, that those embark on a one year AS course will end up with any UCAS credit for it, an unattractive proposition indeed.

The situation will however be completely different if single modules attract UCAS credit. Most students appreciate the value and importance of mathematics, and will be persuadable if there is a reasonable prospect of some reward for the time and effort involved.

My prediction is that if single modules are given UCAS credit we will see a substantial increase both in those starting mathematics courses in the first year of sixth form, and also in the numbers taking a single module in Year 11. It will not completely solve the problems faced by Higher Education, but it will do much to alleviate them.

It is sometimes suggested that giving credit for less than the AS qualification is an encouragement for students to give up part way through a course. Those who put forward this argument might pause to consider whether it is preferable for students to learn the content of 2 modules thoroughly, in the given time, or to obtain an insecure and skimpy understanding of 3. They should also realise that a policy of 3 or 0 will result in large numbers of students doing no mathematics at all.

There is another point that needs to be made. Many students arrive at university terrified of mathematics. Their fear of the subject is often more damaging than their lack of knowledge because it renders them almost unteachable. School courses which take students

through the work too fast in order to complete an AS will only make this problem worse. It is much better for students to be taught rather less at a pace which allows them to build up their confidence. At least then universities will have something they can build on.

Why Mathematics ?

The argument in this paper has been given entirely in terms of mathematics. Should it be extended to other subjects ?

There are a number of respects in which mathematics differs from other subjects, and so it is entirely justifiable to make it into a special case.

- Very large numbers of students need to use mathematics as a service subject. The only equivalent subject is English.
- The number of students taking mathematics beyond GCSE is insufficient to support these needs. Consequently mathematics (or the lack of it) is actually holding many university courses back. Not many other subjects are in this unenviable position.
- The ways in which schools organise mathematics ensure that there are opportunities for students to obtain single modules. Fewer opportunities arise in other subjects. In practice many more students obtain single modules in mathematics than in other subjects. There is thus a difference in scale.
- The new curriculum will place mathematics in the position of being harder and less accessible than other subjects.

There is a case for single modules in other subjects also being given credit but the argument would probably follow rather different lines. It might, for example, be presented in terms of being fair to the students, recognising all their achievements in order to build up accurate profiles of them.

These considerations are important but they are outside the scope of this discussion paper, which concentrates on the issues which are specific to mathematics.

Conclusion

The new tariff opens a rare window of opportunity. A relatively minor decision now will bring very considerable benefits to our students in the future. They will be enabled to make more of their degree courses and so will be better prepared to fulfil their potential during their working lives.