From the Gold Standard to Silver Service?

Work in progress on a National Teaching Fellowship Project

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A level is the "Gold Standard" but this standard's immutability is becoming more debated [1]. Nonetheless, an A level pass in a particular subject is frequently essential for a place on a degree course: gaps between a student's actual attainment and a lecturer's expectations are bridged (or not) by extra work done and extra support offered. For courses like Engineering, on which a student normally embarks with an A level maths in hand, lecturers now find they must pay extra attention to supplying additional learning support for maths, such as workshops, drop-in centres, etc [2].

In this project [3], I am looking at courses in Higher Education where mathematics (which includes statistics) is essential for success in the discipline itself. These include Engineering, Science, Computing and Business where, although the maths content is integral, it is dealt with by what used to be called 'Service Maths'. Increasingly, admissions tutors in these areas cannot *require* a good A level in maths on entry, and so lecturers must address their teaching towards a majority (or large minority) whose starting position is GCSE maths or a non-traditional qualification; the spectrum of pre-HE attainment is very wide. In delivering the subsidiary - but essential – maths, lecturers vainly hope they can depend on the Gold Standard, but lacking that they must still deliver a high quality service [4]. They themselves may or may not be mathematicians, or have skills to deal with learning styles for mixed ability classes. Are universities offering even a 'Silver Service' to students?

As the National Numeracy Strategy enters secondary schools [5], teachers there are rising to the challenge of adopting new approaches to teaching, learning and assessment, setting targets and raising standards. In universities we can probably learn from this. It is maybe not sufficient to diagnose 'weaknesses' in our students, then offer them computer mediated teaching packages and drop-in facilities. To help students succeed better in their maths, we could consider what an integrated approach might involve; we must first identify our present position then build on good practice. A student can only learn 'from where they are', so ideally we should know the (maths) background of each student from the outset, be prepared to focus on their needs as well as their course requirements, and then track their success to evaluate the quality of our provision.

How well we are presently serving our students? I am collecting data on the maths qualifications with which students enter degree courses (where A level maths is *not necessarily* a prerequisite), which I then correlate with their success in the first year university maths modules. I can thus judge 'value-added' effects and variation from expectation. I shall be able to compare results from different universities and different subject areas, commenting on good practice and giving a snapshot of how well overall our students succeed in 'Service Maths': are we 'Serving them Right'?[6].

Method

So far I have data (entry qualifications, maths assessment results for the first two semesters, and approaches to teaching/methods of assessment) from several universities involving five subject areas. I report results to staff concerned, including suitably anonymised comparisons where appropriate.

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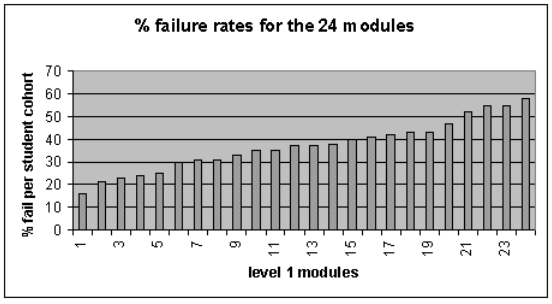
http://ntfs.ilt.ac.uk/

I typically group each cohort of students studying a module into three bands, by their maths qualification on entry. Those in the [M] band have passed maths at A level; those in the [N] band have not studied maths past GCSE. (The middle band, [A], includes students with post-GCSE experience in maths; maybe they failed A level, or passed AS level in maths, or passed another 'numerate' A level, or have foreign qualifications, or other non-standard qualifications.)

For each student I then track their success in their first year maths module(s): many courses include two of these, one in each semester. I take 'student success' in a module to be 'a pass', the lecturer's own criterion, at first attempt. The 'success rate' of a cohort (or band) is the percentage of students who pass the module at first sitting. (I disregard a pass in a resit since I believe too many resits can indicate a lack of planning or care in the system. A resit is not ideal for any student, and the existence of resits, as a safety net, can encourage staff to be complacent.)

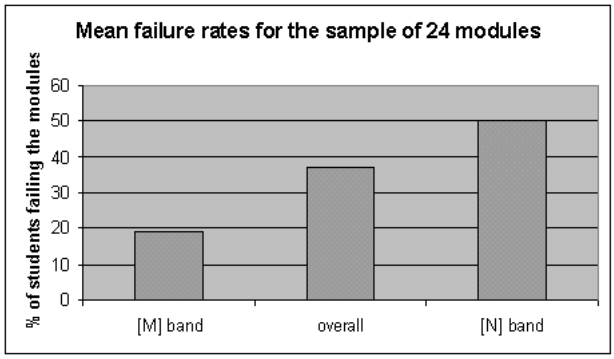
Some results to date

For a flavour of my results I present a sample of 24 maths modules (A level maths not *required*), all from 'modern' universities, which contribute to four different subject areas. The cohorts range in size from 409 students to 55 students (mean = 126), and the overall success rates vary from 84% to 42%. Thus we are failing between 16% and 58% of students enrolled on these modules. (For the failure rates overall, the mean = the median = 37%, and the standard deviation is 11%).

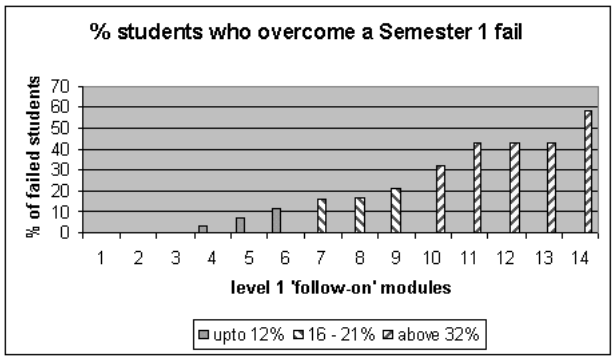


Even more concerning are the failure rates in the different bands of students in each cohort. For the cohorts considered so far, the percentage of students in the [M] band varies from 37% to 4%. This is the band containing students who have achieved maths at A level, and the recorded failure rates are surprising. They very from 0% (to be expected where 'good' students are fully competent in straightforward applications of maths), to 67% (which is hard to understand at level 1); the mean failure rate is 19% (median 16%) with s.d = 17%.

The [N] band forms between 10% and 66% of each cohort, and the failure rates here are very worrying indeed. They vary from 14% to 78%, with a mean of 50% (median 51%) and s.d = 17%. So on average half of these students fail their maths, and I wonder: are these failure rates down to admissions policies, or lack of care by lecturers, or ?



Fourteen of the twenty-four modules are 'follow-on' modules at level 1; usually they are in semester 2, depending on a particular semester 1 module as a prerequisite. Due to the linear nature of mathematics, it is clear that students find it very difficult to follow a failure in semester 1 with a success in semester 2. For the follow-on modules, I have determined the percentages of students who overcame a fail in semester 1 by succeeding in semester 2. In six modules the percentage is no more than 12%; in only five of the modules did more than 30% of the students overcome a previous fail; in no module was the percentage who did this greater than 60%. (There are five modules where not one of the [N] band students who failed in semester 1 managed to succeed in semester 2; where this happens repeatedly is it justice to allow students to proceed?)



Some conclusions

If the figures quoted above are representative (and I have no reason to believe otherwise) surely we cannot be content with how we are servicing students' needs? Maths modules in the first year are virtually all 'core' and essential to the courses. If our admissions criteria are correct, - if we are delivering quality in terms of teaching and learning support, - if we are using appropriate assessments, - then we should not be failing 37% (on average) of our students in maths in their first year of Higher Education. More importantly, where students with only GCSE maths are admitted to courses whose maths entry requirement is just that, then we should not be satisfied with the probability that fully half of them will fail their maths modules.

The 'First Year Experience' is crucial to success in HE: basic work and skills are consolidated, motivation is enhanced and productive patterns of work are fostered and developed. We must be aware that 'a fail' in a semester 1 maths module leads so often (invariably, it seems in some cases) to another fail in semester 2. Unless we are prepared to modify our approach to teaching (taking more account of students' antecedents? looking closely at the expectations of the syllabus? delivering materials in ways that support students better?) could we be accused of carelessly demoralising and damaging students?

In universities, a module's assessment in mathematics is summative for one semester's work, but it often represents the threshold attainment for the next semester's work in maths and/or other disciplines. Although 'all students are adults these days', we have a duty to guide and support their learning in maths. I feel we should monitor success rates very critically, and be prepared to take action, so that we can justify our delivery of a quality ('Silver') service.

Only part way into this Project, I feel I have uncovered many more problems than solutions. I should be pleased to hear from colleagues who may wish to discuss matters/offer data/become involved. With more information, I hope be able to report on wider trends, areas of good practice, and suggestions of ways forward.

References

[1] *Measuring the Mathematics Problem,* Engineering Council, 2000

[2] *A guide to the establishment of a successful mathematics learning support centre.* A C Croft, *Int. J. Math. Educ. Sci.Technol*, 2000, vol 31, No 3, pp431-446

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[4] *Following up cycles of QAA subject assessments for non-mathematicians.* A C Croft, *MSOR Connections,* May 2001, pp17-18

[5] *Framework for teaching mathematics: Years 7, 8, 9.* DfEE, April 2001, www.standards.dfee.gov.uk/numeracy

[6] *"Serving" our students right!* P A Egerton, *Proc.Undergraduate Mathematics Teaching Conference 2000*, ed D Emery, pub Sheffield Hallam University Press, p37