Following up cycles of QAA subject assessments for non-mathematicians

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The stated mission of the Quality Assurance Agency for Higher Education (QAA) is to promote public confidence that quality of provision and standards of awards in higher education are being safeguarded and enhanced. In addition to auditing institutional arrangements for managing quality and standards, it assesses the quality and standards of teaching and learning at the subject level in each university. A subject review report is published for each institution following each assessment visit. On completion of each subject assessment cycle, i.e. when all universities offering that subject have been reviewed, the QAA publishes *subject overview reports* [1]. One advantage of an overview report is that it is one step removed from particular institutions. It represents a distillation of the findings of many reviewers visiting scores of universities. It can thus provide a snapshot of the state of health of teaching and learning throughout England and Northern Ireland in that subject. But a subject overview report looks at a specific discipline, or occasionally a group of cognate disciplines. It is useful to take one further step back and look at the overall picture provided by reports in several disciplines. Such an investigation reveals an interesting and commonly occurring theme: the ill-preparedness of incoming students for the mathematical demands of university science and engineering degree schemes, and its consequences.

A look at some Subject Overviews

The subject overview report on Chemical Engineering states:

Mathematics is of particular importance, as it underpins most aspects of the subject. A source of major concern to providers is the steady decline in the mathematical expertise of entrants to courses. This has resulted in a requirement for remedial mathematics tuition, thereby placing great strain on staff delivering already overcrowded curricula.

The subject overview report on Electronic and Electrical Engineering states**:**

Completion rates on undergraduate degree programmes range from 90 per cent to 40 per cent. Many of the reports express concern at relatively high failure rates in the first two years of undergraduate programmes. Failure is mainly due to the difficulties students experience in acquiring the essential mathematical skills.

Moving to Materials Technology we find**:**

The assessors describe progression through about one-quarter of programmes as high, but in the assessment reports of some 60 per cent of providers it is a cause for concern, particularly for the first year of the programmes. The reasons for the disappointing performance have variously been attributed to semesterisation/modularisation, students' financial difficulties and deficiencies in students' mathematical and scientific skills.

On Mechanical, Aeronautical and Manufacturing Engineering the overview states:

A significant proportion of entrants to engineering programmes need additional support to develop the mathematical knowledge and skills required to study engineering at HE level. The pass rates at the end of the first year vary from

55 to 68 per cent. Failure is commonly due to deficiencies in mathematical skills and many students are able to retrieve their position with additional tuition in basic mathematics.

In Chemistry:

The recruitment of students with modest prior achievements in chemistry or, especially, mathematics requires that institutions are careful to offer remedial tuition, perhaps in the form of 'bridging courses'. The introduction of such courses has helped to overcome some of the perceived deficiencies in factual knowledge brought about by changes in school curricula, but at considerable cost to both academic staff and to the incoming students.

In Molecular Biosciences.

Several institutions have found it necessary to increase support for first-year students to provide essential knowledge in chemistry and mathematics.

Common threads

So, common threads running through many of the reports include

- Decline in mathematical expertise
- Lack of mathematical preparedness
- Diversity in mathematical skills within groups of students
- The need for universities to provide additional support
- Mathematical difficulties cited as reason for failure/withdrawal
- Increasing pressure on teaching staff and on an already crowded curriculum

Of course, for those who teach mathematics to these groups of students this information will come as no surprise. There have been many reports by learned bodies, together with research findings from several independent sources which provide substantial evidence that there are serious problems associated with mathematics education in universities, particularly, though not exclusively, for non-specialists (See e.g. [2], [3], [4]). But the mere fact that there are these common threads running through many subject areas in the majority of universities assessed suggests that there may be some ways in which the problem of lack of basic mathematical skills amongst undergraduates can be attacked at a national level.

The onus is clearly on universities to address these problems and the LTSN is uniquely positioned to make a significant contribution. It is apparent though, that the problem exists in a larger domain of influence than that of a single LTSN Centre. Whilst LTSN MSOR is well-placed to contribute, much of the mathematics taught to engineers and scientists is delivered from within their own departments, the staff of which may have little or no contact with LTSN MSOR. Consequently LTSN Engineering and LTSN Physical Sciences have roles to play too. Indeed the mathematics problem manifests itself across so many other areas, such as Business & Management, and Economics. I propose that the interface problem is sufficiently important and adversely affects such a large proportion of the university intake that it ought to be regarded as a generic issue, and its treatment adequately supported and resourced at the generic level.

References

[1] QAA Subject Review Reports: http://www.qaa.ac.uk/revreps/subjrev/intro.htm
[2] *Measuring the Mathematics Problem*, 2000, Engineering Council, London.
[3] *Mathematics Education Framework for Progression from 16-19 to HE* (1999) R Sutherland & H Dewhurst, University of Bristol, Graduate School of Education.
[4] *University Challenge (2001),* M Savage & A C Croft, Times Educational Supplement, Curriculum Special, 19 January 2001, p8.