Maths support for non-specialist students in science and engineering departments

Report on Day Workshop, Monday 25 November 2002
University of Wales, Swansea

A fuller version of this report, with live Web links and resources, can be found on the Web at http://ltsn.mathstore.ac.uk/workshops/maths-support

This one-day workshop, organised jointly by the LTSN Maths, Stats & OR Network and LTSN Engineering, attracted 33 academics from 19 institutions. Participants were given copies of a Facts and Formulae leaflet, Algebra and Calculus Refreshers and the handbook on Good Practice in the Provision of Mathematics Support Centres. Further copies of these can be provided on request; bulk supplies of the leaflet are available free of charge, and the Refreshers currently cost £125 for 100 copies.

1. *School/university interface - what can students do? A view from the chalkface - Adrian Wells, Penglais School, Aberystwyth*

Although Wales is not obliged to encompass fully the government's numeracy strategy, this and the changes of Curriculum 2000 do constrain and change the way that mathematics is presented in schools there as elsewhere - pressure to teach for good exam results rather than understanding. Students in year 12 lack academic maturity - they can follow the mathematics in the AS modules but can't see the overall picture, so do not perform to their potential when taking exams in that year. This is exacerbated for students that were advised to take Intermediate rather than Higher GCSEs (usually in the interest of the school rather than the student). Other students may be advised - sometimes by the careers service - not to take A level mathematics on the basis that is too hard and better grades could be obtained in another subject.

Adrian outlined some of the changes that are being proposed for the A level curriculum for 2004. He also led discussion on what can be expected from students who are entering HE without A level maths. While the Intermediate GCSE includes some algebra (solving simple linear and quadratic equations) and trigonometry (right angled triangles), lack of practice in years 12 and 13 mean it gets forgotten. Students with a C grade in this exam will usually have some number facility (apart from division), but their estimation skills are likely to be poor.

Penglais is a large comprehensive with eight teachers capable of teaching mathematics at A level, and is able to offer all the AS and A2 modules for single and double maths. In sharp contrast a number of schools have to rely on peripatetic teachers for A level input. One radical solution would be to remove mathematics as a compulsory subject at GCSE. This would have a further benefit in removing the complacency of some teachers - without a captive audience they would need to develop new ways of presenting the subject in order to attract and keep their students. Adrian appealed to maths educators at all levels in Wales to work together so that the perspective in school mathematics goes beyond A level exams.

2. *Holistic support materials - Tony Croft, Loughborough University*

Tony runs a Maths Support Centre at Loughborough for students from across the university. The experience is that tutors can't prepare for the sort of question they might be asked. Student background is extremely varied - on some courses students with only GCSE sit alongside those with A level mathematics. And lecturers' expectations may be way out not only on what students can do mathematically, but also what they can do for themselves. Senior university staff are not fully aware of the problem, and are sometimes appalled at the low level of what is being taught.

There is a range of provision within the Centre:

- Pre-sessional: the Algebra Refresher is sent out in advance to 300 engineering students so they can practice their skills before starting the course. This has been well received, and a Calculus Refresher has been developed along similar lines. Questions from the Refreshers are being developed for Web delivery within AIM - see http://mat111.bham.ac.uk
- Paper-based diagnostic test - helps to inform the Support Centre what materials should be in place
- Hundreds of help leaflets, each less than two sides of A4. Some of these are in a series, eg Business Maths Foundations, or Engineering Maths First Aid Kit
- Formula sheets, useful for students and for staff
- A programme of lunchtime workshops, run by an ex-schoolteacher, covering basic topics on a rotating basis. The programme is emailed to all students

- Drop in surgeries. Students want someone to sit down with them on a one-to-one basis, and this can happen in the afternoons when a rota of mathematics staff are timetabled to spend an hour in the Centre
- Specialist support, eg for students with dyslexia. Students registered as disabled will bring funding from their local authority to subsidise this type of support.

There is little use of computer-aided learning materials by either tutors or students, but students use tools like spreadsheets, Maple or Matlab to do mathematics when required by the tutors.

One delegate asked whether he should encourage his dyslexic son to take up engineering and the consensus was that he should. People with dyslexia often have valuable creative skills - but they need to check what support is available at any given HEI before applying to study there.

3. *Use of technology to support mathematics teaching - Joe Ward, HELM project (Helping Engineers Learn Mathematics)*

The aim of this project, which is funded by HEFCE under its Fund for the Development of Teaching and Learning (FDTL) is to produce flexible learning materials to support engineering students. Much has already been done at Loughborough, where the traditional lecture-tutorial system was too rigid for a diverging intake and an open learning course is now running driven by an intensive testing regime. Materials already developed include first year workbooks, computer-aided learning segments and over 2, 500 questions for web delivery. The project will revise these materials and develop new ones for the second year; test and evaluate their effectiveness; prepare supporting material for academic staff; build a network of consultants to assist in implementation in other institutions; disseminate the final products across the sector; and provide ongoing support for those adopting the materials.

Deliverables will include 40 workbooks covering first and second year engineering mathematics; engineering-related problems, some of which need to be tackled using computer algebra; case studies that emphasise modelling; computer-aided assessment banks; and a guidebook for staff. The project is looking for examples from different branches of engineering; applications for different computer algebra systems; and departments that are interested in trialling the materials either now or from next October. More details from helm@lboro.ac.uk

4. *Good Practice in the Provision of Mathematics Support Centres - Duncan Lawson, Coventry University*

Duncan reported on a project funded by the LTSN Maths, Stats & OR Network, which carried out a comprehensive survey of Maths Support Centres in HE institutions. He summarised the background, the project methodology, the results and the outcomes, which include a handbook detailing good practice, and went on to talk about the development of online provision at Coventry. This had been enhanced by adding a bank of test questions. Some 800 tests were taken each month during April and May. For each topic not answered successfully, students are referred to a handout. The site can be viewed at http://www.mis.cov.ac.uk/maths_centre

5. *Student support using a streamed system - Colin Steele, UMIST*

Colin outlined the mathematics provision at UMIST, which is currently provided by the mathematics department to all other departments including the foundation year. Streaming was introduced to address the increasing diversity of the student body. The more advanced students learn more topics at a faster rate - for example they would have three lectures on complex numbers including De Moivre's theorem; the middle stream would have four lectures including the theorem; while the weaker students learn the essentials at a rate which enables them to 'survive' (four lectures not including the theorem). Students are assigned to a range of streams, determined by their host department, after taking a diagnostic test at the beginning of their first year and also referring to previous mathematics qualifications. Moves between streams are allowed, for example to increase options in the final year. Assessment varies by stream, the more advanced doing coursework and the less advanced having regular class tests, but all take exams at the end of each semester. Most departments weight the streams equally, but a small number scale up the harder courses; a few engineering departments use streaming in the second year.

Colleagues could implement a similar scheme if students numbers are large enough to give reasonable class sizes, but should note that there needs to be an active coordinator in the mathematics department, an active director of studies in each service department and good communications between all. A copy of the diagnostic test used at UMIST is available.

6. *Looking to the Future - Tony Croft and the MathsTEAM project*

The MathsTEAM project was funded by LTSN to produce case studies relating to the teaching and learning of mathematics in science and engineering departments. These will be launched at the IMA conference on the Mathematical Education of Engineers to be held in Loughborough from 2-3 April - see diary for details.

Substantial funding has been made available by LTSN and FDTL for a UK Mathematics Learning Support Centre, which will develop a resource base available to all university staff and students. During the final session of the day ideas and suggestions were invited, with the following results:

- make the website well-structured and easy to navigate,
- allow customisation to the user by a login that will remember what the individual is looking for. Alternatively allow users to choose a "view" of the website that will only display resources relevant to their own needs. For example, on the Mathstore website it is possible to choose a "mathematics" view or a "stats and OR" view
- consistency across all institutions and maybe relate to schools as well
- videoclips that can be seen any time, by someone students can relate to (rather than a TV personality). It was noted that the project is currently looking for tutors to carry out this role
- basic statistical materials
- links to computer algebra packages
- materials suitable for mature students, as some of those seeking support might be on master's courses
- very basic pre-A level material - percentages, fractions, brackets. Alison Whitehead mentioned the "Maths Bridge" book by Phil Thorns (published by Alpha Workbooks) which prepares young people for AS level when they only have Intermediate GCSE.

A fuller report of this and other maths support workshops with up to date details and references can be found on the Mathstore website at http://ltsn.mathstore.ac.uk/workshops/maths-support

First Announcement for UMTC 2003

Dr Neil Gordon, University of Hull
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UMTC
Undergraduate Mathematics
Teaching Conference

The Undergraduate Mathematics Teaching Conference is a working conference that provides an opportunity for lecturers and others interested in mathematics in Higher Education to share ideas concerning undergraduate teaching, learning and assessment.

Following the second organising committee meeting, UMTC 2003 has now been fixed as a 3-day event running from Monday 1st to Wednesday 3rd September . We hope that this will make the conference more convenient for colleagues, whilst maintaining the core elements that have made UMTC so popular in the past.

For those unfamiliar with UMTC, the conference includes plenary sessions by invited speakers, and presentations by delegates. However, most of the conference is spent working in small groups working on briefs relating to undergraduate mathematics. The reports from the groups are refereed as part of the events of the conference, and the finished reports form the major part of the *published* proceedings.

The specifications for the briefs are still being finalised, but the following topics have been selected:

1. Engineering mathematics – coping with students with diverse mathematical backgrounds:
2. Assessment – eg ideas on 'setting good questions', assessing deep learning, and production of best practice guides
3. Virtual Learning Environments in mathematics education
4. Maths Education – a group related to the LTSN 'mathematics as education co-researchers' project
5. Financial mathematics
6. Teaching Probability
7. Performance Indicators for Teaching.
8. Responsive programme design.

Given the wider context - where there are many projects now in progress aiming to promote and develop mathematics teaching - we are aiming to liase and work with ongoing FDTL4 and LTSN projects and the above briefs will link with the relevant projects where possible.

Fees for UMTC have been reduced to £240 for early registration**. Registration forms and electronic registration will be distributed shortly.** Copies of the proceedings of last year's conference will be sent out to mathematics departments later in the year. Copies of some previous year's proceedings are available at the UMTC web site: http://www.umtc.ac.uk/

If you have any queries about UMTC, or think you can contribute something to UMTC, then I would be glad to hear from you.