
Widening Participation in MSOR

Bill Cox
Aston University

w.cox@aston.ac.uk

Penny Bidgood
Kingston University

p.bidgood@kingston.ac.uk



A learning and teaching
project funded by the LTSN
Maths, Stats & OR Network

Mathematics, Statistics and Operational Research (MSOR), like many other subject areas, continues to face the problem of recruiting and educating a more diverse student population. This is fuelled nationally by the Government's push to wider participation in HE generally [1] and also the need to supply appropriate graduates in industry and commerce and as teachers of mathematics [2].

The MSOR community, as a whole, has had a diverse student intake for some time with its breadth of degrees in the subject area and the differing required qualifications for entry. Recent changes to the A-level structure [3] suggest that the incoming students' background will become more diverse. Many universities now have specific funds to encourage wider participation and have outreach activities raising the profile of their programmes and also the aspirations of schoolchildren in areas that do not traditionally send people to university. Although it is difficult to gauge how individual subjects fare from these activities, by offering a variety of degree programmes from mathematics as a single honours subject to combined studies programmes and by having a range of entry qualifications, the MSOR community already makes a significant contribution to widening participation.

As part of the LTSN funded *Where Are We Now* project, designed to identify and disseminate good practice in HE MSOR provision, this article uses a recent survey of QAA MSOR reports [4] to describe some of the things providers are doing to widen participation and support such students. The broad issues are:

- recruitment from more diverse sources
- retention of a wider intake cohort
- realising the potential of a wider pool of students

While all UK quality assessment/subject review reports have been included in the survey, actual figures given below are a snapshot taken from the individual or overall subject reports in the QAA Subject Review of MSOR in England and Northern Ireland.

Recruitment for wider participation

The MSOR community has done much to meet the challenge of widening participation by both broadening entry qualifications and by attempting to attract a greater diversity of intake in terms of gender, ethnicity, social background or age. In recent years 82% of entrants [5] to undergraduate programmes in MSOR were school leavers with A-levels. Most of the remaining 18% of entrants had successfully completed a foundation, Access or similar course. A-level scores ranged between 9 and 40 with an average of 19. 40% of providers admit students with an average points score of between 9 and 15. Required grades in A-level mathematics therefore vary considerably between institutions, and with them the extent of prior mathematics knowledge expected. Some institutions aim to attract well-qualified students and manage this successfully, for example Warwick has an average intake score of more than 29 A-level points. Other institutions aim to recruit from a diversity of backgrounds with a range of entry qualifications, for example at North London 40% of the entry come with non-standard background. Reports suggest that often these students gain creditable degree results.

Many institutions give opportunities to non-standard applicants through foundation courses set up with local FE colleges, Access courses aimed at mature (ie over 21) students or introductory courses leading to a four-year

degree. Again, there is evidence from the reports that such students are successful in their degree studies (particularly after a foundation course) showing substantial added-value. An appropriate HND where students can progress to a degree after year 1, or on completion, has provided a useful stepping stone for those unable to enter directly at degree level. Such students are often very successful eg at Ulster 50% of former HND students gained a first or upper second class degree.

Apart from educational background the student body in MSOR varies considerably between institutions. The percentage of male entrants varies from 40% (eg Liverpool Hope) to 91% (Huddersfield) with an average of 62%. The percentages of mature students also varies greatly, eg they comprise 80% of the total at Bolton to zero at Durham; however, more than 40% of providers recruit significant numbers of mature applicants. Many universities recruit 'locally' eg over half of Plymouth's students are from the South-West, whereas at Northumbria the majority are from the north of England.

We now turn to efforts that individual providers have made to widen participation that have been commended in subject reviews, in terms of:

- outreach to pupils, teachers, parents and career advisers at national and regional level
- provision of alternative entry routes and a broader range of programmes
- recruitment aimed at particular groups

Outreach: Perhaps the most common way to increase recruitment is to improve links with schools and colleges and some providers are very proactive here. For example, Bangor was commended for its interactions with the local community through its Royal Institution Masterclasses for young people in Gwynedd. Bath [6] has recently started a scheme in which schoolteachers are invited to shadow lecturers and lecturers carry out reciprocal shadowing in schools. Whilst this is aimed at easing the transition to university generally, it does keep staff in schools and universities informed about developments in their curricula, and raises the profile of the subject and the institution in schools, thereby encouraging recruitment. Hull is piloting a scheme in which its postgraduates help in local schools to improve the progression of pupils through key Stage 3, GCSE and ultimately to HE mathematics. Liverpool was commended for its local and regional development by spreading appreciation of maths through local organisations such as Liverpool Mathematical Society and Mathematical Education on Merseyside. Portsmouth widens participation through a successful programme of school visits. The University of the West of England

(UWE) produces a magazine, *Tempus*, with circulation to more than 1800 schools in the South and South West regions to stimulate interest in Maths. It also hosts Bristol-Bath Master classes for 12-13 year-old pupils, and runs workshops for teachers. Warwick leads a 'Further Maths by Distance Learning' project funded by MEI-Gatsby which aims to encourage more pupils to choose Further Mathematics under the Excellence in Cities initiative.

Alternative entry routes: Many institutions have Foundation courses usually taken at a local FE college which form level zero of a degree course; others are linked to Access courses. Brunel's Mathematics department hosts the University's Foundation of Science programme and benefits from this by substantial conversion to mathematics each year. As well as this type of Foundation year Coventry offers a one-year, part-time, pre-degree course leading to the University Certificate in Mathematics. Bolton was highly praised by the QAA for all aspects of its Polymaths course. This is a one-year part-time access course providing an alternative route into higher education, tailored specifically to the needs of mature students who do not have A level mathematics. At Hull a foundation year delivered at Wyke College under a franchise arrangement with the university has proved effective in widening participation. The students on the foundation year have access to all the support and facilities offered to campus students and take part in a programme of activities during half-term breaks.

The Open University (OU) encourages extensive participation in degree level maths. This was not so apparent in the past because their degrees were not named - they did not formally produce a graduate mathematician. However, they have recently moved towards named degrees and this will see a welcome stream of graduate mathematicians with diverse backgrounds. UWE allows suitable HND students to transfer to BA in either their first or second year. Portsmouth also encourages those without the necessary pre-requisites to enter their degree courses through an HND route as does Glamorgan.

Recruitment aimed at particular groups: Some providers have targeted particular groups, eg Northumbria provides evening 'taster' sessions for mature students. The MSOR group at Huddersfield contributes to its university's pre-Foundation access-type course Women Into Technology module, commended by the reviewers. Hull has an advanced diploma course linked with a PGCE qualification that acts as a conversion course for graduates in other subjects who have A-level maths or equivalent which has led to an impressive record of sending

graduates out into Maths teaching. Hull was also commended for its high proportion of female entry in mathematics.

Retention

Wider participation will generally have implications for the whole provision including curriculum, teaching and learning methods and student support. Considerations here include:

- flexible modes of study - full-time/part-time, distance learning, etc
- flexible time-tabling arrangements
- match of curriculum to intake profile in prior mathematics
- academic student support eg streaming, recovery opportunities, diagnostic tests, etc
- bridging courses/pre-enrolment opportunities
- close monitoring of student progress
- supportive environment, good staff-student relations, focused support and guidance, peer support from students, etc
- academic support facilities such as resource centres
- special needs support, disability support, etc; equal opportunities, language support
- Financial and personal support, hardship funds, etc

The main approach to retaining 'non-traditional' students and coping with the diversity they bring is to provide a first year curriculum with appropriate support that is matched to the diverse abilities of the wider intake, and to provide flexible pathways and learning opportunities that enable students to play to their strengths. The importance of this is highlighted by a recent report of the Learning and Skills Development Agency [7]. It concludes that in FE the quality of teaching, the course design, the match to students recruited, and the level of support, especially at the transition to HE/employment, are the most significant factors affecting student progress and achievement. It is likely that the same applies for HE.

Bath has an effective and flexible pathway through its programmes in that students who, for whatever reason do not reach honours level at the end of first or second year can return to honours by a 'recovery programme'. This provides a safety net for non-standard entry and has had a positive impact on progression. Birmingham was also commended for the match of its curriculum to the intake and for careful remedial and bridging arrangements. Brunel is another institution that has modified its curriculum to provide better support for the transition. Chester, which takes students from very wide background including Access, also has a carefully

designed curriculum, involving a high level of academic support. Like a number of institutions Chester was commended for their flexible attendance patterns for part-time students or mature students, meeting their special circumstances. Huddersfield has a free bridging course over the summer providing a computer-based self-paced programme of mathematical pre-requisites for potential entrants to a selection of courses at university. Keele responds to varied background in the first year with tests and individualised consolidation programmes. Kingston has a first year core designed to support diverse intake. Liverpool welcomes participation by part-time and mature students and runs a Foundation year for non-A level students. Liverpool also has a special skills programme for mature students and overseas students. North London has a HND route into BSc and good access, bridging modules and other flexibility in the curriculum. Block timetables help part-time students. The OU has a highly flexible curriculum designed to meet the wide diversity of its intake. Wolverhampton has a range of introductory modules for students entering with wide range abilities and students with little prior knowledge in maths can obtain good degrees. Curricula and scheduling are designed for flexibility for part-time students and for those with commitments elsewhere.

As well as providing appropriate match between intake skills and the curriculum, and flexible and supportive pathways and curriculum structure, it is also important for retention that effective supportive structures and facilities are in place to support the wider range of students. Recently there has been great emphasis on easing the transition to university because of weak mathematics background [8]. MSOR providers have long been familiar with this issue due to the need to respond to increased participation and changes in pre-university curricula and in this respect mathematics has been in the vanguard of wider participation and its support. For example it is now common practice to establish 'Support Centres' for dealing with students' (from all disciplines) problems with mathematics, particularly on entry [9]. So, many of the required support mechanisms to meet a wider intake pool are already well advanced in MSOR, and there are a number of other LTSN funded projects in this area. Here we will simply outline some commended activities that specifically relate to support for the wide pool of intake due to widening participation.

Bolton offers tuition in small groups (typically between six and fifteen students), providing an opportunity for more interaction than a traditional lecture setting, and individual pastoral care informed by extensive experience in catering for mature students and students with non-standard backgrounds. Chester was commended for the

high priority it places on welfare of non-standard applicants, its computer-based diagnostic testing, peer mentoring, good staff-student relations, hardship fund and job-shop. Hull was commended for its equal opportunities provision. London Guildhall identifies students with special needs on application and puts appropriate support in place at an early stage. North London was commended for its student support and guidance strategy specifically designed for a wider range of intake. It has effective personal tutor support and Maths workshops and language support and drop-in facilities. The OU student support strategy recognises the part-time, home-based nature of the student population and an open-entry policy, paying careful attention to each applicant's background.

Realising the potential of a wider intake pool

It is one thing to recruit and retain students from a non-traditional background, but quite another to ensure that the full potential of these students is achieved to the same extent that 'traditional' students enjoy. Considerations here include:

- evidence of good progression regardless of prior background
- evidence of added value in achievements and awards
- assessment matched to student profile
- progression to good careers

To gather such evidence providers need to have means of monitoring progression, providing careers support, etc. Under QAA Subject review in England and Northern Ireland 62% of institutions gained grade 4 and the remaining 38% grade 3 in Student Progress and Achievement (SPA). While this suggests overall good performance in SPA, many of the lower grades were from universities with higher numbers of non-standard entry. So there remains a challenge in realising the potential of such students. In this respect some positive comments in the reports are given below.

Bath was commended for the way in which it maintains standards while still meeting the needs of varying abilities. At Bolton it was noted that no obvious correlation exists between entry qualification and degree classification achieved, and that mature students perform at least as well as traditional A-level entrants. Reviewers noted that the Polymaths access course in particular achieves substantial added value. Brighton was commended for its added value, particularly on the success of graduates finding employment, and the development of a Career Planning Agreement with Student Services. At Chester evidence was found that students not particularly well qualified on entry are able to achieve high honours,

indicating considerable added-value, with similar observations at Coventry and Goldsmiths. At Glamorgan the reviewers were impressed by the progression and achievement of students who had come into the degree programme through the HND route. Liverpool Hope was commended on its high pass rates in view of the diversity of intake. North London was particularly commended on the good degrees obtained by many mature students who entered with few or no formal qualifications.

In a way, providers who take students with good prior qualifications are hard pressed to demonstrate added-value, and this is rarely referred to in the reports for such institutions. However, Nottingham was particularly commended for the way in which their weaker students achieved reasonable understanding of material. Conversely, institutions with lower prior qualifications may have high attrition rates, but are never-the-less commendable in view of the entry profile. Portsmouth, for example, was commended for its performance in this respect and it was able to demonstrate evidence of added-value. And, of course, the OU accepts many students with little or no formal qualifications and many of these achieve good degrees. At Wolverhampton reviewers found clear evidence of added value where students, often mature, with few or no formal maths qualifications gain excellent degrees before proceeding to relevant jobs.

Conclusion

Quality Assessment and Subject Review outcomes testify that the MSOR community is doing much to widen participation by developing links with schools and the general community and by providing opportunities such as HNDs, Foundation and bridging courses for students to reach entry levels suitable for degree work. The community supports its students by providing a range of appropriate and flexible curricula, developing learning and teaching methodology, adapting modes of study to cater for various needs and supporting students both personally and academically. Also, in terms of value added, there is considerable evidence that much of the wider pool recruited are realising their potential with the help of this support.

This article only scratches the surface of the good practice that has been identified in this project, and further details will be published elsewhere. Those interested can contribute to this through a JISC Mailbase, MATHS-WP, that can be joined through www.jiscmail.ac.uk/lists/maths-wp.html

References

- [1] A Thomson, A Goddard, P Baty and Sanders, THES, 18 January 2002
- [2] J Henry, Times Educational Supplement, 14 December, 2001, page 11
- [3] C Sangwin (ed) (2001) LTSN Occasional paper 1/01, *Post-sixteen mathematics within Curriculum 2000*
- [4] W Cox and P Bidgood, *MSOR Connections* 1, 3, August 2001
- [5] Mathematics, Statistics and Operational Research Overview Report, Q07/2000, QAA
- [6] K Lord and J White, Mathematics Curriculum Special, Times Educational Supplement 21 December 2001, page 8
- [7] P Martinez (2001) *Improving student retention and achievement*, Learning and Skills Development Agency, London
- [8] Engineering Council (2000) *Measuring the mathematics problem*, Engineering Council, London
- [9] D Lawson, A Croft and M Halpin (2001) LTSN Occasional paper 3/01, *Good practice in the provision of mathematics support centres*

Acknowledgements

We would like to thank the following for their help in this project: Pam Bishop, Roger Bowers, Michael Butler, Chris Collinson, Neville Ford, Judy Goldfinch, Martin Greenhow, Keith Griffin, Jeff Haggett, Trevor Hawkes, Alison Hooper, Charles Ley, Paul Oman, Rob Thomson, Jane White

Support for Personal Development Planning and Higher Level Key Skills development

by John Gillespie, CDELL, john.gillespie@nottingham.ac.uk

Higher Level Key Skills, with their contribution to Personal Development Planning, are now adding value to PhD programmes in Astrophysics at Durham. To encourage similar developments, the Centre for Developing and Evaluating Lifelong Learning (CDELL) is facilitating a series of day workshops over the next few months, as well as organising a two-day conference scheduled for 28 February – 1 March.

Each workshop is planned to have short inputs from two expert practitioners in the PDP/Higher Level Key Skills area, together with other relevant figures, but the main focus of each day will be on small group interaction and working. The format is one that has proved effective before in enabling participants to gain the most from the day through 'directed networking' as well as from useful external inputs.

Each workshop will target a range of related disciplines. For Maths, Stats. and OR, the most appropriate workshop will be the Science, Technology and Engineering one scheduled for Tuesday 30 April in York. Dates for the other workshops are 21 March - Nottingham (social sciences and related areas) and 12 June - London (art, design, and architecture).

Information about the conference and workshops is available on the CDELL website at <http://www.nottingham.ac.uk/education/cdell>

CDELL has also put together a pack of Agendas, Ideas and Issues for university departments, "Supporting Key Skills in Higher Education". These materials can be obtained in printed form from Jackie Last, Administrator, CDELL, School of Education, University of Nottingham, Jubilee Campus, Wollaton Road, Nottingham NG8 1BB (jackie.last@nottingham.ac.uk).

CDELL is providing these workshops as part of its continuing Innovations-funded work with LTSN centres. John Gillespie is our CDELL contact, and he or colleagues at CDELL would also be happy to provide help and suggestions for individual departments if this is required.