Following Richard Gadsden’s article in the last issue of MSOR Connections [5] which introduced the statistics element of the Sigma Centre for Excellence in Mathematics and Statistics Support, I would like to introduce the research element of the Centre.

I am hoping to write a regular ‘column’ in MSOR Connections on mathematics support research and also report on other people’s research into mathematics support. My inspiration for this is the Mathematics Support Association which ran 3 national conferences and produced 8 newsletters between 1993 and 1999 (which I shall refer to in due course).

What is Mathematics Support?

The first question that needs to be addressed in attempting to research mathematics support is to define what it is. As far as I am aware, there is no currently accepted definition. I recently produced the following definition for an internal conference:

Mathematics (and statistics) support is a collective term for the provision of forms of teaching and learning of mathematics (and statistics) which are additional or supplementary to the main provision (which is often, but not necessarily, delivered using the standard lecture / tutorial method) on a course of study for any subject with some mathematics (or statistics) content.

The primary area of use of the term “mathematics and statistics support” is UK Further Education (FE) and Higher Education (HE).

Forms of Mathematics Support

Mathematics support comes in a variety of types. In his comprehensive survey of the types of provision of different forms of mathematics support in UK FE and HE in 1996 [1], Ian Beveridge used a list of 9 types of support:

- Bridging courses;
- Computer-aided learning (which includes computer-aided assessment);
- Diagnostic testing (often with a related follow-up strategy);
- Drop-in centres (or workshops);
- Numeracy classes;
- Paper-based open learning materials;
In [8], the Learning and Teaching Support Network MathsTEAM initiative also identified mathematics support websites as an emerging form of mathematics support. This increases the total number of recognised types of mathematics support to 10. However, this classification list does not exclude the possibility for the current or future existence of other forms of mathematics support. There is also some overlap between types of support, e.g. mathematics support websites, such as http://www.mathcentre.ac.uk, provide diagnostic testing, computer-aided learning, video clips and access to paper-based resources; computer-aided learning, computer-aided assessment and diagnostic testing are all related to each other.

“It is also possible to identify other groups of students, apart from those who have disabilities, who may benefit from a ‘personalised’ support approach”

Apart from the types of support identified above, which may be appropriate to all students, support for specific groups of students with special needs has also been developed. These include:

- Support for specific learning difficulties (SLDs), such as dyslexia and dyscalculia [15] which also requires screening;
- Support for students with physical disabilities, e.g. partially sighted students [2];

A new area of support currently being developed at Loughborough University is for students with mathematics anxiety [6].

It is also possible to identify other groups of students, apart from those who have disabilities, who may benefit from a ‘personalised’ support approach, such as students with non-standard entry qualifications for a particular course [14], although this kind of alternative proactive teaching for targeted groups of students may not strictly be classified as support in the additional.supplementary sense of the definition given above.

In addition, mathematics support may take on different forms according to its content and context, e.g. statistics may best be supported by an advisory service [5] – a form of tutoring; support for courses with a lower level of mathematical content may best be positioned within an academic services centre within student services in order to break down barriers of anxiety, fear and misconceptions or prejudices about mathematical identity [10].

Mathematics Support Research

Research into mathematics support includes the following:

- Why does mathematics support exist?
- Why do students need mathematics support?
- Why are students who need mathematics support studying on FE or HE courses?
- How much of a decline is there in the absolute ability standards of course entry level students?
- What are the alternatives to providing mathematics support and how do they compare in terms of efficacy and economics?
- In what ways is the teaching of mathematics changing and how does this relate to current or future mathematics support, e.g. the current internal virtual learning environment revolution [9]?
- What is the current state of provision of mathematics support in the UK?
- Research into currently identified types of mathematics support, especially their effectiveness and new developments, e.g. adult numeracy and diagnostic testing.
- Research into the use of currently identified forms of mathematics support for specific groups of students, especially their effectiveness and new developments, e.g. student groups identified through the widening participation agenda.
- Research into new forms of mathematics support, including the related proactive teaching methods being used by Sigma (and elsewhere) and the use of new technologies in mathematics support, e.g. mobile technologies, such as video MP4 players.
- How fluent are students in what they are supposed to know and how able are they to learn new material (especially students at entry level)?
- Where should mathematics support be positioned, to whom should it be targeted and how should it best be advertised within an institution?
- What are the foundations of mathematics support as a pedagogical method, including its pedagogical origins?
- Research into student profiling (apart from entry qualifications, SLD screening and organised diagnostic mathematical testing), e.g. psychometric assessment or an adaptive personal diagnosis (like a doctor would diagnose a patient’s need)?
How can we encourage students to use and engage with the mathematics support which is provided for them and how can we best measure their use and engagement?

How can we best encourage students to become more independent learners so that they become less dependent upon support as they progress with their courses [4], e.g. through the provision of study skills support [3] [7] or by encouraging the acquisition of problem solving skills [13]?

How can we best advise institutions to start or improve their mathematics support provision?

How can mathematics support centres best train and develop their staff?

Many of these research areas have become fairly well understood and have accepted answers; several have well formed research communities, such as the Dyslexia and Dyscalculia Interest Group (DDIG), which has its own website (http://ddig.lboro.ac.uk/) and organises its own conferences. Some issues are currently being addressed (or are about to be addressed) through (partly) Sigma-funded PhD research studentships and research fellowships. Others are less well understood or agreed upon and do not have well formed research communities.

I hope to address some of these research areas and communicate other people’s work in future articles.

Invitation for Contributions

As part of my role in Sigma I am carrying out a review of current mathematics support research. My long term aim is inspired by a project I was involved with a long time ago: to develop a mathematics support handbook [11] [12]. This handbook will detail what support exists (according to its form, content, target student group and quality) and how it should best be used. It is hoped that a first version of this handbook will be produced as an outcome of the research review.

Please feel free to contact me if you have a contribution.

References