Mathematics and Statistics are relevant to many areas of study but there is a national recognition that students are now entering Higher Education without the basic mathematical skills necessary to underpin their subjects. This problem is particularly acute in technical and science-based subjects but is also an issue for social sciences and business-related courses where statistics and/or financial modelling are required. The lack of basic maths skills can have huge implications for the retention and progression of students on courses with a large mathematical component.

In order to address this problem and to help bridge the gap between school, college or work and University, the Faculty of Construction, Computing and Technology at Nottingham Trent University has established a Maths Support Centre. The Centre is run on a drop-in basis and provides additional one to one support for students in the Faculty who are taking mathematics modules or who need help with the maths or statistics they have encountered in other modules.

This paper will describe the experience of setting up and running the Centre and the use made of it by students in 2003/4.

Introduction

A survey of Engineering Departments at 42 UK Universities conducted by PROGRESS in 2001 [1] reported that

• Dropout rates among first year Engineering undergraduates average 15.5% for traditional universities and 21.8% for non-traditional universities.
• 75% of the subject areas identified by academics as problematic for engineering students have a high mathematical content.
• 43% of institutions have changed the maths curriculum or mode of delivery as part of their retention/progression programme.
• 94% of academic staff believe there is a mathematical skills gap on entry into HE

So what is this skills gap and how has it developed?

There is a consensus amongst those with experience of teaching numerate disciplines within HE, reflected in the literature, that the root causes lie in changes to the post-14 secondary mathematics curriculum and in the drive towards widening participation.

In ‘Making Mathematics Count’ [2] Professor Adrian Smith identifies ‘the failure of the current curriculum…to satisfy the requirements and expectations of…higher education institutions’. Changes to the A level Mathematics curriculum between 1960 and 2000 (most notably in the 1990s) and the effect upon students entering HE are reported in the Engineering Council’s report ‘Measuring the Mathematics Problem’ [3]. Here and elsewhere the main causes of the mathematics problem are identified as:

• increased modularisation (leading to segmentation of content and a reduction in multi-stage, multi-skill problem solving)
• changing content, with the introduction of statistics and a reduced emphasis on algebraic manipulation, geometry and formal proof
Developing Maths Support

Sarah Woodhouse

• lack of practice as ‘drill’ has become unfashionable
• the fall in numbers of well-qualified mathematics teachers
• a general decline in interest in numerate disciplines, even among capable students, leading to a lack of competition and hence reduction in entry requirements for some HE courses

In addition to changes in what students can be expected to know pre-entry, the Government policy to have 50% of under 30 year olds in some form of HE has led to recruitment to degree courses of students from diverse backgrounds and with a range of entry qualifications including BTEC, HND, GNVQ, Foundation and Access courses as well as A level. Thus, the life and academic experiences of students entering HE today can be very different from those of the former traditional university entrant.

Universities have had to adapt to these changing circumstances and, in order to help those students who have not had the opportunity to develop the mathematical skills required by their degree courses, have increasingly provided additional support, often in the form of drop-in support centres. In April 2003, the School of Engineering and School of Property and Construction at Nottingham Trent University used Widening Participation funds to appoint a mathematics teacher (the author) to set up and run a Maths Support Centre for their students. The core responsibility for the post was to ‘develop structures to enable students to bridge the gap between school and university learning in mathematics, and support students’ learning outside the classroom.’

The purpose of this paper is to describe how students’ learning was supported in 2003/4.

What kind of support?

In 2000/1, an LTSN funded project [4] surveyed existing Support Centres in order to identify successful strategies and good practice. They identified four common features of successful maths support:

• one-to-one tuition
• the provision of a non-threatening, supportive, informal environment
• non-judgemental acceptance of the students’ mathematical needs, however basic
• teachers outside the students’ department who are not perceived as part of the formal assessment procedure

Student feedback consistently showed that, however delivered, it was the one-to-one support that they valued most.

After surveying the literature, visiting the Support Centres at Coventry and Loughborough Universities and discussing with lecturers and course leaders at NTU the mathematical needs of their students, it was decided to run the Maths Support as a drop-in centre where one-to-one support would be available to all undergraduates but with priority given to first years. Most first year students would already be taking a module in mathematics and the drop-in facility would be additional to the lectures, seminar groups and individual support from tutors already provided.

Resources

The main resource was the full-time mathematics teacher who provided the tuition and ran the Centre. In addition, two mathematics undergraduates were later recruited to work two or three hours a week as ‘maths mentors’. Worksheets from ‘The Engineering Maths First Aid Kit’ [5] supplemented with worksheets produced by Coventry University comprised the main paper resources. Algebra [6] and Calculus [7] Refresher booklets were purchased with money from the NTU Alumnus Fund and made available to students. Two computers were also purchased from this fund.

The Support Centre was centrally located in a dedicated room in the Newton Building. The room was carpeted, spacious and airy with wooden tables, comfortable chairs, blackboards and noticeboards. It made a pleasant working environment for students who increasingly used it as a workroom, especially when revising.

The Centre was open on a drop-in basis for 15 hours a week, as shown in Fig 1, although appointments could be made at other times.

![Fig 1 Centre opening times](image-url)
Communication

Having set up the Centre, it was vital to ensure that students knew about the mathematical support available and to encourage them to use it. Students were informed in the following ways:

- Short presentations were given to groups of first year students as part of their induction programme or during the first teaching week, and some tutors included the Maths Support Centre in their tour. It was emphasised that the Centre was a service for the students and was not part of any formal assessment.
- Posters were put up on noticeboards in offices, central areas and on corridors
- All lecturers in the relevant Schools were emailed with details and were asked to encourage their students to use the Centre.
- A news item was placed on the VLP for each first year course in Engineering or Property and Construction
- A screen-saver was designed to appear on computers used frequently by students in the faculty.

As the year progressed, students identified as being ‘at risk’ were also contacted personally by letter or email.

Use of the Centre

The database

An Excel database was set up to record for each visitor

- Name and student ID number
- Course and year
- Date and time of visit
- Area of maths enquiry

It was originally hoped that each visitor would login on arrival and the database was designed to require only the student ID, from which other information would be retrieved automatically. This proved difficult to implement, partly because it was not possible to get a definitive list of students but also because logging-in impeded the friendly informality needed to get students to use the Centre. The Maths Support teacher therefore asked each student for their name and course and completed detailed records at the end of each session. All the numerical information about use of the Centre is based on these records.

How many students?

In 2003/4 150 students used the Centre, making 427 visits between them; thus, 35% of visits have been first visits and 65% return visits. This ratio changed very little throughout the year and was similar for different courses and years.

The distribution of the number of visits made by the students is shown in Fig 2:

![Frequency of visits](image)

**Fig 2 Number of visits made by students**

Many students who made only one visit did so because they had a single, specific enquiry or because they attended for one period of intensive revision. Students who visited more frequently were generally those who attended regularly to consolidate work done in lectures and tutorials (often mature students) and others who extended their revision over a longer period.

Use of the Centre varied from week to week as shown in Fig 3, and attendance appeared to be largely assessment driven, the peaks corresponding with tests and exams.

![Visits each week](image)

**Fig 3 Number of visits by students per week**
Typically, students received between 30 minutes and 1 hour’s tuition per visit, although during the revision periods students increasingly used the Centre as a work base where they could call upon help as required. (These visits are not included in the figures unless support was given.)

Which students?

One purpose of the Centre was to bridge the gap between school or college and university and this is reflected in the fact that 71% of users were in year 1. These first years made 69% of the visits.

Of the targeted first years, 13% used the Centre (in line with the experience of other maths support centres). The second years who attended the drop-in centre came mainly from Civil Engineering (Foundation, BSc and BEng) where at each level the maths required was relatively demanding given the students’ prior qualifications. Some computing students on the second year Applied Maths module, who had not studied A-level maths, also visited the Centre, as did a small group of construction students studying financial management.

The students who made best use of maths support were those who were confident in themselves (although not necessarily with maths), well motivated and well organised. They were often mature students who quickly recognised their need for support and took early advantage of the help offered. Other students who became regular attendees discovered Maths Support later in the year as they became more focused and more able to identify their own needs. These students also made good progress. A few conscientious students who were already fairly confident with maths used the support to raise their marks even higher.

Many students used the drop-in for revision purposes only. This was successful for those who had either worked hard on their own during the year or who were mathematically able and could work quickly and intensively on new material. Some students unfortunately found Maths Support too late.

There were certainly students who encountered no problems with the taught mathematics on their programmes and who did not attend the Centre because they did not need additional support. There was also a minority of disaffected or uncommitted students who rarely attended lectures or seminars and did not respond at all to personal contact; these students were very difficult to reach or help. The students who remain of concern are those who presumably knew that they were struggling and who were aware that help was available but who still chose not to come to the Centre and subsequently failed their maths module.

What sort of maths?

Fig 4 shows the relative frequency of enquiry about different areas of maths. 28% of visits were by students engaged in revision covering several areas of mathematics.

![Fig 4 Frequency of enquiry about different areas of maths](image)

Mentoring

In addition to the one-to-one tuition at the drop-in facility, two mathematics undergraduates were appointed during the year as ‘maths mentors’ to work with first year students who had not used the Centre but who had been identified as being ‘at risk’ mathematically. This was intended as a development opportunity for the mentors as well as an alternative form of support for students struggling with the mathematical content of their courses. Students were contacted personally by letter or email (see Fig 5) and offered the chance to join a small study group led by one of the mentors. Despite careful targeting, the take up rate was disappointing, although the students who participated were enthusiastic about the scheme and made excellent progress.

![Fig 5 Students invited to work with ‘maths mentors’](image)
Subsequent advice from other institutions with experience of running similar schemes has been to target the courses students find mathematically difficult rather than the weaker students.

**Feedback**

Towards the end of the year, feedback sheets were sent out to students, via their lecturers and course tutors, asking them about the service provided by the Maths Support Centre; 159 students responded.

- 98% of respondents were aware of the Maths Support Centre, suggesting that the effort put into communication was worthwhile
- The most successful means of communication were
  - Lecturers (58%)
  - Induction talks (34%)
  - Posters (22%)
  - Letters and emails (17%)
  - Word of mouth (11%)
- Those using the Centre were very happy with the support received (although two said that the Centre was too busy).
- The main reasons given by those not using the Centre related to the opening hours. However, none of these students had contacted the Centre to ask for help outside the advertised times as they had been encouraged to do.

The written comments were nearly all positive, for example

‘Easy to understand and helpful’
‘I needed additional help to understand the lectures’
‘I use the maths support to understand the things that I was not sure about in class’
‘Good teaching – I understood the subject straight away’
‘Having gone to the maths workshop I have improved considerably at maths and I intend to keep going regularly throughout the rest of the year’
‘The support I have received has helped me greatly’

**Looking Forward**

The success of Maths Support in its first year has led to its being rolled out for all undergraduates at NTU in 2004/5. This has involved establishing a base on two sites and it is anticipated that much of the need, particularly for students studying Business, Economics and Social Sciences, will be for support with statistics.

**Conclusion**

At NTU as at other universities, maths support has become a key element in enabling wider access to HE. It is clear that first year students entering university with limited qualifications or confidence in maths can, with support and hard work, develop the skills and knowledge required to gain a degree in a numerate discipline. Feedback from staff and students at NTU suggests that by providing a non-threatening, supportive, informal environment in which to learn the Maths Support Centre has in its first year helped many students to meet the mathematical demands of their degree courses.

**References**