Introduction

Harper Adams University College offers a range of university courses in rural and land-based subjects, including engineering. All students at Harper Adams study mathematics or statistics as part of their chosen courses. The engineering students appreciate the necessity of mathematics in their engineering courses; this does not however prevent students from finding it difficult, and across the college all courses include some study of statistics, which the majority of students do reluctantly.

Since the late 1990’s, there has been much concern about the difficulties students encounter with mathematics, statistics and general numeracy at university, both nationally and across the college. At Harper Adams links were shown between these difficulties and issues with student retention and progression, so in 2001/2 in response to these concerns curriculum changes were made and a part-time mathematics support provision was introduced, which has since been developed and extended. Students are supported by a part-time mathematics support tutor in one-to-one appointments and by optional group sessions aimed at specific modules. Support was aimed particularly at first years to help bridge any gaps between students’ knowledge and the requirements of their degree courses, and this remains the key focus of support provided. The effects of the mathematics support and curriculum changes were positive; improving student performance and confidence.

Support is currently provided for engineering mathematics, mechanical science, statistics modules, computer packages and for dissertations, and remains available on a part-time basis. Demand for support for different subject areas rises and falls according to student workloads and submission deadlines, and revision support for examinations is also an important service offered. The Aspire CETL awarded to Harper Adams enhanced the mathematics support provision, which since 2006 has been based in the converted Aspire Centre, and some CETL funding has contributed to the development of new resources.

This article describes the mathematics and statistics support provision with examples of student needs and student feedback.

Background of Mathematics Difficulties

Much work has been done over the past decade to gather evidence of the difficulties faced by students making the transition from school to university, and the help which some students will need in order to succeed in mathematical subject areas. In Measuring the Mathematics Problem [1] evidence was presented of ‘a serious
The results are used to inform and ratios, is administered with a brief questionnaire and varied questions, including arithmetic, percentages, algebra college. A 10 minute screening test comprising 20 short induction programme of new students enrolling at the University College by a part-time support tutor who is also employed as a part-time lecturer in the engineering sciences, in particular to allow students with different mathematical skills at entry to flourish. 'Mathematics and related analytical topics' as the primary cause [2]. At Harper Adams a study was conducted into student progression across the college, which concluded 'there was a strong (95 to 98%) probability that the lack of GCSE Mathematics Grades 'A' to 'C', was a significant factor in the withdrawal of students from the 1995 HND and Degree entry to the college.' [3]

Recognising that students have a wide range of skills and that some have needs and difficulties, then requires a response from universities to address these needs. In the foreword to the Kent and Noss report on 'Mathematics in the University Education of Engineers', Richard Haryott highlights 'the need to resolve how changes could be made to the teaching of the engineering sciences, in particular to allow students with different mathematical skills at entry to flourish.' [4]. At Harper Adams University College part of the response to the difficulties experienced by students and the college in the learning and teaching of mathematics was the introduction of mathematics support for students.

Mathematics Support Structure and Subjects Supported
Mathematics support is provided at Harper Adams University College by a part-time support tutor who is also employed as a part-time lecturer in the engineering department teaching mathematics, mechanical science and previously some information technology. When the position was originally created, the main roles of the support tutor were specified as follows, and have remained broadly similar:
- Numeracy screening of new students;
- Student mathematics support, both for individuals and small groups;
- Provision of support materials;
- Increase college staff awareness of students' numeracy and mathematics; and,
- Evaluation of progress and future planning.

Numeracy screening is conducted each year during the induction programme of new students enrolling at the college. A 10 minute screening test comprising 20 short varied questions, including arithmetic, percentages, algebra and ratios, is administered with a brief questionnaire and explanatory presentation. The results are used to inform college tutors, and weaker students are encouraged to take up opportunities for help during their courses.

The support was originally aimed at first year mathematics for engineering students and the college-wide first year statistics module, both of which had experienced poor student results pre-2001 [5]. The support has been extended each year and is now offered for the following:
- First Year Engineering Mathematics;
- Second Year Engineering Mathematics;
- First Year Mechanical Science;
- First and Second Year Statistics;
- Excel, SPSS, Genstat and Mathcad packages;
- Dissertation/Project Analysis; and,
- Mathematical topics across college.

The means of delivery of support is primarily in one-to-one and small group situations, but the range of support provided is as follows:
- Individual appointments booked in advance
  Booking can be made on a booking sheet on the tutor's door, alternatively some arrangements are made by e-mail.
- Small group support for students on mathematics, statistics and mechanics modules
  In particular, the first year engineers have weekly timetabled slots for mathematics and mechanics support, which are publicised by small posters from the start of the year. The general first year statistics lectures are also shadowed by weekly drop-in group support sessions, which are widely publicised.
- One-off workshops for mathematical topics
  Various workshops have been developed for particular topics occurring in courses which have a high mathematical content e.g. elasticity in economics, drug calculations for veterinary nurses, and valuation calculations for surveyors. These workshops have been found to run more successfully when course tutors have been involved with the arrangements and publicity.
- Revision / Assignment Support
  Larger drop-in sessions have been arranged (in larger rooms) and publicised when examinations or assignment hand-in dates were approaching, which enables more students to receive help during times of greater demand.
- Support materials
  The standard lecture notes provided for Harper Adams students are the main materials used in student support, often students have required extra help to be able to do the standard work set. Additional in-house materials have been developed progressively for the mathematics support over the six years, sometimes in...
the format of summaries of knowledge required, or as an alternative resource complementing lecture notes and supplementing the supply of library books. External sources of resources are also used, if appropriate, for example, the mathcentre [6] and mathtutor [7] resources and web-sites, from which the partial fractions resources have been excellent support for engineering students.

Support for Dyslexic Students

Harper Adams University College has a relatively high proportion of students who are dyslexic. Some dyslexic students have taken up mathematics support, particularly engineering students. The effects of dyslexia on learning mathematics have been found to vary from student to student, from relatively little effect to wide-ranging. Many dyslexic students consider that they take longer and find it harder to learn mathematics and statistics than their peers. However, analysis of student marks in mathematics and statistics assessments has repeatedly shown that Harper dyslexic students’ marks are not significantly different from non-dyslexic students’ marks in these subjects. The mathematics support provision does have some features which have been particularly beneficial for dyslexic students:

- working at the students’ pace;
- provision of formula sheets and worked examples;
- module handouts (standard provision at Harper);
- single support tutor can build relationships with the students, and,
- encouragement!

Developments in Support Provision

In recent years, the number of workshops offered to provide extra tuition on mathematical topics has been extended, see the full list given above. In 2006/7 positive feedback was obtained for these workshops: Valuations 4.4, Elasticity 4.6 and Statistics Support workshops 4.7 (out of 5). Students also provided comments on what they had found useful, some of these comments are listed below:

‘General clear structure for help with % & valuations’;
‘All the session. I find maths very hard’;
‘Step by step ways to do various statistics’;
‘The summary sheets given were very useful’;
‘Getting different, slightly simpler notes was useful’; and,
‘Was explained so that we could understand’

Another recent development was some additional statistics resources, which were written for ANOVA, Chi-Squared tests and t-tests. These have been well-received by students (mean student rating 4.5 of 5), with high student demand. The content of the leaflets was generally: explanatory text, examples by hand and computer output, conclusions and recommended books. Examples of student feedback are given below:

- ‘Very detailed, more so than any notes I’ve had in the past. They also explain what the tests are used for which I’ve never understood before.’
  Veterinary Nursing student; and,
- ‘I found Sarah Parsons’ statistics worksheet a useful reference with clear examples given.’
  Taught postgraduate student college feedback.

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Student Feedback

Student feedback on the mathematics support provision has been sought by various means during the six years that the service has been available. Feedback questionnaires were given to supported students in the first two years: 2001-3. A difficulty with this approach lay in not knowing the most suitable time to administer a questionnaire (e.g. not knowing when was the last occasion that you saw a student), also students may have been inhibited in their responses by the lack of anonymity and the presence of the tutor. In 2004, an e-mail questionnaire was sent to the whole student body, to which a relatively small number of responses were received, but those received were representative of all modules for which support had been provided and portrayed a useful range of student views. In 2005 and 2006, large surveys were undertaken into students’ learning of mathematics and statistics, and questions regarding mathematics support were included. In 2007 similar, but smaller, surveys were conducted. Student comments regarding mathematics support have also been forwarded from the central college student monitoring, examples of which are given below.

Overall, from all the various methods of seeking student feedback, the feedback obtained has been positive. Ratings for the service provided are generally between 4 and 5 out of 5 (5 being excellent), see for example Table 1 on the following page detailing students’ most recent ratings of mathematics support. Feedback and ratings regarding the timing of the support are sometimes slightly lower than for other aspects, because it can be difficult to fix appointments and regular support at times which are
the most convenient for every student, particularly during times of peak demand.

Examples of central college student monitoring comments regarding mathematics support in 2006/7 are given below:

- ‘Lots of extra help if required’ Engineering student;
- ‘Excellent, thoughtful support’ Engineering student;
- ‘Very helpful support’ Engineering student;
- ‘Taught us for statistics – broke it all down into 2 hours – helped with assignment – very useful’ Veterinary Nursing student;
- ‘Very thorough and explained well’ Surveying student; and,
- ‘Students definitely need her’ Negotiated Studies student.

As can be seen from the range of comments above, the students’ feedback is generally positive.

Ongoing Challenges

Whilst many features of the mathematics support are now well-established at Harper Adams, some challenges remain. Availability at peak times can be an issue as many students leave getting help until close to exams or assignment hand in dates. Close co-operation with lecturers is necessary to ensure that support is consistent with module content and expectations from students. Each cohort of students need encouragement to seek support, some students prefer to avoid mathematics rather than get help which they might need, resulting in some students not seeking the help they need. One 2006/7 first year engineering student wrote this comment regarding mathematics support ‘I think it is useful and should have used it more’.

Conclusion

The mathematics support is now well established at Harper Adams University College. During six years of mathematics support provision many hundreds of students have received help, for which much positive feedback has been obtained. Many students who received support, and have now completed their courses, have achieved good degree classes and must be considered worth the investment to help these students. The Aspire CETL has provided an improved working environment and other benefits. Each successive intake of new students needs to be informed and encouraged to take up the opportunities for help available. The nature of mathematics support provided must continue to respond to changes in the college curriculum and the needs of students, in order to continue to have a positive effect on students’ experiences and achievements in this university college.

References


