centre for excellence
sigma Σ
in mathematics & statistics support

mathematics learning support in UK higher education

the extent of provision in 2012

National HE STEM Programme

As part of its work within the National HE STEM Programme **sigma** has produced a series of good practice guides which provide valuable information for staff involved in providing mathematics support. These reports cover how to set up a mathematics support centre, gathering feedback from students, training postgraduate tutors and evaluating mathematics support. The following guides can be downloaded from the mathcentre website:

- Croft, T. and Grove, M. (eds) (2011) *tutoring in a mathematics support centre: a guide for postgraduate students,* sigma, <http://www.mathcentre.ac.uk/resources/uploaded/46836-tutoring-in-msc-web.pdf>
- Green, D. (2012) *gathering student feedback on mathematics and statistics support provision a guide for those running mathematics support centres*, sigma, <http://www.mathcentre.ac.uk/resources/uploaded/sigma-brochure-for-accfeb5-finalv1opt.pdf>
- Mac an Bhaird, C. and Lawson, D. (2012) *how to set up a mathematics and statistics support provision*, sigma, <http://www.mathcentre.ac.uk/resources/uploaded/51691-how-to-set-upfinal.pdf>
- Matthews, J., Croft, T., Lawson, D. and Waller, D. (2012) *evaluation of mathematics support centres a review of the literature*, sigma, <http://www.mathcentre.ac.uk/resources/uploaded/52487-evaluation-of-msc-7.pdf>

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The Centre for Engineering and Design Education

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Introduction and Background

In 2005 Coventry and Loughborough Universities were awarded Centre for Excellence in Teaching and Learning (CETL) status and **sigma** – Centre for Excellence in University-wide Mathematics & Statistics Support was formed. The five year CETL-funding period has been followed by two years of National HE STEM Programme funding which ended in July 2012. It is therefore now considered timely to capture the extent of mathematics learning support across the UK HE sector. For the purpose of this study, mathematics learning support is associated with the provision of mathematics or statistics support additional to that provided by lectures, tutorials, examples classes and personal tutorials. This study builds on earlier work that was undertaken independently in 2000 and 2004:

1) In 2000, a study funded by the Learning and Teaching Support Network (LTSN) was undertaken to determine the extent to which universities in the UK were providing mathematics support and to disseminate the findings. Lawson, Halpin and Croft (2001, 2002) established that 46 out of 95 responding institutions did provide additional support for mathematics. They also highlighted that the students regarded the provision of one-to-one support as the most helpful element of such support.
2) In 2004 a further study was undertaken by Perkin and Croft (2004) to determine the extent to which universities in the UK were providing mathematics support and to disseminate the findings. In this survey 106 universities were contacted and 101 responses were obtained. From these responses 66 institutions offered some form of additional mathematics learning support.

Some universities that did not offer mathematics learning support at the time of the 2004 survey have, since then, been granted **sigma** funding and now offer support. However, it was not known how many of the universities that were identified in the 2004 survey as offering support still have this provision or how many, if any, have introduced support without **sigma** funding.

There have been curriculum changes and a number of influential reports and policy changes which may have impacted on the number of students needing mathematics support at university. For example, there have been changes to the General Certificate of Education Advanced Level (GCE A Level) Mathematics since the previous survey. Prior to September 2004, modular A Level Mathematics examinations usually consisted of 6 modules, of which 3 were pure and 3 applied. However, from September of that year changes were implemented. The content of the 3 pure modules was spread over 4 modules with only 2 applied modules being taken. Therefore, the new A Level is comprised of 5/6 of the content of the previous A Level. Although they do not cover as much material as was previously the case, it may be that material is covered in more depth resulting in greater understanding of the topics. Furthermore, Advanced Subsidiary (AS) Level Further Mathematics is now available to more students, mainly as a result of the work of the Further Mathematics Support Programme (http://www.fmnetwork.org.uk/) and students undertaking this qualification have encountered more mathematics than was the case for those taking only A Level mathematics prior to 2004 (Porkess, 2003). The number of students taking AS Level Further Mathematics has grown from 3,371 in 2003 (Taking Maths Further, MEI, 2010) to 20,954 in 2012 (The Joint Council for Qualifications, 2012).

However, not all students have studied mathematics at advanced level. In 2010, the Nuffield Foundation reported that the proportion of the population in England, Wales and Northern Ireland studying mathematics after the age of 16 is lower than in any of the other countries that were surveyed. In 2011, The Advisory Committee on Mathematics Education (ACME) also reported on the number of young people studying mathematics after the age of 16:

> *We estimate that of those entering higher education in any year, some 330,000 would benefit from recent experience of studying some mathematics (including statistics) at a level beyond GCSE, but fewer than 125,000 have done so.*

The report, *Solving the maths problem: international perspectives on mathematics education* (Norris, 2012) claimed that *"English universities are side-lining quantitative and mathematical content because students and staff lack the requisite confidence and ability"*.

Also in 2012, it was reported that post-16 mathematics is not taught at a level that meets the needs required for undergraduate study in STEM subjects. Furthermore, STEM graduates do not always have the skills and knowledge required by employers (House of Lords Select Committee on Science and Technology, 2012).

The above are examples of the numerous investigations, reports and publications concerned with the 'Mathematics Problem' since the 1990s. Despite the huge amount of time devoted to producing these reports, it is clear that the problem remains unresolved.

It is possible that the extent of student support in mathematics, and other subjects, may be increased with the introduction of the new fee structure that commenced in the 2012/2013 academic year. It is not only that student expectations regarding support and contact time are likely to increase but also institutions charging the highest fees may be obligated to provide additional student support; in the face of this obligation many are declaring their provision of mathematics support in their Access Agreements with the Office for Fair Access (OFFA).

Methodology

Using results from the 2004 study and the websites of the Higher Education Funding Councils and the Department for Employment and Learning, Northern Ireland, names and details of universities were obtained. A total of 119 universities in England, Scotland, Wales and Northern Ireland, that have their own degree awarding powers, were selected and these are listed in Appendix A.

Prior to contacting any of the universities, a preliminary task was to identify, from the web site of each institution, whether or not there existed evidence of the provision of mathematics learning support. From each university, where support was found to be in existence, a contact name, email address, details of the support available and the URL were recorded. For the universities where evidence of support was not found a member of staff associated with teaching mathematics or engineering was selected. All members of staff whose names had been selected were then contacted by email and asked to complete the survey.

All institutions were assured that their response would remain anonymous as was the case in the earlier surveys.

The Survey

The main focus of the survey was to ascertain, as far as possible, the number of universities providing some form of mathematics learning support and to determine details of such provision. The opportunity was taken to pose two other questions. One related to the dissemination of information about their support provision, and the other to the existence of engineering education centres. The email containing all three questions (see Appendix B) was sent individually to the selected contacts at each of the 119 institutions.

For the universities from which a response was not received, another department (if applicable) or member of staff was then contacted and if this failed to elicit a response, a third and then, if necessary, a fourth member of staff was selected and contacted. Finally, members of the **sigma** regional hubs contacted the remaining non-responding institutions.

We report on the findings from questions 1 and 2 in this publication.

Response Levels by University Category

The 119 institutions that were included in this survey were categorised by their "mission group". The groupings used were:

- Russell Group (http://www.russellgroup.ac.uk)
- 1994 Group (http://www.1994group.ac.uk/)
- University Alliance (http://www.unialliance.ac.uk)
- million+ (http://www.millionplus.ac.uk/)
- Cathedrals Group (http://cathedralsgroup.org.uk)
- Unaligned Universities (i.e., contains universities that do not belong to any group).

There are three universities that are members of both the million+ Group and the Cathedrals Group. For the purpose of this study they have been included in the Cathedrals Group. Replies were received from 103 institutions which gives an 87% response rate. For any survey where responding is optional this is considered to be high, however, it is a little disappointing as the 2004 survey elicited a 95% response rate. Table 1 details the number of universities in each group and the number who responded.

The categorisation shown in Table 1 was based on mission group membership at the start of the project (October 2011), with the exception of the well-publicised movement of four universities from the 1994 Group to the Russell Group in August 2012. There has, subsequently, been some movement between other groups that is not reflected below.

	Russell	1994	Alliance	million+	Cathedrals	Unaligned	Total
Number	24	12	20	25	12	26	119
Responses	22	9	18	24	6	24	103

Table 1: Mathematics learning support survey – response levels by university group

Findings Relating to Question 1 – provision of mathematics learning support

Of the 103 responding institutions, 88 have been identified as having some form of mathematics learning support. These findings may not present a complete picture of the existence of mathematics learning support and the details of its provision in the UK but may be deemed to be highly indicative of the situation in 2012. Comparison with the earlier surveys shows that the percentage of institutions offering mathematics learning support has grown; details are shown in Table 2.

Figure 1 shows the total number of universities in each group, the number of responding universities in each group and the number in each group that have been identified as providing some form of mathematics learning support. Of the 119 universities surveyed, 74% have been identified as offering some form of mathematics learning support. Of the 103 responding universities, 85% have been identified as offering some form of mathematics learning support.

The level of support available is wide ranging, from undergraduates offering a few hours of peer support per week in some institutions to dedicated mathematics learning support centres in others. In some institutions support is only available for first year undergraduates whereas in others it is available for all students and staff.

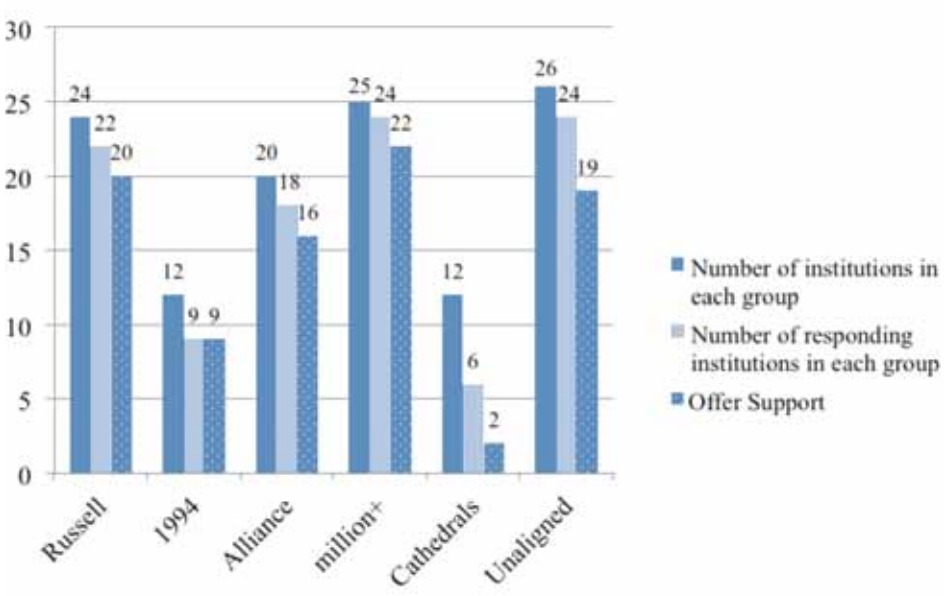

Figure 1: Extent of mathematics learning support

Year of Survey	Number of institutions offering support	Percentage Offering Support (shown as a % of those responding)
2000	46	48
2004	66	65
2012	88	85

Table 2: Percentage of responding institutions offering mathematics support

Table 3 shows the percentage of each mission group that reported providing some form of additional mathematics support.

With the exception of the Cathedrals Group the percentage of those in each mission group offering some form of mathematics learning support is similar. There was only a 50% response rate from the Cathedrals Group and of the six non-responding institutions four of them do not offer courses in mathematics or engineering. Not all universities that provide mathematics support have undergraduate courses in mathematics or engineering, however, the majority of institutions providing this support have been found to offer these courses.

Included in those institutions which have been identified as offering mathematics learning support are five whose support is of a more limited nature, details are provided in Table 4.

Two institutions, which have not been included in those who provide mathematics learning support, do offer some form of limited but specialised help; details are shown in Table 5.

In addition to the institutions which have introduced support since the 2004 survey (many with the support of **sigma** funding) almost all the institutions that were found to provide mathematics learning support in the 2004 survey are continuing their provision. However, at one institution the retirement of the support provider has resulted in reduced support and uncertainty about future provision, two other institutions are offering reduced provision due to resource limitations and another no longer provides support.

There were responses from two institutions that did not respond to the 2004 survey. One ceased to provide support in 2010 and the other would like to implement some form of numeracy support.

	Russell	1994	Alliance	million+	Cathedrals	Unaligned
Total Number Contacted	24	12	20	25	12	26
Identified as providing mathematics support	83%	75%	80%	88%	17%	73%

Table 3: Percentage of institutions, by mission group, providing mathematics support

Number of Institutions	Details of Help Available
2	Only prior to examinations
1	Can be arranged for students who are struggling
2	Optional support classes

Table 4: Institutions offering limited mathematics learning support

Number of Institutions	Details of Specialised support
1	Only for researchers and postgraduate students
1	Help with Qualified Teacher Status (QTS) tests – this will cease at the end of the 2011/2012 academic year

Table 5: Institutions offering specialised support

Russell Group Universities

In August 2012, there were 24 universities in the Russell Group and responses were received from 22 of these giving a response rate of over 91%. Of the 22 responding institutions, 20 of them offer some form of mathematics learning support. This ranges from support being provided to students who are identified as struggling with their mathematics to support centres that are open five days a week.

Of the two Russell Group universities that are not listed as providing support, one offers help to postgraduate and research students and the other commented that:

> *…we do not provide any University-wide support for Mathematics / Statistics as an Institution. Broadly speaking there has not been any suggestion or requirement for this over-and-above that provided internally by individual schools.*

Nine universities detail the provision of learning support on their websites; this information is included in Appendix C. The form of support that is available and the number of universities offering it is shown in Table 6.

Russell Group	
Form of Support	**Number**
Can be arranged for students who are struggling	1
Support provided by undergraduates/ postgraduates	6
Optional support classes	2
Drop-in support prior to examinations	1
Drop-in support (provided by staff)	10

Table 6: Mathematics learning support in the Russell Group universities

1994 Group Universities

In August 2012, there were 12 universities in the 1994 Group and responses were received from nine of these giving a response rate of 75%. Of the nine responding institutions all of them offer some form of mathematics learning support which ranges from drop-in support prior to examinations to support centres that are open five days a week. At one of these universities undergraduate students have organised their own weekly support sessions that are supported by members of staff:

> *We usually provide a tutor to be present at this event in case students have questions that they can't work out amongst themselves. This is typically attended by 15-20 students each week.*

Six of the universities detail the provision of learning support on their websites; this information is included in Appendix C. The form of support that is available and the number of universities offering it is shown in Table 7.

1994 Group	
Form of Support	**Number**
Drop-in support prior to examinations	1
Once weekly drop-in support	1
Drop-in advisory service run by postgraduate students	1
Drop-in support (provided by staff)	6

Table 7: Mathematics learning support in the 1994 Group universities

University Alliance Universities

At the commencement of this project 20 of the universities surveyed were members of the University Alliance and responses were received from 18 of these giving a response rate of 90%. Of the 18 responding institutions 16 of them offer some form of mathematics learning support which ranges from provision of support when requested from module leaders to support centres that are open five days a week with some cover in the evenings. At the university that provides support when requested there are plans to increase the support available:

> *We are reviewing our current mathematics support provision and are planning a summer school. Also, we're intending to employ an Academic Development Tutor (ADT) with mathematics skills.*

Eleven of the universities detail the provision of learning support on their websites; this information is included in Appendix C. The form of support that is available and the number of universities offering it is shown in Table 8.

University Alliance	
Form of Support	**Number**
On request	1
Bookable slots only	1
Once weekly drop-in support (provided by staff)	1
Drop-in support run by postgraduate students	1
Drop-in support (provided by staff)	12

Table 8: Mathematics learning support in the University Alliance universities

million+ Universities

At the commencement of this project 25 of the universities surveyed were members of the million+ mission group and responses were received from 24 of these giving a response rate of 96%. Of the 24 responding institutions 22 of them offer some form of mathematics learning support which ranges from provision of additional example classes when resources are available to support centres that are open seven days a week with some cover in the evenings. One university that now offers support by appointment only, used to have a drop-in maths clinic:

> *The lecturer, a maths lecturer retired at the end of the last academic year. The new lecturer in maths has not as yet decided whether to continue this.*

Fourteen of the universities detail the provision of learning support on their websites; this information is included in Appendix C. The form of support that is available and the number of universities offering it is shown in Table 9.

million+	
Form of Support	**Number**
Extra classes when resources available	1
One-to-one by appointment	2
Additional support for modules with mathematics content	2
Drop-in support (provided by staff)	17

Table 9: Mathematics learning support in the million+ universities

Cathedrals Group Universities

At the commencement of this project 12 of the universities surveyed were members of the Cathedrals group and responses were received from six of these giving a response rate of 50%. Of the six responding institutions two of them offer mathematics learning support. Of the universities not offering mathematics learning support, one commented:

> *We no longer offer learning support for mathematics/ statistics within student services. It ceased in January 2010 following a service restructure. The provision was not picked up outside the service and relies on tutors delivering it as part of timetabled lecturers and tutorials.*

One of the universities details the provision of learning support on their website; this information is included in Appendix C. The form of support that is available and the number of universities offering it is shown in Table 10.

Cathedrals Group	
Form of Support	**Number**
Drop-in support (provided by staff)	2

Table 10: Mathematics learning support in the Cathedrals Group universities

Unaligned Universities

At the commencement of this project 26 of the universities surveyed were not members of any of the mission groups and responses were received from 24 of these giving a response rate of 92%. Of the 24 responding institutions 19 of them offer some form of mathematics learning support which ranges from drop-in support on one day per week to support centres that are open five days a week. One university which used to provide a "by appointment only support scheme" no longer offers this support:

> *Unfortunately, due to other pressures, lack of funding and limited available tutors, [this] is presently in abeyance. We hope to re-start it in September [2012], but that will depend on the availability of tutors to provide sufficient cover.*

Sixteen of these universities detail the provision of learning support on their websites; this information is included in Appendix C. The form of support that is available and the number of universities offering it is shown in Table 11.

Unaligned Universities	
Form of Support	**Number**
Drop-in support one day per week	2
One-to-one by appointment	2
Drop-in support by postgraduate students	2
Drop-in support (provided by staff)	13

Table 11: Mathematics learning support in the Unaligned universities

Highly Visible Centres

As noted previously, the nature, scale and range of mathematics support provision differs significantly across the institutions surveyed. In an attempt to measure the number of institutions providing a high level of support, the authors have introduced the concept of a "highly visible support centre". To be assigned to this classification the mathematics support provision at a university should have the following features:

- Staffed for at least 10 hours per week
- Discrete web pages giving information about mathematics support

Using this definition, Table 12 shows the number and distribution across the mission groups of "highly visible centres".

	Russell	1994	Alliance	million+	Cathedrals	Unaligned	Total
Contacted	24	12	20	25	12	26	119
Replying	22	9	18	24	6	24	103
Mathematics support provision	20	9	16	22	2	19	88
Highly visible centre	8	4	8	5	0	5	30

Table 12: Distribution of Highly Visible Centres

Summary of the Findings for Question 1

Since the 2004 survey there has been significant growth in the number of institutions that offer some form of mathematics learning support. Almost all institutions which were identified as offering support in 2004 have continued with their provision. However, the number of institutions offering support does not remain static; where support ceases or provision is reduced this seems, in the main, to relate to lack of available funds or insufficient strategic lead.

Although not explicitly researched it appears that the change to GCE A Level Mathematics that resulted in a decrease in content, and the significant increase in the number of pupils taking GCE AS Level Further Mathematics has not resulted in a reduced need for mathematics learning support in HE.

Finally, the perusal of university web sites has shown that, in many cases, the existence of mathematics learning support is not easy to locate; even when support is located, it is often difficult to determine a contact name. It may be beneficial not only to current students but also to institutions and potential students if those institutions that provide mathematics learning support, could consider identifying this facility on their web sites.

Findings Relating to Question 2 – publications relating to the provision of mathematics learning support

Of the 88 universities which have been identified as providing some form of mathematics learning support 86 of them answered question 2. There were 27 universities which have external publications relating to their mathematics support and details of an indicative selection of these publications, dated from 2004 onwards, may be viewed in Appendix D. There were a further ten universities that have published internally. Five of the universities that have received **sigma** funding to set up their mathematics learning support mentioned that they will be producing reports as this is a requirement of the funding they received. However, it is not clear if some of those who have published externally have also published internally; therefore institutions are only included once – either in external or internal. Figure 3 shows the number of universities in each group that have published details of their mathematics learning support.

Many of the universities which have published externally provided links to their publications or publication details.

There were 49 institutions that provide some form of mathematics learning support but have not published details of this internally or externally. Very few of whom added any comments to their answer. One university commented:

> *No papers published in this area, I haven't thought about this before.*

Comments made by universities which have received funding to set up mathematics learning support included:

> *Not yet, but hopefully soon!*

> *Not yet but this is something we would consider in the future (especially looking at how it has improved the support for Computer Science students at HE level).*

A publication that may be of interest to those who provide mathematics support is: *evaluation of mathematics support centres: a review of the literature* (Matthews, Croft, Lawson, and Waller, 2012). This publication reviews and synthesises published research that shows evidence of studies demonstrating how mathematics support professionals collect and analyse data to evidence usage of the support and the impact of the support on students, staff and the institution.

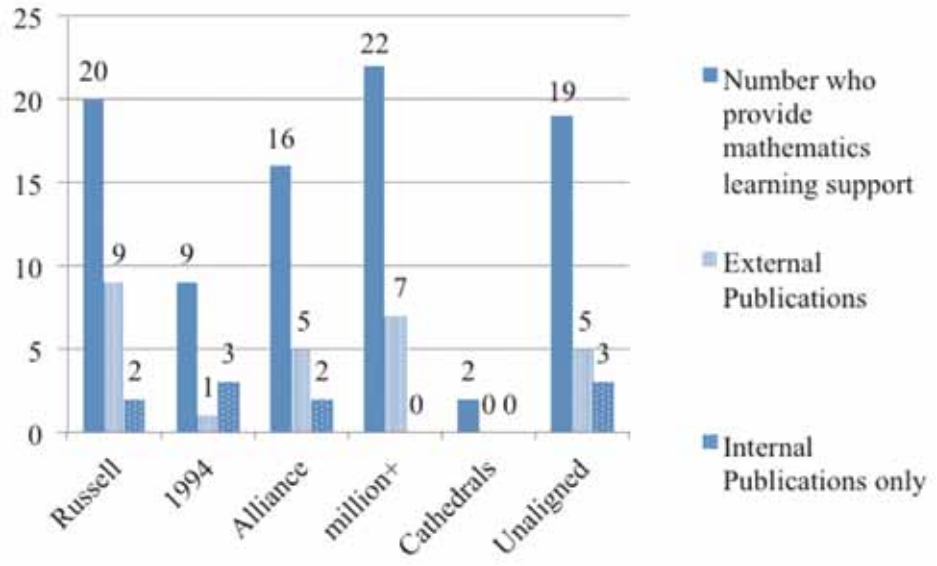

Figure 3: Universities which have published details of their mathematics learning support

Summary of the Findings for Question 2

Of the 86 universities which have been identified as providing mathematics learning support and provided an answer to this question, 31% have external publications detailing their support or findings. This is indicative of a rise in general levels of mathematics support activity and demonstrates that this support is an important and growing area. However, there are still 69% who have **not** published details of their support to the wider community. We would like to take this opportunity to urge staff to disseminate information about the support they provide as this will not only be of interest to those who are already active in this area but may also be of help to staff who are trying to implement mathematics learning support.

Concluding Remarks

The most significant fact is that there continues to be growth in the provision of mathematics learning support within HE. However, the situation is not static but the number of institutions providing such support has grown since the 2004 survey and is now approaching universal provision. The majority of changes appear to be funding related, either insufficient funding to continue with support provision or, conversely, additional funding being received which enables support to be provided.

We would like to emphasise the importance of dissemination to the wider community and encourage staff to ensure that details of support provision and contact names are displayed on their university web pages. Furthermore, the sharing of support practices via journal papers and conference presentations may help to raise the profile of institutions that provide support and also be beneficial to those who would like to implement some form of mathematics learning support.

Recommendations

From this and the previous two surveys it can be seen that the provision of mathematics learning support is not static and has grown during the period from 2001 to 2012. It is recommended that funding be made available to repeat the survey during the 2016/2017 academic year. It would also be of interest to UK institutions, mathematicians and learning support providers to have the opportunity to view the picture on a wider scale. The undertaking of a European or International survey of the provision of mathematics learning support would highlight the extent to which such provision is becoming necessary for Higher Education establishments beyond the UK.

Acknowledgements

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Appendix A – Universities contacted

Universities

Aberdeen
Abertay Dundee
Aberystwyth
Anglia Ruskin
Aston
Bangor
Bath
Bath Spa
Bedfordshire
Birmingham
Birmingham City
Bolton
Bournemouth
Bradford
Brighton
Bristol
Brunel
Buckinghamshire New
Cambridge
Canterbury Christ Church
Cardiff
Cardiff Metropolitan
Central Lancashire
Chester
Chichester
Coventry
Cumbria
De Montfort
Derby
Dundee
Durham
East Anglia
East London
Edge Hill
Edinburgh
Edinburgh Napier
Essex
Exeter
Glamorgan
Glasgow
Glasgow Caledonian
Gloucestershire
Glyndŵr
Goldsmiths, University of London
Greenwich
Harper Adams University College
Heriot Watt
Hertfordshire
Huddersfield
Hull
Imperial College London
Keele
Kent
King's College London
Kingston
Lancaster
Leeds
Leeds Metropolitan
Leicester
Lincoln
Liverpool
Liverpool Hope
Liverpool John Moores
London Metropolitan
London School of Economics
London South Bank
Loughborough
Manchester
Manchester Metropolitan
Middlesex
Newcastle
Northampton
Northumbria
Nottingham
Nottingham Trent
Oxford
Oxford Brookes
Plymouth
Portsmouth
Queen Margaret
Queen Mary, University of London
Queen's University Belfast
Reading
Robert Gordon
Roehampton
Royal Holloway, University of London
Royal Veterinary College, University of London
St. Andrews
St. Mary's University College
Salford
Sheffield
Sheffield Hallam
Southampton
Southampton Solent
Staffordshire
Stirling
Strathclyde
Sunderland
Surrey
Sussex
Swansea
Swansea Metropolitan
Teesside
Ulster
University College London
University College Plymouth Marjon
University of Wales, Newport
University of Wales, Trinity Saint David
Warwick
West London
West of England, Bristol
West of Scotland
Westminster
Winchester
Wolverhampton
Worcester
York
York St. John

Appendix B – Content of email sent to universities

Provision of Mathematics Learning Support in UK Higher Education Institutions

Dear,

In 2000 the LTSN Maths, Stats & OR Network conducted a survey of the extent to which universities were providing mathematics support over and above normal lecturing/tutorial support. The results were published in two parts in MSOR Connections, Volume 1, Number 3 (August 2001) and Volume 2, Number 1 (February 2002). In 2003 I repeated the survey and the findings were published in MSOR Connections Volume 4, Number 2 (May 2004). It is now deemed timely to update the available information regarding learning support for mathematics and statistics in UK Higher Education.

1) I am interested in whether or not there exists learning support for mathematics and/ or statistics at your institute over and above that provided by timetabled lectures and tutorials.
   - If so, could you provide me with details of the available support (location, hours available, who can access the support, usage statistics, web address etc) or a contact name, and e-mail address?

2) I am also interested in whether or not you have published any papers (internally or externally) evaluating or describing your mathematics/ statistics support provision.

3) Thirdly, do you provide any engineering education support and if so is this centrally or externally funded?

As in the previous surveys, all institutions will remain anonymous in any publications. Your co-operation in this survey is appreciated.

Yours sincerely,

Glynis Perkin

Appendix C – Mathematics support detailed on university web pages

The authors apologise to any institution that may have a web site that we have not included in the list below. Please contact Glynis Perkin (G.Perkin@lboro.ac.uk.) regarding any omissions.

Name of Institution	**URL [All accessed on 24th October 2012]**
University of Aberdeen	www.abdn.ac.uk/sls/
Aston University	www1.aston.ac.uk/current-students/academic-support/ldc/maths-centre/
Bangor University	www.bangor.ac.uk/ll/study_skills.php.en
University of Bath	www.bath.ac.uk/study/mash/
University of Bedfordshire	http://lrweb.beds.ac.uk/help/pad/one2one
Birmingham City University	http://library.bcu.ac.uk/learner/Academic%20Skills%20Centre.htm
University of Bradford	www.brad.ac.uk/learner-development
University of Brighton	www.brighton.ac.uk/cem/environment/learningsupport.php?PageId=200
University of Bristol	www.bris.ac.uk/pls/helpdesk/
Brunel University	www.brunel.ac.uk/services/library/ask
Buckinghamshire New University	http://bucks.ac.uk/home_eu_students/academic_services/learning_development_unit/
Cardiff University	www.cardiff.ac.uk/mathssupport/
University of Central Lancashire	www.uclan.ac.uk/students/wiser/wiser_summer_workshops.php
Coventry University	wwwm.coventry.ac.uk/mathssupportcentre/Pages/MathsSupportCentre.aspx
De Montfort University	www.library.dmu.ac.uk/Services/LSS/index.php?page=352
University of Derby	www.derby.ac.uk/computing/maths/the_maths_society
University of Dundee	www.maths.dundee.ac.uk/teaching/mathbase.shtml
University of East Anglia	www.uea.ac.uk/services/students/let/maths_stats
University of Glamorgan	edic.glam.ac.uk/subjects/maths/
University of Glasgow	www.gla.ac.uk/services/sls/informationforstudents/mathsadvice/
University of Gloucestershire	http://insight.glos.ac.uk/departments/ss/studentachievement/Pages/default.aspx
Harper Adams University College	www.harper-adams.ac.uk/learner-support/maths-support.cfm
University of Hertfordshire	www.herts.ac.uk/news-and-events/latest-news/Problem-with-mathematics.cfm
University of Hull	www2.hull.ac.uk/student/studyadvice.aspx
University of Kent	www.kent.ac.uk/learning/academic-advice/maths.html
Kingston University	www.kingston.ac.uk/undergraduate-course/statistics-2012/learning-support.html
University of Leeds	http://skills.library.leeds.ac.uk/topic_improving_your_maths.php

Leeds Metropolitan University	http://skillsforlearning.leedsmet.ac.uk/workshops/index.shtml
University of Leicester	http://www2.le.ac.uk/offices/careers/ld/appt/mathshelp/index?searchterm=Maths%20Help
University of Lincoln	http://mathsandstats.blogs.lincoln.ac.uk/
Liverpool John Moores University	www.ljmu.ac.uk/studysupport/75948.htm
London Metropolitan University	www.londonmet.ac.uk/depts/cctm/maths/maths_home.cfm
London South Bank University	www.lsbu.ac.uk/clsd/skills/maths/index.shtml
Loughborough University	http://mlsc.lboro.ac.uk
Middlesex University	http://unihub.mdx.ac.uk/study/ldu/facetoface/maths-stats-numeracy/index.aspx
Newcastle University	www.ncl.ac.uk/students/mathsaid/
University of Northampton	www.northampton.ac.uk/info/200313/developing-academic-skills/303/maths-drop-in-workshops
Nottingham Trent University	www.ntu.ac.uk/student_services/study_support/maths/index.html
Oxford Brookes University	www.brookes.ac.uk/services/upgrade/
University of Plymouth	www.plymouth.ac.uk/pages/view.asp?page=30109
University of Portsmouth	www.port.ac.uk/departments/academic/maths/mathscafe/
Queen Mary, University of London	www.qmul.ac.uk/undergraduate/schools/educationliaison/wp/pass/
Queen's University Belfast	www.qub.ac.uk/directorates/sgc/learning/AcademicSkills/MathsSkills/
University of Reading	www.reading.ac.uk/internal/mathssupport/about/ms-about.aspx
Robert Gordon University	www.rgu.ac.uk/living/student-advice-and-support/study-support/maths-stats-and-numeracy-support
University of St Andrews	www.st-andrews.ac.uk/students/academic/Studysupport/MathsSupportCentre/
University of Salford	www.mathscope.salford.ac.uk/
University of Sheffield	www.shef.ac.uk/mash
Sheffield Hallam University	http://libguides.shu.ac.uk/maths
University of Strathclyde	www.strath.ac.uk/mathsskills/
University of Sunderland	http://sls.sunderland.ac.uk/lds/study-support-zone/maths-support/
Swansea University	www.swan.ac.uk/deprecated/engineering/deprecatedeng/currentstudents/mathssupport/
University of Ulster	http://scm.ulster.ac.uk/marcs/
University of the West of England	www.cems.uwe.ac.uk/mslc/
University of Wolverhampton	www.wlv.ac.uk/default.aspx?page=30285
University of Worcester	www.worcester.ac.uk/studyskills/657.htm
University of York	www.york.ac.uk/maths-skills-centre/

Appendix D – Indicative selection of external publications relating to mathematics learning support

Institution	Publication Details
University of Abertay Dundee	Kelly, J. (2011) Supporting Students learning in Statistics and Research Methods: ways of coping with a diverse student population. In Ahmed, S., Barnes, S. & Durkacz, K. (2011) The 4th Scottish Maths Support Network meeting 2011. *MSOR Connections*, **12** (1), pp43-45. Available at: http://mathstore.ac.uk/headocs/Connections_12_1_Ahmed.pdf [Accessed on 23rd October 2012]
Cardiff University	Gillard, J.W., Robathan, K. & Wilson, R. (2012) Measuring the effectiveness of a mathematics support service: an email survey. *Teaching Mathematics and its Applications*, **30** (1), pp43-52. Gillard, J., Robathan, K. & Wilson, R. (2012) Student Perception of the Effectiveness of Mathematics Support at Cardiff University. *Teaching Mathematics and its Applications*, **31** (2), pp84-94. Wilson, R. & Gillard, J. (2008) Some problems associated with running a Maths Support Service. In Green, D. (ed.), *CETL-MSOR 2008 Conference Proceedings*, pp94-98. Conference held 8th – 9th September 2008, Lancaster University. Available at: http://mathstore.ac.uk/repository/CETLMSOR2008_Proceedings.pdf [Accessed on 23rd October 2012]
Coventry University	Lawson, D.A. (2010) *The Drop-In Centre Model of Mathematics Support*. In Responding to the Mathematics Problem: The Implementation of Institutional Support Mechanisms, C.M. Marr & M.J. Grove (eds.), The Maths, Stats & OR Network, pp12 -16. Available at: http://www.mathcentre.ac.uk/resources/uploaded/mathssupportvolumefinal.pdf [Accessed on 23rd October 2012] Lawson, D.A. (2004) Supporting the Transition from School Mathematics to University Mathematics. In Demlová, M. and Lawson, D.A. (eds.), *Proceedings of 12th SEFI Maths Working Group Seminar*, pp95-100, ISBN: 2-87352-048-5. Conference held 14th – 16th June 2004 in Vienna, Austria. Available at: http://sefi.htw-aalen.de/Seminars/sefi2004.pdf [Accessed on 23rd October 2012]
Coventry University and Loughborough University	Lawson, D.A. & Croft, A.C. (2010) *Enhancing the Quality of Mathematics Support throughout the UK: The Role of sigma*. In Responding to the Mathematics Problem: The Implementation of Institutional Support Mechanisms. C.M. Marr & M.J. Grove (eds.), The Maths, Stats & OR Network, pp6-10. Available at: at: http://www.mathcentre.ac.uk/resources/uploaded/mathssupportvolumefinal.pdf [Accessed on 23rd October 2012] Solomon, Y., Croft, T. & Lawson, D. (2010) Safety in numbers: mathematics support centres and their derivatives as social learning spaces. *Studies in Higher Education*, **35** (4), pp421-431. Lawson, D.A., Carpenter, S.L. & Croft, A.C. (2008) Mathematics Support: Real, Virtual and Mobile. *International Journal for Technology in Mathematics Education*, **15** (2), pp73-78. Symonds, R.J., Lawson, D.A., & Robinson, C. (2008) Promoting student engagement with mathematics support. *Teaching Mathematics and its Applications*, **27** (3), pp140-149. Croft, T., Lawson, D., Hawkes, T. & Petrie, M. (2008) ***sigma***: university-wide mathematics & statistics support – three years on. *MSOR Connections*, **8** (4), pp34-37. Available at: http://www.ltsn.gla.ac.uk/headocs/84Croft_T.pdf [Accessed on 23rd October 2012] Croft, T., & Lawson, D.A. (2007) SIGMA - Centre for Excellence in Mathematics and Statistics Support. *Mathematics Today*, **43** (1), pp15-18.

	Symonds, R.J., Lawson, D.A., & Robinson, C. (2007) The effectiveness of support for students with non-traditional backgrounds. *Teaching Mathematics and its Applications*, **26** (3), pp134-144.
	Carpenter, S., Croft, T. & Lawson, D. (2006) Developments in Mathematics Support in the United Kingdom. In Demlová, M. and Lawson, D. (eds.), *Proceedings of the 13th SEFI European Seminar on Mathematics in Engineering Education*, pp20-28. Conference held 11th - 14th June 2006, Kongsberg, Norway. Available at: http://sefi.htw-aalen.de/Seminars/SEFI_2006.pdf [Accessed on 23rd October 2012]
Coventry University and University of Sheffield	Samuels, P. & Patel, C. (2010) Scholarship in Mathematics Support Services. *Journal of Learning Development in Higher Education*, Issue 2, ISSN: 1759-667X.
University of Exeter, Cardiff University, Plymouth University and University of Bath	Cooper, B., Gillard, J., Graham, D., White, J. & Wilson, R. (2011) Summer Internships in **sigma-sw**. In Waller, D. (ed.), *CETL-MSOR 2011 Conference. Proceedings*, pp39-48. Conference held 5th – 6th September 2011, Coventry University. Available at: http://mathstore.ac.uk/headocs/Proceedings2011.pdf [Accessed on 23rd October 2012]
University of Glasgow	Ahmed, S. and Love, L. (2010) Provision & Evaluation of Mathematics Support at the University of Glasgow. In Green, D. (ed.), *CETL-MSOR 2010 Conference Proceedings*, pp9-11. Conference held 6th - 7th September 2010, University of Birmingham. Available at: http://www.mathstore.ac.uk/repository/CETL-MSOR_Proceedings_2010.pdf [Accessed on 23rd October 2012]
University of Greenwich	Bradshaw, Noel-Ann. (2011) The University of Greenwich Maths Arcade. *MSOR Connections*, **11** (3), pp26-29. Available at: http://mathstore.ac.uk/headocs/Connections_11_3_Bradshaw.pdf [Accessed on 23rd October 2012]
Harper Adams University College	Parsons, S.J. (2010) *Mathematics Support in a University College and Research in Students' Experiences of Learning Mathematics and Statistics*. In Responding to the Mathematics Problem: The Implementation of Institutional Support Mechanisms. C.M. Marr & M.J. Grove (eds.), The Maths, Stats and OR Network, pp59-63. Available at: http://ltsn.mathstore.ac.uk/headocs/responding_to_the_maths_problem.pdf [Accessed on 23rd October 2012]
	Parsons, S. (2008) Overview of the provision of mathematics support to students in a University College. *MSOR Connections*, **8** (2), pp29-35. Available at: http://mathstore.ac.uk/headocs/8229_parsons_s_mathsupport.pdf [Accessed on 23rd October 2012]
	Parsons, S. (2005) Success in engineering mathematics...through maths support and changes to engineering maths lectures at Harper Adams. *MSOR Connections*, **5** (1), pp31-34. Available at: http://mathstore.ac.uk/headocs/51successengmaths.pdf [Accessed on 23rd October 2012]
	Parsons, S. (2004) Overcoming High Failure Rates in Engineering Mathematics: A Support Perspective. *Proceedings of the International Conference on Innovation, Good practice and Research in Engineering Education*, pp195-200. Conference held 7th – 9th June 2004, University of Wolverhampton. Published by the University of Wolverhampton Press.
Harper Adams University College and Loughborough University	Parsons, S., Croft, T. & Harrison, M. (2009) Does Students' Confidence in their Ability in Mathematics Matter? *Teaching Mathematics and its Applications*, **28** (2), pp53-68.
Kingston University	Atkins, N. & May, S. (2005) Widening Participation in subjects requiring data handling skills: the MathAid Project. *The Journal of Further and Higher Education*, **29** (4), pp353-365.
University of Lincoln	Gallimore, M. (2012) *Aiding student transition through a novel approach to Mathematics Support*. In HEA Compendium of Effective Practice in higher education retention and success, pp46-50. Available at: http://www.heacademy.ac.uk/assets/documents/what-works-student-retention/What_Works_Compendium_Effective_Practice.pdf [Accessed on 23rd October 2012]

London South Bank University	Starkings, S. (2004) Maths for Business and Computing Students. *MSOR Connections*, **4** (2), pp22-24. Available at: http://mathstore.ac.uk/headocs/42business.pdf [Accessed on 23rd October 2012]
Loughborough University	Croft, T., Harrison, M.C. & Robinson, C.L. (2009) Recruitment and retention of students – an integrated and holistic vision of mathematics support. *International Journal of Mathematical Education in Science and Technology, Special Issue: Recruitment, Entrance and Retention of Students to University Mathematics Studies in Different Countries*. Guest Editor: Derek Holton, **40** (1), pp109-125.
	Croft, T., Solomon, Y. & Bright, D. (2008) Developing academic support for mathematics undergraduates – the students' views. In Green, D. (ed.), *Proceedings of CETL-MSOR Conference*, pp22-27, ISBN: 9780 9555914-1-9. Conference held 10th – 11th September 2007, University of Birmingham. Available at: http://mathstore.ac.uk/repository/CETLMSOR2007_Proceedings.pdf [Accessed on 23rd October 2012]
	Pell, G. & Croft, T. (2008) Mathematics Support – Support for all? *Teaching Mathematics and its Applications*, **27** (4), pp167-173.
	Perkin, G., Pell, G. & Croft, T. (2007) The Mathematics Learning Support Centre at Loughborough University: staff and student perceptions of mathematical difficulties. *Engineering Education – Journal of the Higher Education Academy*, **2** (1), pp47-58.
	Perkin, G. & Croft, A.C. (2004) Mathematics Support Centres – the extent of current provision. *MSOR Connections*, **4** (2), pp14-18.
University of Manchester	Steele, C.D.C. (2010) *The Manchester Mathematics Resource Centre*. In Responding to the Mathematics Problem: The Implementation of Institutional Support Mechanisms, C.M. Marr & M.J. Grove (eds.), The Maths, Stats & OR Network, pp33-37. Available at: http://www.mathcentre.ac.uk/resources/uploaded/mathssupportvolumefinal.pdf [Accessed on 23rd October 2012]
Newcastle University	Foster, B. (2005) Maths-Aid. *MSOR Connections*, **5** (3), pp1-8. Available at: http://www.mathstore.ac.uk/headocs/53mathsaid.pdf [Accessed on 23rd October 2012]
University of Northampton	Rice, P. (2012) Pilot of on-line maths tutorials: you can lead a horse to water... *Research active Library and Learning Services Conference Proceedings*. Conference held on 19th June 2012, University of Northampton. Abstract and presentation available at: http://llsconference2012.wordpress.com/presentations/pilot-of-on-line-maths-tutorials-you-can-lead-a-horse-to-water/ [Accessed on 23rd October 2012]
Nottingham Trent University	Woodhouse, S. (2004) Developing Maths Support. *MSOR Connections*, **4** (4), pp1-5. Available at: http://www.mathstore.ac.uk/headocs/44mathssupport.pdf [Accessed on 23rd October 2012]
University of Portsmouth	Pevy, L. (2010) *The Portsmouth University Maths Café: Making a Virtue of Necessity*. In Responding to the Mathematics Problem: The Implementation of Institutional Support Mechanisms, C.M. Marr & M.J. Grove (eds.), The Maths, Stats & OR Network, pp17-22. Available at: http://www.mathcentre.ac.uk/resources/uploaded/mathssupportvolumefinal.pdf [Accessed on 23rd October 2012]
Queen's University of Belfast	Cole, J.S., Crawford, T.J., Zubairi, M.S. (2012) Implementing a maths support system for first-year engineering students. In Kapranus, P. (ed.), *ISEE 2012 4th International Symposium of Engineering Education*, Paper 55. Conference held 19th – 20th July 2012, University of Sheffield. Available at: http://isee2012.group.shef.ac.uk/proceedings.html [Accessed on 23rd October 2012]

Robert Gordon University	Little, J. (2011) Rationalisation of a Basic Maths Diagnostic Assessment. *MSOR Connections*, **11** (1), pp30-33. Available at: http://mathstore.ac.uk/?q=node/1763 [Accessed on 23rd October 2012]
	Little, J. (2010) *Maths support tuition provided remotely via Wimba classroom built into a moodle VLE, using a graphics tablet and MS Paint.* Available at: http://www.heacademy.ac.uk/assets/evidencenet/case_studies/little_rgu_moodle_maths.pdf [Accessed on 23rd October 2012]
	Little, J. (2009) *Maths and Stats Support*. In Scottish Maths & Stats Network Meeting, Glasgow. Available at http://www.st-andrews.ac.uk/mathsnetwork/events/2009events/ [Accessed on 23rd October 2012]
	Little, J. (2006) Online Support for Medicine Dosage Calculations. *British Journal of Nursing*, **15** (21), pp1192-1195.
	Patel, C. & Little, J. (2006) Measuring Maths Study Support. *Teaching Mathematics and its Applications*, **25** (3), pp131-138. Available at: http://teamat.oxfordjournals.org/content/25/3/131.abstract [Accessed on 23rd October 2012]
	Patel, C. (2004) Participation (Diagnosis + Prescription) = Resolution. Learning and teaching. *MSOR Connections*, **4** (2), pp19-21. Available at: http://mathstore.ac.uk/headocs/42participation.pdf [Accessed on 23rd October 2012]
University of Sheffield	Patel, C. & Rossiter, J.A. (2011) Encouraging engagement with mathematics through course change and additional support. *MSOR Connections*, **11** (2), pp24-28. Available at: http://mathstore.ac.uk/headocs/Patel.pdf [Accessed on 23rd October 2012]
	Patel, C. & Rossiter, J.A. (2009) Student Engagement and Non-engagement with Mathematics and Statistics Support. In Green, D. (ed.), *CETL-MSOR Conference Proceedings*, pp99-104. Conference held 7th – 8th September 2009, Open University. Available at: http://www.mathstore.ac.uk/headocs/Proceedings_2009_Upload_0.pdf [Accessed on 23rd October 2012]
Sheffield Hallam University	Porteous, J. (2010) Evaluation of Maths Help and Maths Support offered at Sheffield Hallam University. *CETL-MSOR 2010 Conference*. Conference held 6th – 7th September 2010, University of Birmingham. Abstract available at: http://www.ltsn.gla.ac.uk/index.php?pid=277 [Accessed on 23rd October 2012]
Swansea Metropolitan University	Marotin, A. (2012) Mathematical skills of new entrants to engineering courses. *EE2012 Conference Proceedings*. Conference held 18th – 20th September 2012, Coventry University. Available at: http://cede.lboro.ac.uk/ee2012/papers/ee2012_submission_142_gp.pdf [Accessed on 23rd October 2012]
University College London	Angelini, M. (2011) Measuring the effects of Peer-Assisted Learning on the development of students in transition to maths-based teaching programmes. *CETL-MSOR 2011 Conference Proceedings*. Conference held 5th – 6th September 2011, Coventry University. Available at: http://www.ucl.ac.uk/transition/research-evaluation/Measuring_the_effects_of_Peer_Assisted_Learning.pdf [Accessed on 23rd October 2012]
University of the West of England	Henderson, K. and Swift, T. (2011) *expressoMaths*: a drop-by station. *MSOR Connections*, **11** (2), pp10-13. Available at: http://mathstore.ac.uk/headocs/Henderson.pdf [Accessed on 23rd October 2012]

The National HE STEM Programme

Working across the higher education sector with a particular focus upon the disciplines of Chemistry, Engineering, Mathematics and Physics, the National HE STEM Programme supports higher education institutions in encouraging the exploration of new approaches to recruiting students and delivering programmes of study. It enables the transfer of best practice across the higher education STEM sector, facilitates its wider adoption and encourages innovation. Through collaboration and shared working, the Programme focuses upon sustainable activities to achieve long-term impact within the higher education sector. As part of this philosophy The National HE STEM Programme actively disseminates project outcomes and evidence based good practice to HEIs beyond those involved in the project.

The **sigma** Network

sigma was a HEFCE-funded Centre for Excellence in Teaching and Learning (CETL) – a collaborative initiative between Loughborough and Coventry Universities.

At the end of sigma funding in 2010, the **sigma network** was supported by The HE STEM Programme to continue to share and enhance the work of sigma at universities in England and Wales.

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