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## RESOURCE REVIEW

# mathcentre 2013

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## Abstract

**mathcentre** was developed in 2003 as a free online mathematics learning resource to aid the transition from school to university in a range of disciplines. This paper shows how **mathcentre** has developed and evolved into a valued, respected and growing set of resources catering for staff, mathematics learners and mathematics support professionals. The paper examines **mathcentre** in 2013 and provides insights into the **mathcentre** user community and highlights resources that are now available.

**Keywords:** mathematics support, mathcentre, online learning resources

Developed in 2003 and enhanced in 2010, **mathcentre** offers free online learning resources for post-16 mathematics in a variety of formats such as leaflets, video tutorials, exercises and booklets. Its primary aim is to offer resources to support students' transition from school mathematics to university mathematics in a range of disciplines. The site and its resources are now highly regarded as a positive response from the university sector to the well-documented 'Mathematics Problem' facing many students and those who are seeking to teach and support them. Many universities link directly to **mathcentre** resources through their virtual learning environment (VLE) or from mathematics support centre websites, for example, Sheffield University MASH (<http://www.sheffield.ac.uk/mash/mathematics/logs>).

The upgrade in 2010 saw the development of the **mathcentre** *Communities Project*. This facilitates the contribution of new mathematics support resources by the academic community enabling resources developed elsewhere to be accessed by a wider community. Longevity is assured as Loughborough University has undertaken to host **mathcentre** for the foreseeable future. Described here are additions to **mathcentre** since 2010 and insights into the **mathcentre** community (Figure 1).

A number of research papers, key reports, case studies and staff resources, which relate to the teaching or support of students studying undergraduate mathematics on a range of courses, have been made accessible from **mathcentre**. Areas covered include for example diagnostic testing and measuring the effectiveness of mathematics support.

As part of its work within the Higher Education (HE) STEM Programme, *sigma* (<http://www.sigma-cetl.ac.uk>) has produced a series of good practice guides for staff involved in providing mathematics support (Figure 2). These guides are available from

Figure 1 mathcentre (<http://www.mathcentre.ac.uk>) home screen

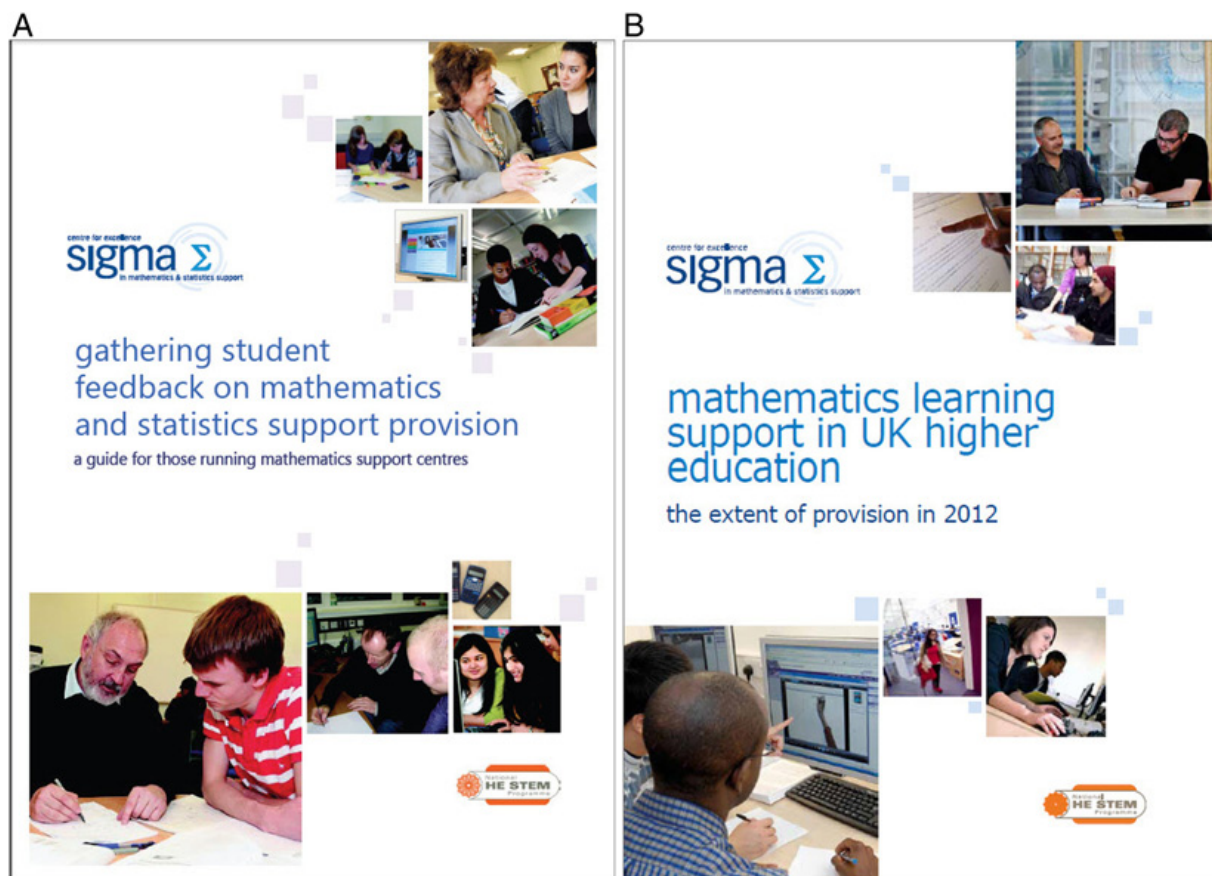
mathcentre and cover topics such as setting up a mathematics and statistics support provision (Mac an Bhaird & Lawson 2012), postgraduate tutoring in mathematics support centres (Croft & Grove 2011), gathering student feedback on mathematics and statistics support provision (Green 2012), a review of literature on evaluating mathematics support provision (Matthews *et al.* 2012) and the extent of mathematics support provision in the UK in 2012 (Perkin *et al.* 2012).

The Maths, Stats & OR (MSOR) Network together with the Institute of Mathematics and its Applications as part of the Mathematical Sciences Strand of the National HE STEM Programme supported a number of *Mathematical Sciences HE Curriculum Innovation* projects in 2010–12. A report containing a summary of the aims, objectives and outcomes of each project is available from mathcentre (Rowlett 2012). Also hosted are links to resources that were developed and the individual project reports, which may be downloaded.

## mathcentre for Students

In addition to hosting HE STEM project reports, mathcentre undertook to host two formative assessment resources namely *maths eg* and *Numbas*.

The resource *maths eg* (<http://www.mathcentre.ac.uk:8081/mathseg/>) standing for 'mathematics examples galore!' is a collection of almost 2000 mathematics questions covering a range of topics from GCSE to undergraduate level 2 made available through mathcentre by Martin Greenhow and Abdulrahman Kamavi from Brunel University. Random parameters are incorporated into all aspects of questions including equations and



**Figure 2** Examples of Sigma guides for practitioners supporting HE students

diagrams. There is detailed feedback allowing students almost unlimited practice. The resource has been extensively trialled at Brunel with students from a wide range of departments. The *maths eg Teacher's Interface* (<http://www.mathcentre.ac.uk:8081/mathsegteacher/>), also hosted by **mathcentre**, allows lecturers and teachers to compile tests containing specific or randomly selected questions from the database.

The resource *Numbas* (<http://numbas.mathcentre.ac.uk/>) is an open-source e-assessment web-based system developed and used extensively at Newcastle University and made available by Bill Foster. *Numbas* consists of a set of tools which produce SCORM (sharable content object reference model)-compliant self-contained exam packages particularly suitable for creating formative assessment and learning materials in mathematics, statistics and numeracy. Question content can be randomised, and multimedia content such as videos can easily be incorporated. Links to a number of *Numbas* examinations have been made available as **mathcentre** resources.

## mathcentre Communities Project

**mathcentre** would like to encourage the academic mathematics teaching community to consider contributing mathematics support resources to **mathcentre** via the *Communities Project* to add to the number of resources that are available and to cover topics where there is currently no provision. A wish list of over 40 resources that have been requested has

been compiled and is available from the *Communities* page. Entries from this list include suggestions for both videos and written resources for decision mathematics, discrete mathematics, Fourier series, number theory, problem solving techniques, topic related problems for specific disciplines (e.g. physics, biology) and materials for lower entry level and vocational learners. Contributions to-date are mainly in the form of Quick Reference (QR) leaflets covering two A4 sides. This format has been found to be easily accessible to students as the information is in bite-size chunks. QR leaflets are also useful to mathematics support centres as each leaflet may be distributed on one sheet of paper. Topics contributed include: Proof by Induction, Direct Proof, Solving Differential Equations, Eigenvalues and Eigenvectors, Forward Prices and Numeracy for Adults.

Contributions are normally licensed under a *Creative Commons Attribution-NonCommercial-ShareAlike* (<http://creativecommons.org/licenses/>) licence so that the community may both use the resource and develop it further. For this reason the source files for printed resources, e.g. diagrams and LaTeX code or Word files, are also deposited. Accompanying the resource is an *Excel* spread sheet containing metadata such as keywords to enable the resource to be searched in **mathcentre**. To ensure the quality of resources in **mathcentre**, authors are requested to arrange for their resource to be peer reviewed prior to submission. Full details and templates may be downloaded from the **mathcentre** *Communities* page.

## mathcentre Users

Web statistics from Google analytics show that 240,000 visits were made by 128,000 visitors during the year 1 December 2011 to 30 November 2012. 39% of visitors to **mathcentre** returned with 2% visiting more than 200 times during the year and 5% more

**Table 1** Proportion of visits to **mathcentre** by country of origin (top 10)

Country	Visits
UK	63%
US	6%
Australia	5%
Ireland	3%
India	3%
Germany	2%
Canada	1%
New Zealand	1%
Malaysia	1%
Hong Kong	1%

than 50 times. The average duration of a visit was 4.5 minutes. Almost two thirds of visits to **mathcentre** are from the UK (63%). International users are based in a wide range of countries (see Table 1).

**mathcentre** is used predominantly for HE. The **mathcentre** survey used SurveyMonkey to collect responses from those accessing **mathcentre** from 26 January 2011 to 19 December 2012, achieving 957 responses. The results indicate that 63% of regular users are accessing **mathcentre** for HE, 25% for school use and 12% for the workplace. Analysis of HE regular users shows that 36% are students and 41% are lecturers/teachers; 46% access **mathcentre** for their own needs and 36% to support others; 72% find the resources they are looking for

**Table 2** Proportion of regular higher education (HE) users that find a particular resource type helpful (SurveyMonkey).

Resource type	HE regular users	HE students regular users	HE support others regular users
Quick Reference leaflet	49%	29%	64%
Teach Yourself booklet	70%	59%	69%
Practice and Revision booklet	51%	36%	60%
Fact & Formulae leaflet	38%	28%	54%
Case studies/research papers	15%	8%	22%
Video tutorial	64%	76%	55%
iPOD video	16%	19%	8%
3G video	6%	4%	5%
Diagnostic tests	23%	23%	27%
Exercises	49%	44%	60%

most of the time. Table 2 shows which resources regular HE users report that they find helpful. Students find the video tutorials very helpful and the accompanying Teach Yourself booklets are helpful to both those supporting others and students themselves.

Web statistics (see Table 3) show that five videos are included in the top most accessed **mathcentre** resources. It is not clear from this data though what proportion of users are accessing video tutorials for HE purposes. Two of the three Practice and Revision booklets receive high usage. These may be being downloaded by **mathcentre** users revising

**Table 3** Most accessed resources in **mathcentre** in year to 30 November 2012 (Google analytics)

Resource	Resource type
Algebra Refresher	Practice & Revision booklet
maths e.g.	Community Project resource
Calculus Refresher	Practice & Revision booklet
Solving Differential Equations by Separating Variables	Community Project Quick Reference leaflet
Logarithms	Video
Arithmetic and Geometric Progressions	Teach Yourself booklet
Algebra Refresher - Interactive version	Practice & Revision booklet
Completing the square - an Animation	Video
The Chain Rule	Video
Tangents and Normals	Video
maths e.g. Teacher interface	Community Project resource
Arithmetic and Geometric Progressions	Video

mathematics they have studied previously. It is interesting to note that *maths eg*, the *maths eg Teacher's Interface* and a Communities Project leaflet are well used **mathcentre** resources.

Resources may be searched from **mathcentre** in a variety of ways – direct search, locating through topics e.g. *Algebra > Partial fractions* or locating through course being studied e.g. *Engineering*. Table 4 shows the top eight most frequent searches, indicating that most users favour a topic search.

**Table 4** Most searched items in **mathcentre** in year to 30 November 2012  
(Google analytics)

Search
Topics > Differential Equations
Topics > Algebra > Completing the square
Topics > Algebra > Transposition of formulae
Topics > Complex numbers > Complex arithmetic
Topics > Mechanics > Forces and Newton's laws of motion
Topics > Differentiation > Differentiation from first principles
Topics > Algebra > Logarithms
Course > Engineering > Algebra

In 2012 **statstutor** (<http://www.statstutor.ac.uk>) was launched having been developed by staff from Loughborough and Coventry Universities with contributions from the Royal Statistical Society's Centre for Statistical Education, as well as a number of other colleagues from other HE institutions in the UK. With a similar web-interface providing the same look and feel as **mathcentre**, **statstutor** provides a range of post-16 statistics resources such as case study videos, video tutorials, teach yourself materials, tests and quizzes and facts and formulae leaflets. **statstutor** is seeking contributions of additional statistics learning resources from the academic community through the **statstutor Communities Project**. Further information is available from the **statstutor** website or by email from: [community@statstutor.ac.uk](mailto:community@statstutor.ac.uk).

## Feedback

When **mathcentre** was originally developed in 2003, it was designed to be a virtual drop-in mathematics support centre. It is evident that the resources are assisting mathematics learning and teaching, illustrated by the following quotations from the **mathcentre** survey.

*wonderful resources that we [the tutors] are utilising more now and sharing with our students by providing direct links via our VLE*

*I am studying a 10 credit introductory astronomy unit at the Open University. Having no background in natural sciences and having been entirely useless at algebra and trigonometry all my adult life (now 61), I was finding the maths content particularly challenging and had sought self help guides from various quarters. This site is far and away the best I have come across. I have found the video tutorials especially clear and helpful.*

*It is a wonderful resource that I recommend frequently to students – our Maths Learning Centre could hardly function without it – a huge thank you and congratulations to all involved, the resources are simple, clear and well-designed.*

*It is a fantastic resource that has helped me through my foundation year and year one of university. I am finding that now (in year two of an engineering degree) it is not as much help. Thanks anyway and keep up the good work!*

*I think mathcentre is a brilliant resource. I haven't used it much in the last year, but used it a few years ago to improve my basic algebra. It's great for quick revision of material which I've lost familiarity with since leaving school/university. I've just revisited the mathcentre website after showing it to a colleague who wished to improve her maths skills.*

*The resources are attractive and accessible. I especially use the teach yourself guides for supporting students. They are good size chunks, clearly presented and interesting.*

*It is a great resource especially when you are doing self study. It has helped me further my understanding of mathematics and I would like to express my thanks to all the people who have created this repertoire of information.*

In a climate of reduced funding and a demonstrable need for continued support for students at the transition to university (see Matthews *et al.* 2012), it is hoped that, through the **mathcentre Communities Project**, additional resources will continue to be made available to assist future students in their learning of mathematics.

## Acknowledgment

**mathcentre** (<http://www.mathcentre.ac.uk>) was developed by a group from the Universities of Loughborough, Leeds and Coventry, the Maths, Stats and OR Network and the Educational Broadcasting Services Trust in 2003. Important components of the site were developed through the sister project **mathtutor** which was funded by Higher Education Funding Council for England (HEFCE) and the Gatsby Charitable Foundation. **mathcentre** was upgraded in 2010 with funding from JISC.

## References

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> (accessed 4 January 2013).

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-accf5-finalv1opt.pdf> (accessed 4 January 2013).

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> (accessed 4 January 2013).

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> (accessed 4 January 2013).

Perkin, G., Lawson, D. and Croft, T. (2012) *Mathematics learning support in higher education: the extent of provision in 2012*, sigma. <http://www.mathcentre.ac.uk/resources/uploaded/52789-mls-in-uk.pdf> (accessed 4 January 2013).

Rowlett, P. (ed.) (2012) *Summary of work in mathematical sciences HE curriculum development*, HE STEM. <http://www.mathcentre.ac.uk/resources/uploaded/hestemoverview.pdf> (accessed 4 January 2013).