sigma: university-wide mathematics & statistics support – three years on

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sigma, the centre for excellence in university-wide provision of mathematics and statistics support, is one of 74 Centres for Excellence in Teaching & Learning (CETLs). Three years since its establishment in 2005, it is now providing students from all disciplines at Loughborough and Coventry Universities with superb environments in which they can access support and build confidence in their ability to apply mathematics or statistics in their mainstream studies. The most public face of sigma can be seen in its modern, well-staffed and well-equipped drop-in centres providing students with one-to-one tutorial help, pleasant and friendly workspaces, high quality learning resources and other facilities. Behind the scenes, sigma staff and postgraduate students are researching and developing ways of enhancing the teaching, learning and support of mathematics and statistics. As sigma has developed, it has begun to stimulate and encourage growth of similar activity across the sector. This article will describe briefly some of these developments. For further details contact any member of the sigma directorate or visit the website http://www.sigma-cetl.ac.uk.

The work of sigma

Within the two partner universities of Loughborough and Coventry work is focused upon six core areas as depicted in Fig 1. These are described below. Beyond the core areas, sigma funding has enabled mathematics and statistics support activity to grow in many other universities through sigma-funded centres, regional hubs, secondment opportunities, sharing of resources and dissemination. Furthermore, sigma facilities are being used to contribute to national initiatives including those aimed at increasing the pool of students wanting to study STEM subjects at university. A consequence has been that very many students and staff throughout the UK are now benefiting from sigma’s work.

Fig 1 – The breadth of sigma’s core activities and related initiatives
Drop-in centres

Probably the most visible manifestation of the work of sigma is the drop-in centre, with one-to-one support provided by experienced teaching staff. Sigma funding has enabled pre-existing drop-in centres to be significantly enhanced and provided a second location at Loughborough, more convenient for some student groups. Students have commented favourably on how the high quality environments (illustrated in Fig 2), where they can work independently or in groups, with ready access to resources, computers and staff has improved their learning experience and motivated them to work harder.

Additional mathematics support resources have been created; many of these are now freely available to the community. A recent addition has been a suite of ten short video tutorials and accompanying text introducing complex numbers. These are available for watching on-line or for free download to use on mobile phones or mp4 players from www.mathcentre.ac.uk. In addition, a range of 5 Facts & Formulae leaflets, that have been developed in conjunction with the Maths, Stats & OR Network, are now freely available.

Important objectives of sigma are to raise the profile of mathematics support, to change the culture amongst many students who are disaffected by mathematics so that they engage with the support offered, and to provide students with opportunities for personal development. Various initiatives are underway to achieve these. At Coventry University first year students from the School of Art and Design designed a series of postcards intended to raise awareness of mathematics support. This activity was part of their assessed coursework. It also formed entry into a sigma competition to which over forty designs were submitted. Student Adam Roberts won the first prize for best overall design (shown in Fig 3). This and other winning designs are now being used to advertise the Mathematics Support Centre at Coventry.

At Loughborough, in 2007 a student ambassador scheme was introduced, whereby six students, each from a different department, were employed for three hours per week to assist with promotion of the mathematics and statistics support services. The ambassadors gave talks in their home departments and worked with staff-student committees. They also provided valuable insight into how the support on offer is perceived by fellow students. They wrote and produced a promotional video, which is now available on for viewing on http://mlsc.lboro.ac.uk/services.php and is being used at induction events throughout the university.

Statistics support

Postgraduate and final year students in many disciplines need to gather and analyse data for their projects. Often, such students have succeeded at school and university despite having underdeveloped statistical skills and despite lacking confidence to rectify this. Prior to the establishment of sigma no formal mechanisms existed to support these students in developing the necessary statistical expertise. Sigma funding has enabled a dedicated Statistics Advisory Service for final year project and postgraduate students in both universities to be provided. This service is...
appointment based; bookable slots have been very quickly taken and the service is oversubscribed. A challenge for the future will be to continue to meet the demand. Student feedback has been overwhelmingly positive. Quotes from students include:

“The one-to-one approach was essential as was the non-judgemental attitude of the lecturer who took pains to explain what would no doubt have been ordinarily, an elementary point, with patience and understanding.”

MN PhD Student

“As a PhD student I have a lot of stats to do and after being out of education for a couple of years this was very scary! It’s been extremely helpful to have someone to chat through ideas with as this has helped clarify things for me whilst not having to ask my supervisors each time”

SL PhD Student

Additional needs support

Specific resources and support have been provided to students with additional needs, e.g. dyslexia, dyscalculia, mathematics phobia and blindness as well as those students who lack confidence in their mathematics or statistics. sigma has funded the establishment of the Eureka Centre for Mathematical Confidence (http://eureka.lboro.ac.uk) which as well as being the focus for additional needs support offers workshops to students preparing for employers’ numeracy tests.

Proactive teaching interventions

In many disciplines student subgroups have been identified that, it is believed, may benefit from targeted support. Sometimes a particular module has a history of high failure rates, or some programmes attract students with non-traditional mathematics backgrounds. In such cases, sigma funding has been able to provide supplementary teaching and support to students, for example, through small group teaching, additional teaching hours and course-specific drop-in sessions.

One such intervention at Coventry has targeted students studying discrete mathematics as part of a computer science degree. The intervention has consisted of offering to a subgroup, additional video-based resources to be used in a supported, self-paced mode. The resources used were originally developed at Brunel University, but a recent award from JISC (the Joint Information Systems Committee) is enabling sigma staff to re-develop, extend, deploy, evaluate and disseminate them. At Loughborough, seven sigma staff and two postgraduate students are working together to introduce the use of GeoGebra (an online geometry package providing for both graphical and algebraic input) to over 200 students studying the mathematics module of the Science and Engineering Foundation Programme. The aim of this intervention is to reduce failure rates on the module by using GeoGebra to motivate the students and by using the additional staff involved to provide more substantial and personal support to this large student group.

Innovative uses of technology

Capital funding enabled sigma, in Years 1 and 2, to purchase a wide range of equipment to improve the learning experience of students. This included a video recording studio, mobile editing equipment, electronic voting systems, hand-held devices (mobile phones, iPods, etc.), Bluetooth technologies (e.g. writing tablets), classroom management software, Interactive Whiteboard technology and software, and robotic and technical Lego. The focus has now turned to evaluating the use of this equipment in different settings and to disseminating the findings to the wider community. Achievements to date have included:

- workshop on use of Bluetooth writing tablets;
- investigations into electronic voting systems; and,
- proof of concept activities around repurposing resources for mobile devices.

Fig 5 – A student receiving support during a Statistics Advisory Service session

Fig 6 – Two of the mobile devices being trialled in the delivery of mathematics support resources
Pedagogic research

sigma activities are underpinned with a programme of evaluation and pedagogic research. There are currently four sigma funded PhD students and the first of these is expected to complete her PhD on proactive teaching interventions and student engagement with mathematics support, in the Autumn of 2008. Other students are working on formative computer-assisted assessment of first order differential equations, the mediating and moderating effects of personality on student engagement with mathematics support, and on personalised computer-based mathematics support. The existence of sigma has been catalyst for further developments in pedagogic research. For example, sigma staff have achieved part-funding from the Higher Education Academy to support a postgraduate student working in statistics education, who is co-supervised by staff from the Royal Statistical Society Centre for Statistical Education.

Beyond the core activities

Beyond the six core areas, sigma is working to enhance the student experience at many other universities, and to contribute to national initiatives aimed at regenerating mathematics in the UK. For example, in summer 2008, sigma created two projects to be undertaken by local school students under the Nuffield Science Bursary Scheme. The scheme gives them the opportunity to join a real research project in any STEM subject area. At Loughborough, two students from Longslade Community College, Leicester, undertook a four week project developing interactive workshops for Year 10 students using robotic Lego. At Coventry, a student worked on repurposing existing mathtutor resources for use on mobile devices.

Fig 7 – Nuffield Science Bursary students working on the mathematics of Lego robots

Following on from the successful funding of the mathematics support initiative at the University of Leeds, a competition took place to award sigma funding to two further centres. The fact that the competitive bidding process attracted fourteen high quality bids (each with matched funding from the bidding institutions) is indicative of the need for additional mathematics support throughout the sector. In summer 2007, sigma supported the establishment of two new mathematics and statistics support initiatives at the Universities of Bath and Sheffield. Both of these universities have made significant additional funding available to support the respective initiatives, enabling the recruitment of support staff and the allocation of space.

To achieve further impact, sigma has overseen the development of the Regional Hubs Pilot Scheme. The key purpose of these hubs is to provide more local access to sigma events and workshops. In addition, they aim to facilitate the sharing of information and materials across their constituency, build local networks, co-ordinate views from the local networks to feed into an annual forum, and to help raise the profile of mathematics support locally. Initial meetings have been held in the south-east (co-ordinated through the University of Bath) and Scotland (co-ordinated through the University of St Andrews). Both meetings were well attended and proved fruitful, with plans being drawn up for a series of activities and further meetings over the coming year. sigma will be providing support through access to resources, staff time for events and training workshops and guidance. There has also been strong interest in establishing hubs in the north-east, Yorkshire and Ireland and funding opportunities to support these are currently being explored.

As part of its staff engagement activities, sigma has been keen to work with academic staff from other universities who are interested in developing new and innovative approaches to teaching. Currently, there are seven ongoing secondment projects. For example, Dr Olivia Gill from the University of Limerick is working on a project to ease the transition to third level (higher) education for adult (mature) learners who are intending returning to/starting college to pursue courses which contains mathematical elements. Details of the other secondees and secondment opportunities can be obtained from Assistant Director, Moira Petrie.

sigma has now existed for three years, and during that time there has been significant development of student learning spaces, resources, and the one-to-one and group supported provided. Staff have had the opportunity to experiment with emerging technologies in their teaching, and students are now seeing the benefits of this. A great deal of effort has been made to share experience and resources and now many more student groups throughout the UK are benefiting from the work of sigma. During the final two years of sigma funding, staff will be working to consolidate their early achievements, evaluate the success of their various initiatives and to disseminate findings as widely as possible.