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network for excellence in mathematics and statistics support

Senior Management Perspectives on Mathematics and Statistics Support in Higher Education

The Executive Summary
and
sigma Directors' Response to
a research report by Professor Harry Tolley and Dr Helen Mackenzie

Professor Tony Croft, Professor Duncan Lawson
and Michael Grove

The full report is available from www.sigma-network.ac.uk

HIGHER EDUCATION FUNDING COUNCIL hefce FOR ENGLAND

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Executive Summary

1.1 In 2013, HEFCE funded the **sigma** Network to further embed mathematics and statistics support across the HE sector in England. A key part of this work is to explore existing and future high-level needs, including the assistance institutions might welcome from HEFCE and the **sigma** Network in ensuring appropriate provision. The investigation reported here has collected and analysed senior management perspectives on mathematics and statistics support needs.

1.2 Semi-structured interviews were conducted with senior managers (typically Pro-Vice-Chancellors) from a sample of 23 institutions from across the mission groups. Questions addressed included:

- the challenges facing students in relation to mathematics and statistics;
- how those challenges are being addressed;
- the degree to which support is embedded and visible;
- plans and intentions with regard to the provision of support;
- how institutional priorities are determined;
- the external support that universities would value.

The resultant interview data were subjected to a 'thematic induction' and key analytical themes were summarised. Close attention was paid to appropriate ethical guidelines for educational research. Institutions have not been named and every attempt has been made to preserve their anonymity.

1.3 The challenges facing institutions across the sector with regard to mathematics and statistics are multi-faceted. Some of these challenges relate to students' prior mathematical experience. Only a small proportion of post-16 students continue to study any form of mathematics prior to entering HE and many of these students have developed a dislike or even fear of mathematics. Furthermore, some universities report that many students who have achieved high grades in A level mathematics seem unable to apply their mathematical skills in the context of their discipline of study. Other challenges relate to graduate attributes. Universities are under increasing pressure to produce graduates with good levels of numerical skills in order to compete successfully in the labour market or to be capable of undertaking advanced study, with many disciplines becoming increasingly quantitative at higher levels.

1.4 All of the HEIs questioned reported having students who are challenged by mathematics and statistics. These are not confined to the mathematical sciences and STEM disciplines, but extend to a rapidly increasing range of subjects that make use of quantitative methods, and to courses in which little or no use is made of mathematics or statistics but whose graduates often face numerical reasoning tests when seeking to enter employment. Postgraduate courses, which are often more quantitative than their undergraduate counterparts, give rise to further challenges.

1.5 The aforementioned challenges were attributed to:

- the fact that only a small proportion of students entering university have studied mathematics post-16;
- inhomogeneity amongst undergraduate cohorts;
- the fact that a GCSE grade C is insufficient preparation for many degrees which do not have a mathematics entry requirement above this;
- the difficulty many with an A-level in mathematics have in applying their knowledge to solving unfamiliar problems;
- supporting students with disabilities and specific learning differences in their learning of mathematics and statistics;
- the negative attitudes of some students to studying any form of mathematics or statistics.

1.6 Furthermore, all the universities questioned recognised that unless they provide appropriate forms of learning support for mathematics and statistics, it is inevitable that there will be an adverse impact on their students' satisfaction, retention, achievement and employability. Every university had identified issues and initiated some form of response. Further, mathematics support is now more visible and high-profile within HEIs and is seen as important for enhancing the student experience and aiding success.

1.7 Learning support for mathematics and statistics varies widely across the institutions sampled, ranging from that which is restricted in scope and embedded in the design and delivery of selected modules in particular programmes through to comprehensive systems of university-wide support (often including drop-in facilities in a mathematics and statistics support centre) that can be accessed by all students. The extent to which mathematics and statistics support has become visibly embedded as a core part of institutional provision and practice also varies across the institutions questioned, being a recent, small-scale innovation in some, and university-wide and long established in others.

1.8 Many of the institutions sampled recognise the need to further develop the support they offer and to extend its scope and/or improve its effectiveness. Decisions related to the development of the provision are often not taken in isolation but as part of wider strategic considerations. In some cases the developments will build upon previous experience and work within existing organisational structures, whereas in others the need to make transformational changes has been acknowledged and priority is being given to developing and implementing plans for university-wide systems of support.

1.9 Coupled with such developments, a number of institutions reported they were considering requiring a full A-level in mathematics for entry to some courses, but given the already mentioned (see Paragraph 1.3) issues with low post-16 participation rates in mathematics, this may prove challenging.

1.10 The overwhelming majority of those interviewed recognised the value of some level of national collaboration in respect of mathematics and statistics support. At the most basic level, this provides for sharing of resources and experiences to help avoid 're-inventing the wheel'. There were repeated requests for contextualised learning resources. Many respondents pointed to contributions beyond the provision of resources that national collaboration could enable.

1.11 The provision of CPD was a frequently recurring theme. Two principal foci for CPD were distinguished. Firstly, the needs of specialised staff working in mathematics and statistics support were identified, with several respondents suggesting that there was a need for appropriate training leading to some kind of recognised or professionally accredited status. The second focus related to the embedding of mathematics and statistics support within modules. Staff in a range of disciplines need CPD to assist them in both the development of appropriate curricula and in the contextualised delivery of quantitative material.

1.12 Higher levels needs were also identified in relation to more strategic issues such as the dissemination not only of products (systems and resources) but also of processes including leadership, strategic thinking, brokerage, and promoting engagement with staff and students across the institution; helping institutions to develop their own capacity for curriculum innovation and organisational change; and, guidance targeted at HEI senior managers with responsibility for the strategic planning of the student experience.

1.13 The value of a single 'go-to organisation' that was the 'first port of call' in issues relating to mathematics and statistics support was frequently acknowledged. There were some differences of opinion about how such an organisation might operate – with some institutions favouring regional collaboration but others suggesting groupings of 'like universities' would be more effective. It was suggested that such an organisation might provide such things as bespoke on-site training, and on-going mentoring and guidance regarding evaluation of the effectiveness of mathematics and statistics support.

1.14 The accumulated intellectual capital of the **sigma** Network is respected and valued by many HEIs across the sector. This includes the knowledge and understanding **sigma** has acquired about mathematics and statistics support, and its established networks of collaborating institutions, organisations and communities of practitioners.

1.15 The need for mathematics support across all subjects is a major challenge that all HEIs surveyed regard as likely to continue. The **sigma** Network has the human resources and organisational structures to continue to play a leadership role in the development and dissemination of effective practice in the provision of such support.

Response of the sigma Directors to the report

1. It is pleasing to note that so many university senior managers seem to be aware of the challenges faced by their universities, staff and students in respect of mathematics and statistics and are aware of the national backdrop against which their work is taking place.

2. It is pleasing that so many university senior managers are aware of the work of **sigma**.

3. This report has revealed that, in most institutions, mathematics and statistics support is now strategically planned to be an essential element of wider student support provision. This contrasts with the origins of mathematics support as a provision driven by individual enthusiasts operating largely independently of formal university structures.

4. Many of the benefits of national collaboration and networking that the participants in the survey identified are already being delivered by the **sigma** Network.

5. Extensive sharing of quality-assured staff and student resources takes place through the websites www.sigma-network.ac.uk, www.mathcentre.ac.uk and www.statstutor.ac.uk. Within the current HEFCE-funded programme, **sigma** is providing grants to institutions to develop additional learning resources, many of them contextualized to specific subjects and disciplines. These resources will be shared with the wider community through these websites.

6. With regard to continuing professional development (CPD), **sigma** has developed training resources for those involved in tutoring in mathematics and statistics support centres and annually delivers regional training workshops. The alignment of this training to the descriptors within the UK Professional Standards Framework is being made explicit and this should support participants in seeking professional recognition through the Higher Education Academy.

7. In respect of CPD in relation to the embedding of mathematics and statistics support *within subject-focused modules*, this is an area in which **sigma** has not been active nor is it within the remit of the current HEFCE funding. Such work was previously undertaken by the Mathematics, Statistics & Operational Research (MSOR) Subject Centre of the Higher Education Academy, but, since its demise, there has been a gap in such provision. This report highlights the need for a national body to take forward the wider brief if improvements and enhancements to mathematics and statistics teaching and learning are to be encouraged.

8. The **sigma** Network provides mentoring for those institutions which are newly developing mathematics and statistics support and this support has been highly valued by the recipients.

9. In terms of a focus on process as well as products, **sigma** has developed a range of materials aimed at those charged with developing and providing mathematics and statistics support. These include 'how to' handbooks on topics such as setting up a support centre and evaluating the support provision. As a result of this report, **sigma** is now developing a guide for university senior managers and others with responsibility for oversight of student support. This will focus on process.

10. The annual CETL-MSOR conference (**C**ontinuing **E**xcellence in **T**eaching and **L**earning in **M**athematics, **S**tatistics and **O**perational **R**esearch), which **sigma** has organised since 2006, has established itself as the leading national conference on issues relating to the teaching and learning of mathematics, statistics and operational research in higher education. It is a forum that enables exchange of ideas and promotes capacity building.

11. The **sigma** Network is a functioning national community of practice with participants from the full range of HEIs. Notwithstanding comments made by some respondents, **sigma**'s experience has been that there has been significant value in sharing amongst different 'types' of universities.

12. The **sigma** Directorate would like to thank the report's authors and all those who responded to their survey for contributing to this important report which will now be considered further by, and inform, the **sigma** Network Advisory Group and the Directorate.

The **sigma** Network is a HEFCE funded, national community, that seeks to embed mathematics and statistics support throughout the higher education sector, support practitioners in their work with students, thereby enhancing the student experience and addressing a national agenda to improve the quantitative capabilities of higher education students.

www.sigma-network.ac.uk

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