

Joint Mathematical Council of the United Kingdom: Council

Minutes of the meeting held at the Royal Statistical Society on Tuesday 17 June 2014

Present

Officers

Chair	Tim Rowland
Honorary Secretary	Peter Thomas
Honorary Treasurer	Paul Harris

Representatives of Participating Societies

Association of Mathematics Education Teachers	Ros Hyde
Association of Teachers of Mathematics	Sue Pope
British Society for Research into Learning Mathematics	Hilary Povey
British Society for the History of Mathematics	June Barrow-Green
Conference of Heads of Departments of Mathematical Sciences	David Arrowsmith
Edinburgh Mathematical Society	Colin Campbell
Institute of Mathematics and its Applications	Chris Sangwin
London Mathematical Society	Tony Gardiner (deputy)
The Mathematical Association	Peter Ransom
Mathematics in Education and Industry	Charlie Stripp
National Association for Numeracy and Mathematics in Colleges	Sally Barton
National Association of Mathematics Advisors	Alice Onion
NRICH representing the Millennium Mathematics Project	Lynne McClure
National STEM Centre	Stephen Lyon
Operational Research Society	Louise Orpin
Royal Academy of Engineering	–
Royal Statistical Society	Olivia Varley-Winter
Wales Institute of Mathematical and Computational Sciences	Stephen Williamson

Co-opted Members

JMC International Representative	–
UK Representative to International Commission on Mathematical Instruction	–
Executive Secretary	David Martin

Representatives of Observing Societies

Adults Learning Mathematics	David Kaye (deputy)
Advisory Committee on Mathematics Education	Robert Barbour
Department for Education [England]	–
Department of Education [Northern Ireland]	Nick Todd
Education Scotland	–
Higher Education Academy	–
National Centre for Excellence in the Teaching of Mathematics	John Westwell (deputy)
National College for Teaching and Leadership	James O'Donoghue
Office for Standards in Education	–
The Office of Qualifications and Examinations Regulation	–
The Royal Society	–
School Mathematics Project	–
Sector Skills Council for science, engineering and manufacturing technologies in the UK	–
United Kingdom Mathematics Trust	Bill Richardson

Visitors

Advisory Committee on Mathematics Education Secretariat	Niamh Mc Mahon
Department for Education and Skills [Wales]	–
National Numeracy (for item 2)	Mike Ellicock
Nuffield Foundation (from item 11)	Vinay Kathotia
Royal Statistical Society (from item 11)	Roger Porkess

1 Introduction

1.1 **Welcome** The Chair welcomed everyone to the meeting.

1.2 **Practical Arrangements** The procedure for emergency evacuation was announced as laid down in the contract for the booking of the premises.

- 1.3 **Apologies for absence** The Honorary Secretary announced that apologies for absence had been received from Jeff Evans (ALM), John Harris (SEMATA), Jane Imrie (NCETM), Jane Jones (Ofsted), Mary McAlinden (HEA), Fiona Robertson (Education Scotland), Alice Rogers (LMS) and Ros Sutherland (JMC International Representative).

2 **Application for Membership as a Participating Society from National Numeracy**

The Chair welcomed Mike Ellicock (Chief Executive of National Numeracy) and invited him to speak in support of National Numeracy's application.

Mike Ellicock said that National Numeracy was a new charity that was about mathematics from early learning to adult life: it was for everyone, for life and the everyday application of mathematical thinking. In mathematics 49% of English adults are operating below the Entry 3 / Level 1 threshold and 78% below the Level 1 / Level 2 threshold; this is a vast swathe of the population who are missing out and it is a great loss to individuals, mathematics and the UK economy (the extent of which has been revealed by the work of the National Audit Office). National Numeracy is working to change attitudes towards mathematics and numeracy away from talk of a 'maths gene' and the associated negative views towards a more resilient and can-do mindset. It was seeking to bring about change in the approach to mathematics and numeracy in schools, and change for adults as well: over 33000 adults have registered for the Numeracy Challenge. Much of National Numeracy's work is about removing barriers. Mike Ellicock mentioned the work of Sue Johnston-Wilder on building mathematical resilience: persuading learners of the need for effort, that all can do it with effort. He also referred to Paul Hamlyn's project on parental engagement and the work of the Behavioural Insights Team. In addition, National Numeracy provides, along with the Institute of Chartered Accountants in England and Wales, the secretariat for the All-Party Parliamentary Group for Maths and Numeracy which was founded by Caroline Dinenege (at the instigation of Elizabeth Truss) and is co-chaired by Barry Sheerman.

The Chair asked Mike Ellicock what he would pick out as the key achievement of National Numeracy in the last two years. He replied that National Numeracy had made numeracy a topical issue; they had got the figure of 78% of adult learners operating below the Level 1 / Level 2 threshold into the public domain; they had given both written and oral evidence to the BIS Select Committee; they had held meetings with David Laws, Elizabeth Truss, Matthew Hancock and Alison Wolf; they were trying to bring about changes which would flow up through schools and onward into adult life.

Lynne McClure was concerned to know what was distinctive about National Numeracy. She applauded the achievements of National Numeracy and the establishment of the All Party Parliamentary Group, but she was concerned that it had held many events relating to the National Curriculum which seemed to be in competition with other providers rather than providing something different. Mike Ellicock said that National Numeracy was in a transitional stage. In September 2013, the National Mathematics Partnership, led by Lynn Churchman, had become the trading arm of National Numeracy; this resulted in some legacy commitments; next year the focus will not be on the National Curriculum but numeracy across the curriculum.

Tony Gardiner said that National Numeracy was an excellent organisation but he pointed out that we were the JMC and not the JNC. The All Party Parliamentary Group is for Maths and Numeracy but mathematics does not appear on its website. In high-performing jurisdictions schools focus on mathematics rather than numeracy. Mike Ellicock replied that there was a very strong connection between mathematics and numeracy, and these were reasons why National Numeracy needed to be at the JMC table and not just engaged in bilateral discussions with JMC member organisations.

David Kaye asked what was seen as being different about what National Numeracy does from what is done by other organisations. Mike Ellicock said that National Numeracy seeks to build on the work done by other organisations. It is a cradle to grave organisation which included what was happening in schools and the consequences for adults. It was trying to get across the message about the importance of numeracy: literacy is improving but numeracy is not. It is working with the Behavioural Insights Team to find ways targeted ways to help those with poor levels of numeracy to take steps to improve their numeracy. The National Numeracy Challenge has created a baseline and a distance-travelled measure.

Mike Ellicock then withdrew and discussion then took place of the merits of the application. Following the discussion a vote took place on whether National Numeracy should be admitted as a Participating Society of the JMC; there were 18 votes in favour of admission, 1 vote against admission and 1 abstention. Mike Ellicock rejoined the meeting to be informed of the outcome of the vote and that National Numeracy had been admitted as a Participating Society of the JMC.

3 Minutes of the meeting held on Tuesday 25 February 2014

3.1 **Approval** The minutes were approved following one change to the draft minutes:
6.3 [final line] *replace* 'have input' *by* 'meet delegates'

3.2 **Matters arising not elsewhere on the agenda** None.

4 Reports from JMC Executive Committee

4.1 Chair

The Chair reported that the Executive Committee had had an all-day meeting on 10 April 2014 which had proved very useful. There were a number of large issues which needed discussion and the fruits of those discussions would become clear in the papers for this and subsequent meetings of the Council.

The Chair said that Council would recall that following the meeting between JMC representatives and Ofqual, the JMC Executive wrote to the DfE (that is to Michael Gove but copied to Elizabeth Truss) urging that the new GCSE Mathematics be a double award (as Ofqual had said this was a matter for DfE rather than Ofqual). A prompt reply was received from Elizabeth Truss saying it was a matter for Ofqual. Tony Gardiner said he had heard that opposition to a double award was because of the loss of flexibility it would cause in the eight-subject GCSE performance measure and he asked whether this had been mentioned in Elizabeth Truss's letter. The Chair replied that it had not and that the situation felt as though we were just being batted back and forth between DfE and Ofqual with no progress in sight on the matter.

4.2 Honorary Secretary

The Honorary Secretary reported that the Executive Committee intended to bring forward proposals for the JMC to become a Charitable Incorporated Organisation. By this means the JMC would become a registered charity (which would be helpful in seeking outside funding) and become incorporated (so able to enter into contracts in its own name rather than those of its trustees) with limited liability (at present the trustees have an unlimited joint and several liability, which may dissuade some from becoming trustees). The Honorary Secretary said that drafts for the constitution and regulations would be brought to the AGM in November 2014 for discussion, then revised drafts would be brought to a Special General Meeting before the Council meeting on 10 March 2015 for decision. It was recognised that the process of conversion was a complex one, given the nature of the JMC, and this may involve some discussion with the Charity Commission which may require us to amend what we propose. In order to expedite such technical revisions, it is proposed to bring to the AGM a proposal that the period of notice for an amendment of the constitution be reduced from three months to one month while this process is being carried out.

4.3 Honorary Treasurer

The Honorary Treasurer apologised for the late circulation of the accounts; their preparation had been delayed by new security measures introduced by our bankers. He said that we are on course to meet our budget, although there were some unplanned expenditures, including insurance and our subscription (of £100 for the half-year) to the Council for Subject Associations. He also noted that a few societies had not paid their subscriptions and that he would be writing to them again.

4.4 Executive Secretary

The Executive Secretary spoke in his role as Returning Officer for the election of the Honorary Treasurer (to serve from November 2014 to November 2017). There had been one nomination, Paul Harris (nominated by the MA and NRIC) and he was declared elected. The Executive Secretary observed that this result would be formally announced at the AGM on 11 November 2014 at the end of which Paul Harris would begin his second term as Honorary Treasurer.

5 BCME

5.1 BCME8

The Chair said that a late report on BCME8 had been received from James Nicholson and that this would be presented to the next meeting of the Council. The Chair said that BCME8 had been a vibrant and successful event with close to 500 delegates, nearly 200 presentations and 4 plenary sessions; overall it was a remarkable achievement. He added that the proposals relating to BCME9 were in no way questioning the achievements of those responsible for BCME8 but were an attempt to bring BCME more explicitly within the ambit of the JMC.

5.2 BCME9

The Chair introduced the proposals in the paper which he said built upon the discussions that had taken place at the Executive Committee meeting on 10 April 2014. He said that the preamble set out the rationale for bringing BCME formally and explicitly within the oversight of the JMC.

The Honorary Secretary made some clarifications of the preamble of the paper.

- In stating that it was envisaged that BCME included a joint ATM/MA conference it was not meant that there was to be a separate conference within BCME but that BCME would take the place of the annual conferences of ATM and MA that year, and that ATM and MA would participate in BCME.
- In stating that BCME's identity as a JMC event had become less clear in the last decade it was recognised that this was as at least as much because of changes by JMC as by BCME itself.
- In stating that the BCME Chair had been the same person for the three most recent BCMEs it was to draw grateful attention to his long service but it should also have made clear that, whilst he was Chair of BCME7 and BCME8, he was Vice Chair of BCME6 but had had to step up when the Chair of BCME6 became seriously ill.
- In stating that the JMC should take a closer interest in the BCME bank account it should have been made clear that this related to the adoption of current good practice for charities in regard of subsidiary accounts.

Bill Richardson asked what control JMC envisaged over the BCME bank account. The Honorary Secretary replied that the JMC Honorary Treasurer would be an additional authorised signature for the account so that the JMC could operate the account in extremis; it was not intended that all cheques would have to be co-signed by the JMC Honorary Treasurer.

Tony Gardiner expressed his thanks for what had been done by those who had organised BCME8. The Chair reinforced those thanks; he said it had been a huge event and a huge effort.

Alice Onion asked whether possible BCME chairs would have to be drawn from among the JMC. She was assured that this was not the case.

Bill Richardson said that it had been the practice for the BCME Committee to make a suggestion to the JMC Chair who then brought it to Council.

The alternatives provided within the proposals were then considered.

Sue Pope, Hilary Povey and David Arrowsmith spoke in favour of Alternative 3A. When the choice between Alternatives 3A and 3B was put to the vote, Alternative 3A was carried (there was no support for Alternative 3B).

Sue Pope said that in future the appointment of the BCME Chair should be by the whole of Council at its June meeting. Alice Onion said the appointment should be at the meeting immediately before the previous BCME so the incoming BCME Chair could (if not already BCME Chair) observe the role at that BCME. Bill Richardson agreed the appointment should be at the spring meeting. In discussion it was agreed that Alternative 4A should be re-worded so as not to assume BCME would always take place at Easter; Sally Barton suggested a wording. It was also recognised that a different procedure would be necessary for BCME9. It was agreed that an amended version of Alternative 4A should be adopted from BCME10. For BCME9, it was agreed Alternative 4B would be adopted but that once the open call for applications had closed Participating Societies would be canvassed for their opinions before the Executive Committee made an appointment.

[[Post-meeting note: The wording of 2.4 used in the open call was: 'The chair shall be appointed by the Council at its last meeting before a congress and shall take office three months after that congress. (This is so that the incoming chair, if not already involved, can observe the running of the previous congress in preparation for organising the next one.) Exceptionally, for the four-year cycle leading up to BCME9, the chair shall be appointed by the Executive Committee; the appointment will be made before 11 November 2014 (when the Council next meets) and the chair will take office immediately upon appointment.' The open call for applications for the position of Chair of the BCME Committee opened on 24 June 2014 and closes on 31 July 2014.]]

The Chair added that once the BCME Chair had been appointed, it would be proposed that he or she would be co-opted on to the Council. In response to a question, the Honorary Treasurer said that generally the JMC pays travelling expenses for Co-opted Members.

6 International Affairs

The Executive Secretary reported on the work of the review group which had looked at the roles of the JMC International Representative and the UK Representative to International Commission on Mathematical Instruction. Ros Sutherland and Chris Budd, the current holders of these respective

positions, had concluded that there was a lot of sense in combining the roles. The recommendations of the review group:

- 1 that JMC does not appoint a JMC International Representative as planned in November 2014,
- 2 that the current UK Representative to ICMI, Professor Chris Budd, works with the JMC Executive Committee and LMS early in 2015 to define a single role, that of the UK Representative to ICMI, that combines in an appropriate and manageable way the two roles of UK Representative to ICMI and JMC International Representative, and
- 3 that the JMC Executive Committee considers what duties then remain for it to cover and ensure that these are assigned within JMC and its Executive Committee

were approved by Council and will be submitted to the LMS for its approval.

Tony Gardiner said that the LMS Council and its General Secretary had only become aware of the proposals the previous afternoon and there was a need to tread gently given the past history relating to these roles.

7 Reports from Participating Societies

7.1 **Association of Mathematics Education Teachers** Ros Hyde introduced the report. She noted that Ofsted had gone ahead with the proposals about the inspection of Initial Teacher Training about which it had consulted. Recruitment remains a concern, especially as the economy improves. Schools Direct is recruiting very slowly. A particular problem with the current system is that current applicants need not decide whether to accept offers of places until August so it is hard for providers to know what is happening and plan provision. Ros Hyde said that no more was known about the Carter Review of ITT in which a sample of providers will be reviewed to try to establish what good practice looks like; in particular, the membership of the panel is unknown.

7.2 **Institute of Mathematics and its Applications** Chris Sangwin introduced the report. He said that recruitment to the Mathematics Teacher Training Scholarships scheme had been disappointing and help from other organisations would be appreciated in recruiting to the scheme.

The Chair asked what had happened with the specialist teacher of mathematics definition draft brought to the previous Council. Chris Sangwin replied that he did not know but would send a response to the Executive Committee about it.

7.3 **NRICH representing the Millennium Mathematics Project** The report was received.

7.4 **National STEM Centre** Stephen Lyon introduced the report. He said the Centre is keen to work in partnership with other organisations. In particular, he highlighted three areas for consideration by other societies: the Centre could publicise their activities, it could act as a channel for disseminating resources and reports of interest to mathematics teachers, and its building in York could be used as a venue for CPD events and conferences.

7.5 **Wales Institute of Mathematical and Computational Sciences** Stephen Williamson introduced the report. He said that things were changing in Wales and they were diverging slightly from the situation in England. The Welsh Government has been accused of complacency over the standard of education in Wales but it is now bringing forward several measures. There will now be examinations in numeracy proficiency and numeracy reasoning in each of Years 2 to 9. There are also structural changes with, instead of 23 separate local authorities being responsible for schools, the introduction of 4 educational consortia: with stronger authorities supporting weaker ones and stronger schools supporting weaker ones. In the autumn, the First Minister will bring forward legislation to make professional development part of every teacher's contract.

8 Reports from Observing Societies

Scotland

8.1 **Education Scotland** Bill Richardson said that in understanding the report it might be helpful to know that P_m and S_n in Scotland corresponded to Year m and Year $n + 7$, respectively, in England and Wales.

England

8.2 **Advisory Committee on Mathematics Education** Robert Barbour said that at the Executive Committee meeting immediately prior to this Council meeting ACME had presented and discussed its Annual Report. He said that ACME's work had most recently focused on Core Maths and professional development but they were now moving on to other concerns. He also mentioned the roundtable that ACME had held on the National Curriculum which had been a source of wise advice.

Robert Barbour went on to talk about the new short policy documents which ACME was developing. The overall blueprint had been published and ones were to follow on post-16 and professional development, recruitment and retention. They are designed for the intelligent lay reader. He went on to say that ACME's finances were in a difficult state: the membership of the committee was being reduced from 8 to 7 and the annual conference was also a casualty. There had been an open call for applications to fill the one forthcoming vacancy on ACME and interviews would take place in the next week. The Maths Memos blog had been introduced and JMC members were invited to write contributions for it; those wishing to do so should contact Niamh Mc Mahon (niamh.mcmahon@royalsociety.org).

- 8.3 **National Centre for Excellence in the Teaching of Mathematics** John Westwell highlighted the development of the Maths Hubs programme with 31 leads approved (as of the previous week). The first Maths Hubs Forum would bring the leadership of the Hubs together to look at how to work effectively and make use of the expertise in the system. NCETM wanted a strong community voice in the Forum and so had included JMC and ACME as advisers. There was also the concept of national partners to the programme, work had begun on implementing this and NCETM was looking to see how to take this forward.
- 8.4 **National College for Teaching and Leadership** James O'Donoghue observed that recruitment for this year would not be known finally until November. He said that recruitment was a top priority for NCTL but it was getting harder because of the improvement in the economy. There were no caps on allocations for mathematics for good and outstanding providers for this or next year. Recruitment to Schools Direct was slower than to HEIs as schools are more selective than HEIs. The UCAS decision window for applicants is 40 days but experience showed that most people were not using the full 40 days. The Mathematics Teacher Training Scholarships was a highly selective scheme and good people were coming through it. He also said that providers can now recruit for future SKE courses; this was welcomed by Ros Hyde.

Robert Barbour queried the seeming consistency of some figures. He said that 3054 places had been allocated this year whilst the DfE target for recruitment was 2570. James O'Donoghue replied that NCTL over-allocates places as part of its management of the market and in order to hit targets; the target this year is again about 2500.

9 Reports from meetings

- 9.1 **Meeting with the new head of the National STEM Centre held on 28 February 2014** The report was received.
- 9.2 **Joint Ministerial STEM Advisory Group held on 10 March 2014** The Chair said the discussion was principally about a programme from Number 10 for the promotion of STEM through three strands. There was to be a communications campaign, 'Your Life', encouraging sixteen-year-olds to continue with mathematics and physics at A Level; it would show the options open to them. The roundtable on 23 April 2014 was part of this and included celebrities who were to act as the public face of the campaign. There was to be a diversity compact with organisations to encourage wider recruitment, especially of girls. Finally, Teaching Chairs were to be established who would continue to research but also work in schools. Tony Gardiner said that this last initiative seemed in practice to be focussed on London.
- 9.3 **DfE roundtable on a campaign to promote maths, the sciences and engineering held on 23 April 2014** The Chair reported on this meeting as part of his report on item 9.2.
- 9.4 **Council for Subject Associations Annual General Meeting held on 28 April 2014** Sally Barton said that in 2006 JMC had been involved in the case for the establishment of CfSA and in 2007 the DfE had supported its establishment, paying for its staff, particularly to support teachers in primary schools. Initially CfSA's constitution allowed JMC to be a member but it was subsequently changed to exclude umbrella organisations. In 2010 the DfE withdrew funding and CfSA has since been run on a voluntary basis. This year CfSA has again changed its constitution and it is now possible for us to re-join; indeed it is keen to have the JMC on board.
- Sally Barton said that the CfSA is representing the interests of subject associations on the committee which is investigating the establishment of a College of Teaching. At the AGM Annette Smith became the new Chair of CfSA. JMC needed someone to represent it on CfSA from a classroom-facing organisation with an understanding of the needs of the primary sector.
- 9.5 **Joint Ministerial STEM Advisory Group held on 13 May 2014** The Chair drew attention to the third topic of discussion in the report which was based on a joint paper submitted by ACME, CMS and JMC.
- 9.6 **IMA Fiftieth Anniversary Celebration held on 14 May 2014** The Chair congratulated the IMA on its fiftieth anniversary.

10 Any other business not elsewhere on the agenda

None.

The Council adjourned for lunch at this point.

11 Discussion Items

11.1 **A world full of data** In preparation for the item the paper given in Appendix 11.1 below was circulated. The Powerpoint presentation used (and shown here) has been placed in the JMC Document Archive.

ROYAL STATISTICAL SOCIETY DATA EVIDENCE DECISION

Institute and Faculty of Actuaries

Scope

This report is ...

- **About statistics in A levels in subjects other than mathematics**
- **But it has profound implications for Mathematics at GCSE and A level and for Core Maths**

ROYAL STATISTICAL SOCIETY DATA EVIDENCE DECISION

Institute and Faculty of Actuaries

A world full of data

Roger Porkess

Roger Porkess began by introducing his report *A world full of data*. He said statistics is everywhere; what is happening in higher education and the workplace is driven by data. Although the report was not about statistics in A Level Mathematics but about the statistics in other subjects, it did have major consequences for mathematics at school level.

ROYAL STATISTICAL SOCIETY DATA EVIDENCE DECISION

Institute and Faculty of Actuaries

Research question

Statistics is now extensively used in most subjects in HE and in employment.

What teaching opportunities does this present for A levels in relevant subjects?

He outlined the methodology of the report which was based a series of roundtable meetings, one for each of the ten subjects studied. (The structure developed for the first of these, for Biology, provided a framework for the others.) He had expected the subject reports from the ten disciplines to be the major output from the work but he was taken aback by the way the same messages came over from each subject and a major part of the final report is taken up with generic findings which he summarised by use of a Venn diagram.

The needs of end users for statistical literacy were not being met at present and had profound implications for the statistics included in A Level Mathematics and Core Maths.

ROYAL STATISTICAL SOCIETY DATA EVIDENCE DECISION

Institute and Faculty of Actuaries

Methodology

Roundtable meetings

Biology	Economics	Physics
Business Studies	Geography	Psychology
Chemistry	History	Sociology
Computing		

HE	Employment	Learned Societies
Teachers	Exam Boards	Curriculum experts

➤ **Thoughtful discussions summarised in a report for each subject using an established format**

ROYAL STATISTICAL SOCIETY DATA EVIDENCE DECISION

Institute and Faculty of Actuaries

Generic findings

End-user requirements

Opportunities

Constraints

ROYAL STATISTICAL SOCIETY
DATA EVIDENCE DECISIONS

End-user requirements

Statistical Literacy

HE
Confident and competent engagement with data, including interpretation

Employment
Working with data, including reports and research papers, and communicating the results to colleagues

Implications for A level and Core Maths

Institute and Faculty of Actuaries

There was a clear need for more investigative work using a cycle analogous to the statistical problem-solving cycle. One important question is how we can foster such work.

ROYAL STATISTICAL SOCIETY
DATA EVIDENCE DECISIONS

Opportunities: Investigation

Using an Investigative Cycle

How can more investigative work be fostered?

Institute and Faculty of Actuaries

ROYAL STATISTICAL SOCIETY
DATA EVIDENCE DECISIONS

Opportunities: Computing

Computing: Teaching, Learning & Curriculum

- Data visualisation
- Modelling and simulation
- Making good use of data analytic tools
- The impact of big data
 - Different statistical techniques becoming important

We need more innovative pilot courses

Institute and Faculty of Actuaries

The power of computing has had profound effects on statistics; all statistical work is now computer-based. This needs to be recognised in how we teach statistics and what statistics we teach. For example, techniques for visualising and analysing multivariate data are becoming more important. Innovative pilot courses are needed which incorporate these approaches.

ROYAL STATISTICAL SOCIETY
DATA EVIDENCE DECISIONS

Constraints (1)

GCSE Mathematics

- Reluctance of students to engage with data
- Lack of transferable skills
 - data not used from other subjects
 - timing is not co-ordinated
- Fear of all forms of mathematics, including statistics

How can the mathematics provision up to GCSE better meet our overall national needs?

Institute and Faculty of Actuaries

Nevertheless, there are constraints on what can be done. The new GCSE in Mathematics is a missed opportunity. Teachers will need new knowledge and skills, and the effects of accountability measures in stifling innovation will need to be overcome.

ROYAL STATISTICAL SOCIETY
DATA EVIDENCE DECISIONS

Constraints (2)

Teachers' knowledge

- Many teachers are already working at, or beyond the limit of their knowledge of statistics. Serious CPD is required if teachers are to embrace new data-driven ideas.

Accountability

"It's more than my job's worth to try out anything new if it's not going to come up in an examination question"

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ROYAL STATISTICAL SOCIETY
DATA EVIDENCE DECISIONS

Working across subjects

In summary ...

- What are we as a country doing to prepare our young people for their adult lives?

Institute and Faculty of Actuaries

Roger Porkess concluded his presentation by asking how we are going to prepare the young for the rest of their lives. He emphasised the strength of feeling across the ten subjects investigated that we are not doing it right at present.

There then followed a period of discussion. Robert Barbour asked Roger Porkess where he felt the solution lay. Roger Porkess replied that Mathematics has got to provide a basis

that allows other subjects to build upon it. The new GCSE is disappointing but Core Maths is a huge opportunity. Charlie Stripp said that MEI was doing a lot of work on statistics for Core Maths; it was also working with David Spiegelhalter to develop the type of question that makes you want to find the answer; he believed that Critical Maths can also be an answer to this.

Tony Gardiner said that the example of percentages was pretty low-level but is what was wanted simpler tools rather than black boxes. Roger Porkess said that what is wanted are students who come in ready to engage. He asked why the data from subjects is not used instead of the trite examples from mathematics textbooks. He said there was no coordination of timing of content between mathematics and other subjects; there needs to be a conversation over timing but there is no mechanism at present to have that conversation.

Roger Porkess said that he rated the FSMQ in Using and Applying Statistics very highly; it was designed to encourage good teaching. Olivia Varley-Winter said that RSS was talking to awarding organisations about the provision for statistics. Sally Barton said people need to realise that statistics and data can be used to discover interesting things.

Roger Porkess proposed that pre-release data should be issued at the start of the course, analogous to a set book in English, and there should be an expectation that teaching would use these data wherever possible; half the examination would assume candidates had worked with those data. The Chair said that the explosion of data was related to the use of technology and he asked how it might be possible to encourage young people to relate to data more positively; he felt that some use of technology should be the norm. Tony Gardiner said there was a need to contrast the pre-release data with other data. Roger Porkess said that assessment would drive this.

John Westwell asked if anything was being done about the innovative pilots that Roger Porkess had recommended. Roger Porkess proposed that a course be set up which was an AS in Data Analytics. Olivia Varley-Winter said the RSS was interested to speak to people about possible ways forward, such as MOOCs. David Arrowsmith asked what the timeframe was; he mentioned that the EPSRC recently gave out money for data analytics. Roger Porkess said that there was a case for making a quantum leap but manpower was tied up in A Level reform; there was also a need to give people time to think things through.

- 11.2 **The Mathematics-Related Work of the Nuffield Foundation** Vinay Kathotia thanked the JMC for the opportunity to make a presentation on the work of Nuffield Foundation. He circulated the paper given in Appendix 11.2 on the Foundation's mathematics education funding priorities, as well as booklets describing, with samples, projects on Applying Mathematical Processes (see <http://www.nuffieldfoundation.org/AMP>) and Free-Standing Mathematics Activities (see <http://www.nuffieldfoundation.org/fsmqs>); information on other Nuffield projects can be found at <http://www.nuffieldfoundation.org/mathematics-education-0>.

Vinay Kathotia began by giving a short history of the Nuffield Foundation, from its beginning in 1942, and a description of the range of its benefactions. He mentioned Nuffield Primary Mathematics which started in 1964 (and was at one time used by a quarter of primary schools) and Nuffield A level Mathematics in the late 1990s; the resources from both projects can be download freely from the National STEM Centre through the 'teachers' link on its website. The Nuffield Foundation also gives grants for research and for the development of resources; beneficiaries have included Celia Hoyles and Alison Wolf. He mentioned also nine booklets on exploratory data analysis which used authentic data (which are in need of updating).

The Applying Mathematical Processes project produced resources to support the development of mathematical thinking. It was linked to the work on mathematical processes which had been led by Margaret Brown at the Chelsea Centre. Twenty of the activities have now been refreshed, seven of them now involve the use of technology; examples were to be found in a hand-out that accompanied the presentation. Activities produced to support Free-Standing Mathematics Qualifications have also now been refreshed as Free-Standing Mathematics Activities, which are of use in teaching GCE Use of Mathematics and Mathematics as well as individual FSMQs. Exemplification of the resources was to be found in a hand-out.

Plans to set up practicalmathematics.org were aborted when the trustees of the Nuffield Foundation decided to move curriculum development out of house, reducing a team of seven or eight to one, the speaker (and he was leaving in a week's time). Now the Foundation largely engages in policy work and grant-giving.

Vinay Kathotia outlined the Nuffield Foundation's priorities for mathematics (see Appendix 11.2) which it promotes through grant-giving. The Foundation has assets of between £ 220 million and £ 250 million and an annual expenditure of about £ 10 million with £ 3 million spent in-house. Grants are typically in the range £50000 to £150000 and are for work in understanding policy and practice. Over

£ 1 million a year is normally given for mathematics and over £ 2 million a year for education. Over five years £ 19.5 million was given in collaboration with HEFCE and the ESRC to support work on quantitative methods for the social sciences. Another aspect of Nuffield's work is to support opportunities for and the progress of women. In giving grants the Foundation particularly favours projects that bridge research and practice. A wide range of activities are supported, from age 3 upwards, including a project on mathematical language in GCSE sciences and, at university level, work on the teaching of derivatives being done at Loughborough University.

Policy work is undertaken in-house (including such projects as 'Values and Variables') and the two recent reports carried out under the leadership of Jeremy Hodgen. There is work forthcoming (jointly funded with the Gatsby Foundation) on getting a better sense of the post-16 teaching force, where it is estimated 1000 to 2000 more teachers are needed; this work is being undertaken by John Howson and Leeds University; a report will be launched in September. The Foundation also engages in capacity-building, providing bursaries for Nuffield research placements.

From 28 June 2014 responsibility at the Nuffield Foundation for mathematics will lie, at least temporarily, with Josh Hillman but the Foundation's future plans in this area are expected to become clearer in September.

12 Conclusion

The Chair thanked those present for their contributions and closed the meeting.

13 Dates of future meetings

Tuesday 11 November 2014 (following the Annual General Meeting which will start at 1000)

Tuesday 10 March 2015 (starting at 1100)

Tuesday 16 June 2015 (starting at 1100)

These meetings will be held at the Royal Statistical Society.

APPENDIX 11.1

A world full of data

A note for the JMC, Roger Porkess, October 2013

*A world full of data*¹ is the title of a report published by the Royal Statistical Society and the Institute and Faculty of Actuaries in September 2013. It follows a 2012 report, *The Future of Statistics in our schools and colleges*. I was the author of both.

The focus of the earlier report was the statistics being taught across the curriculum at that time; however, its recommendations and title looked forward to how the provision could be improved. While I was working on it several people made the point that the nature of many subjects is changing in higher education and the workplace, with increasing emphasis on mathematics and particularly statistics.

Increasing quantification is not some passing fashion but a long-term trend driven by digital technology making data, and the means to process them, now available on a scale that was unimaginable just a few years ago. This situation is here to stay; it is not something that will go away if we ignore it. However, the implications of this new world have yet to filter down to schools and colleges. So it was reasonable to ask what teaching opportunities, based around the increased use of statistics, could become available to teachers and lecturers across the various A level subjects. This would involve an aspirational piece of work.

The Royal Statistical Society agreed that this was an important question and thanks are due to the actuaries for funding the work. We decided to investigate 10 subjects: biology, business studies, chemistry, computing, economics, geography, history, physics, psychology and sociology. For each of these, a half-day roundtable discussion took place with an invited cross-section of the subject community; the meeting was subsequently summarised in an agreed subject report.

At the outset I had expected that the 10 subject reports would be the major outcome from the project. What I had not anticipated was that all the subject communities were saying essentially the same things, highlighting general themes and issues that are relevant across the whole curriculum. Even the subject specific opportunities usually fitted into general patterns. So the report begins with a major section on generic findings and these are then followed up by the 10 subject reports which provide much of the underpinning evidence.

The generic findings are classified as end-user requirements, opportunities and constraints. These categories are not, however, discrete; they all interact with each other.

The end-user requirements, both for higher education admitting new undergraduates and for employers giving jobs to new graduates, can be summarised as that their recruits should be statistically literate. The report goes into some detail as to what that means at each of these levels and for each of the different subjects. Overall people should be willing to engage with data and do so confidently and competently.

The generic opportunities come under two headings: investigative work and the use of computing.

Investigation is an important part of learning in all the subjects covered, and it often involves a complete cycle of activity, starting with the analysis of a problem and deciding what information is required, collecting the information and then using it to come up with a possible solution that requires interpretation and evaluation. Very often the information takes the form of statistical data and then the work follows the

Statistics Cycle. However, statistics is not being used for its own sake but to lead to a better understanding of the particular subject. In the 2008 syllabus revisions, several A level subjects lost their coursework, often resulting in a reduction in investigative work; as a direct consequence the statistics in some syllabuses has become isolated and disconnected from students' hands-on experience.

So far, with the exception of Geography, computing has had very little impact on A levels in the subjects considered and I was left with the concern that today's students are being prepared for yesterday's world. Computing is clearly so important that, in addition to the roundtable meeting on A level Computing, we held an extra expert meeting looking at the various ways in which its use could improve teaching and learning across the whole curriculum. This is covered in some detail in the generic findings part of the report.

All the roundtable meetings identified three major constraints: the effects of the mathematics curriculum up to GCSE; the difficulty that many teachers of the various subjects find with statistics; the straitjacket imposed by the accountability system. I will say some more about the first of these.

In these subjects, the role of mathematics, including statistics, is an enabling one, providing access and insight into particular topics. However, this can only happen if the students are comfortable with the mathematics and very often this is not the case. Many students are so frightened of mathematics that they are unable to engage with it when it arises in other subjects. Knowing this, many teachers are understandably reluctant to introduce new approaches involving statistics, or indeed other mathematics. It is thus the case that the inadequacy of our mathematics provision up to GCSE is holding back curriculum development in other subjects.

It is not just a case that some students are not very good at mathematics. Teachers and lecturers report that even those who have obtained quite high grades in GCSE Mathematics are not able to use it in their subjects. The students have not been given transferable skills. Maybe we should not be surprised at this; after all transferable skills do not feature in the aims of the National Curriculum or GCSE.

Although it was not among the 10 subjects covered, the insights that emerged have profound implications for mathematics at GCSE and A level, and for the whole subject not just statistics.

This report has given me the opportunity to work with a very large number of experts from across a wide range of disciplines. I really hope that it will be widely read so that others may benefit from their collective wisdom.

¹ <http://www.statslife.org.uk/index.php/news/938-rss-launches-new-report-on-statistics-in-non-maths-a-levels>

APPENDIX 11.2

Nuffield Foundation

Mathematics education funding priorities

We are interested in supporting research and development projects designed to improve understanding, policy and practice in the teaching and learning of mathematics. **We use the term 'mathematics' in a broad sense, including statistics and the range of quantitative approaches across all subjects and disciplines that can be considered as applying and doing mathematics.**

We are particularly interested in proposals that address one or more of the following themes:

- How children best acquire the **foundations** of mathematical and quantitative thinking in the early years and at school, and the implications for curriculum, assessment and pedagogy. Approaches to these 'foundations' might include developmental psychology, neuroscience, parental and social influences; or subject-specific areas such as number sense, spatial awareness, proportion, probability, and concepts of fairness and randomness.
- The promotion of, and support for, quantitative approaches and skills across **all subjects** (including mathematics, statistics, sciences, social sciences, the arts and vocational qualifications).

- How policy and practice – and in particular curriculum, qualifications and pathways – might support increased participation and achievement in mathematics-related learning (in its widest sense) **after 16**. This includes mathematics learning pre-16 that feeds into post-16 pathways; mathematics-related pathways (including statistics or other quantitative skills) in addition to current A-levels; and the implications of these for different groups of students.
- How such pathways might better support subsequent studies in further and higher **education** (particularly for those not continuing to study pure mathematics or physical sciences), and everyday quantitative skills and statistical literacy in the **population at large**.
- The use of **technology** in the teaching, learning and assessment of mathematics, statistics and quantitative skills.
- Implications of all of the above for the **school workforce**, at pre-school, primary, secondary and post-16 levels, including recruitment, training and development issues.
- The **gender** dimensions of all of the above.

For more information, please visit www.nuffieldfoundation.org