

16 April 2013

Reform of the National Curriculum in England: Royal Statistical Society response

Dear Sir/Madam,

The Royal Statistical Society (hereafter 'RSS') is responding to the government's consultation on 'Reform of the National Curriculum in England' on the form provided, but wish also to take this opportunity to make broader key points about recommended approaches to teaching statistics in the 21st Century. For a fuller view of promoting statistical education, please see the RSS and The Actuarial Profession report of 2011, 'The Future of Statistics in our Schools and Colleges'.¹

Statistical understanding plays a unique role in allowing learners to make sense of the world. This has important implications across the school curriculum.

Statistics in 2013

In a world awash with data, statistical understanding is increasingly important in all areas of society. The ability to understand numbers, interpret data and communicate evidence is an essential feature of the modern workplace, and crucial to competitiveness in the global market. And in the academic world, almost all subjects are increasingly quantitative. Facility with data and statistics is a vital life skill. In today's complex world, every citizen needs to be able to make sense of key statistical concepts, such as risk and probability, on an almost daily basis.

Statistics is a multifaceted discipline, and although it clearly has strong roots in mathematics, it is also very important in its application in a wide range of fields, from science and engineering to the financial sector, the social sciences and sport. In December 2012, Deloitte calculated that mathematical science as a whole contributes 2.8 million jobs, and 16 per cent of the UK's Gross Value Added.² Statistics is an important part of mathematics which, when taught well, ignites the interests of students who might not be motivated to continue their study in other areas of mathematics.

¹ Available for download at:

<http://www.rss.org.uk/uploadedfiles/userfiles/files/The%20Future%20of%20Statistics%20in%20our%20Schools%20and%20Colleges.pdf>

² 'Measuring the Economic Benefits of Mathematical Science Research in the UK', Deloitte for the Council for the Mathematical Sciences, December 2012

The importance of statistical education in the modern world is backed up by recent research from both the education and business communities. The Advisory Committee on Mathematics Education (ACME)'s Mathematical Needs project, which reported in 2011, found that the quantitative demands of almost all university courses had increased and that the explosion in data in the workplace, linked to technological advances, is raising the importance of quantitative skills in employment. Statistics, and how statistics is taught, are thus of vital importance.

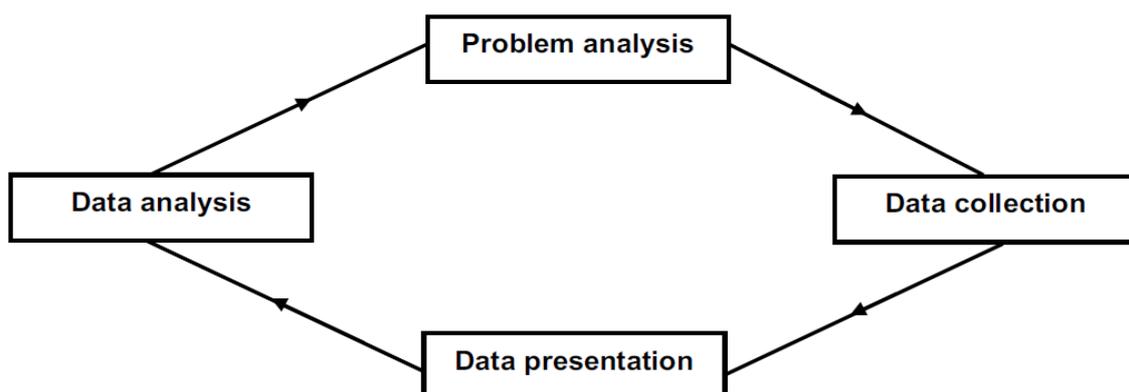
The Nuffield Foundation, Economic and Social Research Council (ESRC) and Higher Education Funding Council for England (HEFCE)'s recent £15.5 million initiative to improve quantitative methods training for undergraduates in the social sciences further demonstrates the increasing recognition of how important data and statistical literacy have become in higher education.

The Confederation of British Industry (CBI)'s most recent Education and Skills Survey (2012) found problem solving and numeracy to be skills weaknesses among significant proportions of both graduates (19% and 9% respectively) and, particularly, school and college leavers (43% and 35% respectively). Those are areas in which statistics, well taught, is an underpinning and facilitating subject.

Teaching statistics

Statistics, properly understood, is fundamentally about information (often numerical) in context – data – and about applying quantitative skills to real problems that relate to it. It is not about a collection of techniques in isolation, but about creatively applying those techniques in the context of a problem solving cycle. As such, it promotes a way of understanding the world that is transferable across a range of subjects and situations.

Diagram: the statistics cycle



As research published by the RSS shows,³ this holistic approach is followed to a large extent at primary level. At secondary level, however, the mathematics curriculum has tended to focus on data presentation techniques, to the detriment of teaching statistics as a problem solving cycle. This culminates in GCSE examinations which test individual data presentation techniques, but do little to assess, and thereby encourage the teaching of, students' statistical problem-solving abilities. There are additional weaknesses in the co-ordination between the statistics in the mathematics curriculum and that needed in other subjects, and in recognising the practical nature of statistics as a subject in the formal assessment system.

The RSS has wide experience and understanding of the teaching of statistics, both within the UK and internationally. We would especially wish to draw the government's attention to the New Zealand curriculum in Mathematics and Statistics (a summary of which is attached), which we commend for its coherence of approach. It is particularly notable for its integration of mathematics and statistics, and for the clarity in progression between levels, and how understanding and mastery of concepts are developed and built upon. As evidenced by research published earlier this year by the Nuffield Foundation, New Zealand has a very high participation rate in post-16 mathematics, especially among countries where such participation is voluntary.⁴

It is important that the government is aware, also, that mathematics teachers can themselves lack understanding in how to teach statistics in the manner we describe. In addition to changes to the curriculum, therefore, we would recommend that the government gives consideration to how to improve the quality of statistics teaching in schools. Research commissioned by the Teaching Statistics Trust in September 2012 found significant weaknesses in statistics knowledge and pedagogy in mathematics teacher training courses, and produced a series of recommendations on how to improve the situation.⁵

Finally, ICT presents significant opportunities for teaching and practice of statistics. The way in which today's students will use their statistical knowledge and understanding in the workplace and in HE will be closely linked to the way in which technology is opening up the possibility of using new and bigger datasets. Data visualisation is a very efficient way of looking at large and complex data sets – and can serve as an analytical as well as a presentational tool.

The use of geographic information systems in A-level Geography is an example of how new technologies can be brought into schools and school curricula. Using advanced and stimulating ICT tools can help to bring statistics alive as a subject for students, while also making it more relevant and contextualised – and thus better taught and understood. It is crucial that both assessment and the curriculum and teaching that are so closely linked to it are aligned with such technological possibilities.

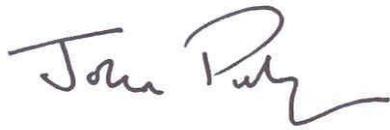
³ See 'The Future of Statistics in Our Schools and Colleges', Roger Porkess, Royal Statistical Society and The Actuarial Profession, 2011

⁴ 'Towards universal participation in post-16 mathematics: lessons from high-performing countries', Hodgen, Marks and Pepper, Nuffield Foundation, 2013

⁵ The report is available for download at: <http://www.rss.org.uk/uploadedfiles/userfiles/files/RSSCSE-Teaching%20Statistics%20Trust%20-%20Teaching%20Stats%20in%20British%20Secondary%20Schools%20report.pdf>

The success of our society and our economy will be determined by our ability to meet the challenges presented by the explosion of data in all spheres of life. The world of tomorrow will be full of opportunities for individuals – in education, in employment, and as citizens – who have the skills and confidence to deal with and interpret ever-increasing amounts of data. The RSS would be delighted to be involved in discussions about how to translate the principles of statistical education that we describe into a revised National Curriculum.

Yours faithfully,

A handwritten signature in black ink that reads "John Pullinger". The signature is written in a cursive style with a long, sweeping underline.

John Pullinger,

President of the Royal Statistical Society