

**Press release, Wednesday 31 October 2012**

## **Expanding post-16 participation in mathematics: Developing a curriculum to promote mathematical problem solving**

Relative to its international competitors, England has very low rates of participation in post-16 mathematics<sup>1</sup> and Michael Gove has expressed the ambition that *“we should set a new goal for the education system so that within a decade the vast majority of pupils are studying maths right through to the age of 18.”*<sup>2</sup>

In order to achieve this ambition, a new curriculum is needed, suitable for all students with a grade C or above in GCSE-level Mathematics. Professor Timothy Gowers has some very interesting ideas on the nature of such a curriculum, as explained in his weblog, <http://gowers.wordpress.com/2012/06/08/how-should-mathematics-be-taught-to-non-mathematicians/>. The underlying theme is that students should learn to engage with realistic problems. As well as helping students to develop the skills of analysing problems and thinking flexibly to find solutions, the problems also stimulate the need for mathematical and statistical analysis.

The DfE is funding the educational charity Mathematics in Education and Industry (MEI, annex 1) to investigate how Professor Gowers’s ideas might inform a curriculum that could become the basis of a new course for students who do not currently study mathematics post-16. Such a course could be taken by students with a grade C or above in GCSE Mathematics, as part of their post-16 programmes in school, sixth form college or Further Education.

The curriculum will be based on discussing and attempting to solve problems such as those on Professor Gowers’s weblog. Some example problems are given in annex 2. The aim is that students will develop transferable problem-solving skills that they could deploy in a range of contexts. This innovative approach will need to be supported by professional development for teachers and by extensive teaching and learning resources.

The curriculum will also address the mathematical and statistical knowledge and skills students need to become ‘educated’ citizens in the context of today’s society. Such content is likely to include: modelling with spreadsheets; risk; estimation; interpretation of graphs (including rates of change); exponential growth/decay; the use of simple mathematical and statistical models to make predictions.

Although the curriculum will involve mathematical and statistical content, addressing realistic problems will be the primary focus.

The development work will also consider how the curriculum should be assessed. The assessment must reflect the problem-solving philosophy of the course by assessing students’ ability to analyse open-ended problems and communicate their solutions, skills that are highly valued in higher education and employment.

This is just one experiment. The Advisory Committee for Mathematics Education<sup>[1]</sup> (ACME) is developing an overarching strategy for realising the ambitious challenge of significantly increasing post-16 participation in mathematics. New post-16 courses, such as the one MEI will be developing, are an important component of this strategy. In November, ACME will be hosting a workshop for awarding organisations and others, including MEI, to discuss in further detail the development of these new courses.

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<sup>1</sup> ‘Is the UK an Outlier?’, Nuffield Foundation, 2010

<sup>2</sup> Speech at the Royal Society, June 2011

<sup>[1]</sup> <http://www.acme-uk.org/home>

*'We need to educate young people to be problem-solvers in the real world and to understand how mathematical skills are a vital part of this. This is a new type of maths course that will start from interesting, difficult realistic problems, that students can see the point of solving, and show them how maths can help solve them. Many students are turned off maths because they can't see the point of learning maths techniques to answer textbook questions that seem irrelevant to real life. We hope this course will motivate many more young people to take maths post-16, instead of dropping it after their GCSEs, only to regret it later when they realise they lack the skills they need.'*

Charlie Stripp, Chief Executive of MEI

*'Professor Tim Gowers's brilliant blog has sparked huge interest in how we could radically improve maths teaching. I am delighted that MEI is trying to develop the Gowers blog into a real course that could help thousands of students understand the power of mathematical reasoning and problem-solving skills.'*

Michael Gove, Secretary of State for Education

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## Annex 1

### About MEI [<http://www.mei.org.uk/>]

- Mathematics in Education and Industry (MEI) is a membership organisation and a charity. Since the 1960s, MEI has worked to support mathematics teaching and learning. Any income generated through MEI's work is used to support mathematics education.
- MEI emphasises understanding and enjoyment of mathematics and also highlights the importance of mathematics in industry and commerce.
- MEI manages the government-funded Further Mathematics Support Programme [<http://www.furthermaths.org.uk/>], providing advice and support for teachers of AS/A level Mathematics and Further Mathematics in schools and colleges throughout England.
- MEI is a partner in the consortium that manages the National Centre for Excellence in Teaching Mathematics (NCETM) [<https://www.ncetm.org.uk/>]
- MEI pioneers the development of innovative teaching and learning resources, including extensive online materials to support all major examination syllabuses.
- MEI offers teachers of all GCSE and A level Mathematics specifications a range of continuing professional development (CPD) courses, provides specialist tuition for students and works with industry to enhance mathematical skills in the workplace.

## Annex 2

### Example problems

All of the problems should be engaging in their own right and should form rich starting points for problem-solving. They can also link with other subjects students may be studying and to mathematical and statistical techniques which students will find useful for solving the problems.

The following problems are selected from Professor Timothy Gowers's weblog.

1. *You have a product to sell. How should you price it so as to maximize your profits?*

This links directly to economics and business studies.

In mathematics it relates to ideas about rates of change and optimisation.

2. *Keeping the coffee warm: Somebody pours you a cup of coffee but you aren't yet in a position to drink it. You take milk, and the milk provided is cold. You want your coffee as warm as possible. When should you put in the milk: now, or just before you drink it, or some time in between?*

This links directly to science.

In mathematics it relates to ideas about exponential decay and rates of change.

3. *You are in the process of buying a washing machine for £250, and are offered a five-year guarantee for £60. The sales attendant tells you that typical repairs cost at least £100. Should you go for the insurance?*

This relates to economics and business studies.

In mathematics it relates to ideas of estimation, probability and decision analysis.

4. *How much can we trust opinion polls?*

This links directly to social science.

In mathematics it relates to statistical ideas, including sampling and inference.

5. *A doctor tests a patient for a serious disease that one in ten thousand people have. The test is fairly reliable: if you have the disease, it gives a positive result, whereas if you don't, then it gives a negative result in 99% of cases. So the only problem with it is that it occasionally gives a false positive. The patient tests positive. How worrying is this?*

This links to science and social science.

In mathematics it relates to probability ideas, including conditional probability.