Research Update

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Mathematics Education Centre · Loughborough University www.lboro.ac.uk/mec

Research Update is a newsletter sent out three times a year to schools by Loughborough University. We hope you find this newsletter useful and we welcome feedback and suggestions. If you are not on our teacher email list and would like to be, then please contact Ian at the address below.

Dr Ian Jones
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Teaching problem solving: Launching an inquiry.

In order to address problem-solving elements of the new curriculum, we are interested in exploring with teachers the design and use of inquiry-based tasks with students.

The idea would be to form a research partnership with a number of schools and teachers through which we will design tasks together and try them out in the classroom. Our joint research would explore the nature and use of such tasks and the ways in which students learn from them. We would choose jointly an area or areas of the curriculum to explore.

We are currently seeking funding and if successful we will make contact with schools giving more details in the future. Meanwhile, if you would like to know more at this stage or want to express an early interest in being involved in such a project then please email us.

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Writing about letters.

Children in five local primary schools have been taking part in a Maths project funded by the Nuffield foundation. One of the aims of the project were to compare children's understanding of the use of letters in algebra following three one-hour lessons using one of two computer software packages. Half of the children were taught using *Grid Algebra*, and half of the children were taught using *MiGen*. At the end of the three lessons, we measured children's conceptual understanding by asking them one open-ended question: "Explain how letters are used in algebra to someone who has never seen them before". Children were encouraged to use examples and writing to make the best explanation that they could. We then used a method called 'comparative judgement' to obtain a measure of the quality of children's answers. Comparative judgement doesn't require any marking because all is required is to compare pairs of answer scripts and make a judgement each time about which one is best (try it out using the nomoremarking.com website). We then compared the average quality of children's answers in each group, and we found overall that those in the *Grid Algebra* group outperformed those in the *MiGen* group. But what did children think? They liked both computer programs!

Dr Marie-Josée Bisson
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An age-old comparison.

There has been much debate over the age at which children transition to school and start to receive formal education. The school starting age varies across different European countries. Here in England children start school the September following their fourth birthday. This is much earlier than other European countries in which children tend to start school at the age of six (e.g. Belgium, France, Germany) or even seven (e.g. Finland, Denmark, Sweden). Do these differences in educational experiences matter? At what age are children ready for school? In an upcoming study we will compare children's school settings and the development of attention and thinking skills across four countries: Northern Ireland, England, Belgium and Finland. This research is funded by the Economic and Social Research Council (ESRC) and the Academy of Finland. We are currently recruiting children aged 4, 5, 6 and 7 years to take part in our study. If you think your school might be interested in getting involved please contact Sophie at the address below.

International Comparison of CHILDREN'S ATTENTION AND LEARNING ICCAL

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Making progress in measuring progress.

We have been working with No More Marking Ltd. and FFT to explore whether, post-levels, comparative judgement can help schools compare and measure progress in mathematics. To do this, 1215 Year 7 pupils in 7 schools sat specially designed tests in September 2014 and again in May 2015. Each test contained three open-ended questions such as:

Give examples of large fractions and small fractions. Show how some are larger than others.

Pupils were provided with a single blank page to write their answers. As you can imagine, what they wrote was very varied, and their answers displayed creative mathematical reasoning to varying extents.

The answers were assessed by mathematics PhD students using the comparative judgement approach. Statistical analysis revealed the outcome was valid and reliable.

Information was fed back to schools showing how their pupils' mathematical understanding compared to that of other schools. Information was also provided on the relative progress each pupil made between the first and second tests. This information also allowed us to provide a predicted GCSE grade for every pupil, and show whether this had changed over the course of the year.

The project is continuing this year with about 10,000 pupils in 74 schools. If you are interested in getting involved next year please contact Ian.

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SUM: Skills Underlying Mathematics

Dr Camilla Gilmore explains what skills are needed to learn mathematics - and why some children might struggle.

The Skills Underlying Maths (SUM) project was a three-year research study funded by the Economic and Social Research Council. The aim of the project was to discover which general thinking skills (also known as executive function skills) are involved in different aspects of learning and doing mathematics. We used a variety of different research methods, including measuring children's and adults' individual performance on experimental tasks as well as studying learning in the classroom, to achieve these aims.

One of the main aims of the project was to discover how different executive function skills are involved in different aspects of mathematics knowledge. Executive function skills include the ability to manipulate information in memory (working memory), ignore distractions (inhibition), and think flexibly. We found that all these skills are involved in mathematics performance, but different combinations of skills are more or less important for different components of mathematics. For example, working memory and inhibition are more important for learning mathematics facts and procedures than they are for conceptual understanding. We also found that executive function skills make an important contribution to mathematics performance across all of the age groups we studied, from Year 1 up to University level.

Our findings highlight the importance of these general thinking skills for mathematics learning, and shed light on why some children may struggle with mathematics.

Further details about the project, including a downloadable summary for teachers, can be found at www.sumproject.org.uk. The lead investigators on the project were Dr Camilla Gilmore, based in the Mathematics Education Centre at Loughborough University, and Dr Lucy Cragg, based in the School of Psychology at the University of Nottingham.

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