

# Research Update

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Mathematics Education Centre · Loughborough University

[www.lboro.ac.uk/mec](http://www.lboro.ac.uk/mec)

## Welcome

It has been a time of expansion here in the Mathematics Education Centre at Loughborough University over recent months. Our research team has increased with the arrival of new PhD students, and we have recently finished building a brand new, state-of-the-art Toddler Lab.

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.

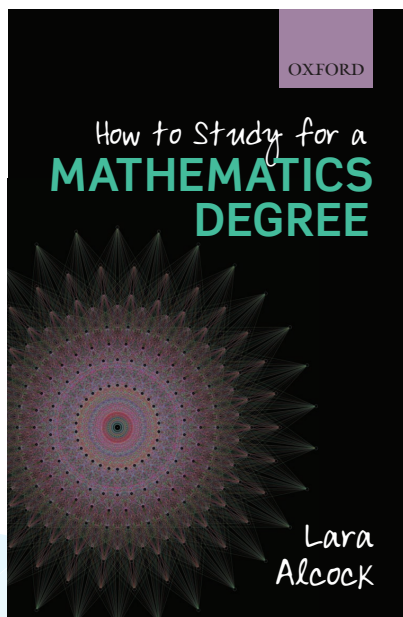
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## New Book by Dr Lara Alcock

### Making the Transition to University Mathematics.

Do you teach students who intend to study mathematics at university? Then you might be interested in a new study guide written here at the MEC. This guide is based on mathematics education research conducted at Loughborough and around the

world, and it provides information for intending, new and experienced undergraduate students. Part 1 discusses the nature of university mathematics, and explains how students can adapt and extend their existing skills in order to develop good understanding of abstract material. Part 2 covers study skills as these relate to mathematics, and suggests practical approaches to time management, interacting with university lecturers, and making the most of academic



opportunities. For more information see <http://tinyurl.com/boz6mwc>

## Upcoming Research

Here at Loughborough we're often seeking teachers and students interested in participating in upcoming research studies. If interested please contact Ian at the above address.

**There's More To Maths Than Maths.** The Skills Underlying Maths (SUM) project is exploring the general thinking skills that are important for learning and doing maths. We know that skills such as flexible thinking, being able to hold and manipulate information in mind, and ignoring distractions are involved in mathematics. In this project we are trying to understand how these skills are used in learning different types of mathematics across a wide age range. In particular we are keen to explore the skills involved in learning mathematics in secondary school. We are looking for secondary schools who may be interested in becoming involved in this research. For more information please see [www.sumproject.org.uk](http://www.sumproject.org.uk) or contact Camilla at [c.gilmore@lboro.ac.uk](mailto:c.gilmore@lboro.ac.uk)

**(Literal) Assessment for Learning.** We know that ongoing teacher assessment and feedback is good for pupil learning. But what about when pupils themselves assess one another's mathematical work? We are interested in finding out how judging the quality of peers' work can help pupils to better understand and communicate mathematical thinking. To explore this we would like Key Stage 3 and 4 pupils to use a specially designed computer programme to assess the quality of peers' understanding of fractions. If you are interested in getting involved in exploring the benefits of peer assessment for mathematical learning please contact Ian at the above address.

## Recent Research

In this section you can find a round up of recent research studies of interest to teachers. More Loughborough research can be found at [mec.lboro.ac.uk](http://mec.lboro.ac.uk)

**To The Maths Born.** The Preterm Infants Skills in Mathematics (PRSM) project has been exploring the mathematics skills of children who were born

prematurely. Previous research has shown that prematurely-born children have a higher likelihood of having difficulties with learning mathematics than their peers who are born full-term. However, the reasons for these difficulties have been unclear. In this project, which has been run in collaboration with the University of Leicester and is funded by the charity Action Medical Research, we have

visited around 200 children aged 8-10 years-old. Half of the children were born very prematurely (less than 32 weeks gestation) and half of the children were born full-term. We have been exploring the different types of mathematics skills and general thinking skills that prematurely-born children have difficulty with. Early results suggest that prematurely-born children have a particular profile of difficulties with mathematics that may require specific interventions. To find out more about the project and keep track of our future findings please see [www.primstudy.org](http://www.primstudy.org) or contact Camilla at [c.gilmore@lboro.ac.uk](mailto:c.gilmore@lboro.ac.uk)

## mathcentre and mathtutor

### Resources to Support Students' Transition to University Mathematics

Physical sciences and engineering courses have always required their students to study advanced mathematics, but an increasingly wide range of other courses require mathematics too, from biology to nursing. It often comes as a shock to new students that they will be required to do any mathematics all when they get to university, yet so many subjects now rely on quantitative techniques. Many students find themselves ill-prepared for the transition to university study in mathematics.



Universities clearly have a hole to plug! To help overcome transitional problems we have established [www.mathcentre.ac.uk](http://www.mathcentre.ac.uk) and [www.mathtutor.ac.uk](http://www.mathtutor.ac.uk)

**mathcentre** is a virtual drop-in centre where students can find information about long-forgotten techniques, material that is assumed but they don't know, and much more. There are video tutorials, texts, help-leaflets, on-line quizzes, and more, and all freely available without the need to register or acquire a password. Topics covered range from basic arithmetic, through algebra, through most **GCSE** and **AS** and **A level** topics and into first year university mathematics. A staff area of the site provides access to Key Reports and research that describes the "mathematics problem", and help guides for those working to assist struggling students.

Many of the resources have proved to be **useful to school students, their parents and their teachers** as they revise for examinations. Much of the same learning material can be found on **mathtutor** but here it is presented in a much more structured way - ideal for self-study.

*mathcentre and mathtutor were developed by a consortium of Loughborough, Coventry and Leeds Universities in association with the Higher Education Academy MSOR Subject Centre, and EBS Trust.*

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**The Problem Solving Problem Solved?** Problem solving tasks can be very difficult to mark accurately. Part of the problem is that marking schemes are not very good at capturing a wide range of open - and sometimes unpredictable - answers. A recently completed study here at Loughborough looked at how mathematical problem solving might better be assessed. Examiners used an innovative assessment method, called Comparative Judgement, which involves no marking and no making schemes. Instead the examiners were shown two pieces of pupils' problem solving work and asked simply to decide which was the better. The outcome of many such judgements by several examiners were then statistically analysed to produce a rank order of pupils' work from "worst" to "best". We found that the Comparative Judgement method worked very well, enabling problem solving to be assessed reliably and validly.

**All The More Reason to Study Maths.** A recently completed study tracked the development of mathematics and English students' reasoning skills over the two years of A-levels. Students completed a conditional reasoning task (e.g. If not D then 4; D; therefore not 4; is this necessarily valid?) at the beginning and end of their AS year and again at the end of their A2 year. Whilst English literature students did not change in their reasoning behaviour, mathematics students became significantly more logical by rejecting more invalid inferences at the end of their studies. This is despite the mathematics syllabus not containing any explicit reference to conditional logic, i.e. no definition of the conditional statement nor any reference to which inferences are valid or invalid. This suggests, for the first time, that there may be some truth to the long-standing claim that studying mathematics improves logical reasoning skills. We are now investigating which other reasoning skills might be improved by studying mathematics, and in particular, whether the effect extends to any real-world reasoning.