

Research Update

May 2014

Mathematics Education Centre · Loughborough University

www.lboro.ac.uk/mec

Welcome.

Research Update is a newsletter sent out three times a year to schools by the Mathematics Education Centre (MEC) at Loughborough University. We hope you find this newsletter useful and we welcome feedback and suggestions.

In this issue we report on some exciting new developments at the MEC. From September 2014 we are starting a **new PGCE in Mathematics**. Dr Jo Harris provides an overview of the new PGCE on back page of this newsletter.

In addition the MEC is currently offering **calculus taster days for Year 11 students** thinking of taking A-level mathematics. Dr Rod Bond and Dr Marie-Josée Bisson describe how positive these days have been for all involved.

The MEC is also about to launch it's very own **MOOC (Massive Open On-line Course) in April 2014**, focussing on helping learners develop their understanding of mathematical symbolism. Course founder Professor Tony Croft reports.

See also the **call for participation** from Sara Humphries, a post-graduate research student at the MEC who is interested in the relationship between spatial abilities and STEM learning.

Finally, a new free website is available that lets teachers (and indeed students) assess problem solving and other extended mathematical tasks. The website is called **No More Marking** and, as the name suggests, enables assessment without any marking.

Please do get in touch with myself or the other contributors for more information.

Dr Ian Jones
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Miraculous Calculus!

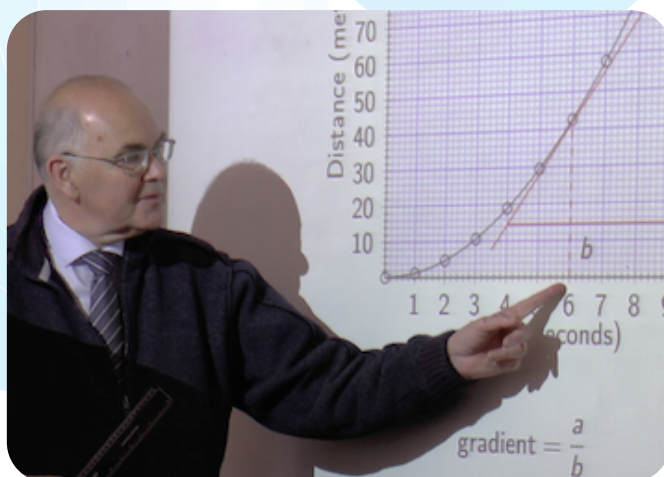
As part of our research project Measuring Conceptual Understanding, groups of Year 11 students have been spending a day at the Mathematics Education Centre where they tackled aspects of Differential Calculus, taught by Dr Rod Bond.

Students were introduced to differentiation from first principles which led on to developing confidence in differentiating simple functions, the use of maximum and minimum values, and sketching quadratic and cubic functions. The work also provided useful GCSE revision by including topics such as equations of straight lines and tangents to curves, indices, expansion of brackets, factorising quadratic equations, and so on.

Throughout the sessions students were supported by undergraduate helpers. They also enjoyed an informal session at lunchtime with the undergraduates where they were encouraged to ask questions about life at university whilst eating their packed lunch.

The feedback from both students and teachers was very encouraging. University staff were impressed by the work ethic of the students. They covered some difficult work at a fast pace and yet they maintained an excellent attitude throughout the day. Student comments suggested that they valued the opportunity to visit and work at the university.

We hope that the sessions helped to enthuse students about mathematics and that they will be inspired to think about continuing their mathematics at A level and beyond. This may lead them to consider studying the STEM subjects at university which, at present, is a national priority.



The work of the students will be of great use to us in the research project but it is good that, in addition, we have provided them, hopefully, with a challenging, useful and enjoyable day.

Calculus taster days will resume in November 2014. If you would like your Year 11s to attend a session please get in touch with Rod or Marie.

Dr Rod Bond and Dr Marie-Josée Bisson

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Get a Grip.

MOOCs (Massive Open On-line Courses) are free and open-access courses offered by universities and other institutions. The Mathematics Education Centre in conjunction with FutureLearn is offering the course *Getting a Grip on Mathematical Symbolism* aimed at those who are considering studying science or engineering foundation courses at university level.

The course is particularly appropriate for those who have some engineering or science knowledge gained through vocational qualifications or through workplace experience but who have not studied mathematics formally since leaving school. It will also be appropriate for those lacking confidence and needing to establish a bedrock of knowledge in order to further their scientific or engineering education.

Through an accessible introduction to graphical and algebraic techniques students will start to think mathematically and develop an informal understanding of vital properties of points, lines and curves before formalising mathematically some of these essential notions. The course will go on to introduce the equation of a line and the significance of its slope and vertical intercept, and will emphasise the importance of linear

relationships in many scientific and engineering applications.

Students need to register for the course by **Monday 28 April**. The course expects students to learn for around two hours per week for three weeks, although the course remains online afterwards so alternatively students can also work at their own pace. Successful participants will obtain a Statement of Participation. For more details and registration visit the link below.

Professor Tony Croft

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tinyurl.com/MECMOOC

Primary Teacher Equality.

Primary teachers! We'd like you to tell us how your children think about the equals sign and number sentences. If you teach Key Stage 1 or 2 and can spare up to 10 minutes completing an online survey then please go to the link below. For more details please contact Ian.

www.survey.lboro.ac.uk/ptms

Spaced Out.

Sara Humphries is a PhD student at the MEC. Here Sara explains her research and how teachers can get involved.

Project background. I am interested in exploring the growing research area of spatial abilities and STEM careers. It has been found previously that students with higher than average spatial abilities go on to be very successful in science and mathematics jobs.

I plan to measure a number of spatial abilities in students who are just finishing their time in compulsory education (Year 11), or those at the beginning of their A-level courses (Year 12) in September. This will provide insight into the levels of development of these skills at this age. Ideally, I would then like to extend the research project to follow-up the spatial ability development of the students as they progress through A-level study.

Your participation. This research relies heavily on co-operation with schools, particularly those with successful, attached sixth form colleges. I am therefore keen to hear about the possibility of including either a number of Year 11 or 12 students in September from such schools and colleges in the study.



One aspect of the data collection will involve a session in which a number of pen-and-paper tasks can be completed as a whole class/group. The other will be conducted in small groups (two to four students) in which the students will complete some computerised spatial ability tasks.

To ensure that the students have all received a comparable level of taught subjects, I would be interested in only those students that have taken the Higher paper for their maths GCSE.

Further contact. Participating schools will be provided with a booklet outlining the results of the study and the important role that your school will have played. I would also be very happy to discuss the current project, and other, more general, aspects of the research with staff and students if that is something that you might be interested in knowing more about.

Furthering knowledge in this area of spatial abilities and STEM education research will allow better design of educational programmes and better identification of students with a strong potential for success in STEM areas.

If you feel that this research study is an opportunity that your school would be interested in taking part in, please reply to the e-mail address below with any further questions about the study.

Sara Humphries
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No More Marksism.

How would you like to assess students' mathematical problem solving and project work without having to mark a thing? This is now possible using a new website called No More Marking (link below). The website is particularly useful for those difficult-to-mark open-ended tasks and questions that best assess deep mathematical understanding and application.

The underlying approach, called comparative judgement, is very simple. Students first complete a test or project, and their work is scanned and uploaded. The website then presents pairs of student work on the screen and you choose which is the better of the two. The decision outcomes are then analysed to produce a rank order of students from "best" to "worst".

No More Marking allows you to set open-ended and problem-based work, and to get on with assessing it without first needing to write a mark scheme or anticipate in advance what the students might produce. Moreover, we have found that students themselves enjoy using the website to assess one another's work, and are surprisingly adept at doing so.

Research at the MEC has shown the approach to be robust and reliable for assessing mathematical understanding. If you would like to have a go yourself visit the following link, or get in touch with Ian.

www.nomoremarking.com

The screenshot shows a web browser window displaying the 'No More Marking' website. The page title is 'Who is the better mathematician?'. It presents two student solutions to a math problem. The problem asks to compare the number of draws in football games in 1911 and 2011, and to compare the excitement of games in 1911 and 2011 based on goals scored. The left solution shows calculations for draws and goals, concluding that the numbers are more or less the same. The right solution shows calculations for draws and goals, concluding that the games were more exciting a hundred years ago.

New Mathematics PGCE at Loughborough University



Loughborough University is delighted to be launching a new secondary Mathematics PGCE course from September 2014. This will sit alongside the well established and highly regarded secondary PGCE course in Physical Education. Dr Jo Harris, Director of

Teacher Education, explains.

Loughborough is recognised as a high quality provider of initial teacher training, following three consecutive Ofsted inspections in which the provision of teacher education has been judged to be 'outstanding'. Furthermore, the Loughborough PGCE is a masters level qualification and represents half a full masters qualification (i.e. 90 masters level credits). Loughborough students can attain their full masters by the end of their second year of teaching.

Loughborough enjoys very high completion and employment rates and Loughborough-trained teachers are in great demand, with the majority moving quickly on to leadership roles within the schools in which they are employed.

Given all of the above, Loughborough is very well positioned to partner secondary schools in developing and producing high quality teachers and is keen to expand its School Direct provision in future years in both Mathematics and Physical Education. To this end, we have planned a **Loughborough School Direct Event on Tuesday 3rd June 2014 from 4.30-6.30pm** at Burleigh Court (which is located at one end of the University campus). Formal invitations will be sent out to schools about this after Easter but please put the date and time in your diaries as we are hoping for a good turnout.

We have appointed a PGCE Mathematics Programme Director to lead the subject and a one day a week teacher secondment post to support the Programme Director. In addition, a PGCE Maths Advisory Group has been set up to help steer the design and delivery of the new programme. Any experienced mathematics teachers who are interesting in joining this group are welcome to contact me at the below address or number.

We are also in the process of selecting trainee teachers for the first year of the programme. Details of entry requirements are on the University's website (link below). We hope to recruit up to 18 trainee teachers in the first cohort for 2014-15.

During the next few months, we will be looking to secondary schools to host teaching practice placements during 2014-15 for these trainee teachers. Any secondary schools interested in hosting our trainee teachers are invited to contact Sarah Kirkham, our Partnership Manager (s.kirkham@lboro.ac.uk).

We are very excited to be launching a new secondary PGCE Mathematics course from 2014-15 and are very much looking forward to working with new schools and staff in supporting the development of high quality teachers of Mathematics.



Dr Jo Harris
Director of Teacher Education

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