Research Update

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 know of colleagues in other schools who might like to receive this newsletter, then please contact Ian at the address below.

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50 years of A level Mathematics

Recently published research led by the MEC hit the headlines. We applied a comparative judgement technique to an archive of A level Mathematics scripts spanning 50 years. The purpose was to map how standards have changed over that time. We found that a grade B today is equivalent to a grade E in the mid-sixties. However, most of this change appears to have happened before the mid-nineties. We found no evidence of a change in standards over the last twenty years. You can read the full report here: homepages.lboro.ac.uk/~maij/BERJpre.pdf

A-level maths standards down on 1960s but not on 1990s

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No More Marking teacher guide

Included with this issue of Research Update is a guide for teachers on using the No More Marking website. The website enables a radical new approach to assessment based on comparative judgement, which has been developed at the MEC. It's helpful for assessing hard-to-mark learning such as problem solving and conceptual understanding, and lends itself naturally to peer learning activities. Contact Ian at the above email address for help setting up and using No More Marking in your classroom.

Eyeing up number sequences

As part of the curriculum, students are asked to find n^{th} term rules for given sequences of numbers. Or they are involved in a problem solving activity where they generate a number of terms from special cases and want to try to find an underlying rule. How do students go about trying to find n^{th} term rules for a sequence of numbers? We are currently working on tracking the eye movements of participants as they try to find such rules when the sequence of numbers is presented in different forms. To do this we make use of special eye-tracking technology we have in the MEC. The tracking of eye movements will help us see where each participant places their attention whilst trying to find n^{th} term rules. This can have implications for the way in which such sequences are presented to students and also offer insights into what might be useful for teachers to stress when helping students with this area of the curriculum. The results will be reported in a future issue of Research Update.

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Parallel lines

Primary children's understanding of the meaning of the equals sign is surprisingly important for their mathematical understanding, particularly when they come to learn algebra in secondary school. Building on previous research, the MEC will soon begin an international study comparing how primary children, teachers and classroom resources present and perceive the equals sign. As part of the study we will be seeking Key Stage 2 teachers who might be interested in participating. This will involve administering a short test to students, and completing a teacher questionnaire.

If you think you might be interested please contact Ian at the above email address.

Loughborough University

The Teaching Triad

Professor Barbara Jaworski explains three important domains to consider when analysing or developing mathematics teaching.

The Teaching Triad is a tool for analysing teaching and / or developing teaching. As the name suggests it consists of three domains of teaching. These domains are closely interlinked and interdependent.

Management of Learning describes the teacher's role in constituting the learning environment. It includes choice of topic, use of textbook, choice of tasks, grouping of students, setting of norms, and so on.

Sensitivity to Students describes the teacher's knowledge of students and their needs, both affective and cognitive, and the ways in which the teacher interacts with individuals and guides group interactions. It includes encouraging quiet students to contribute, supporting students with learning needs, and asking more demanding questions when a student seems to be understanding well.

Mathematical Challenge describes the challenges offered to students to engender mathematical thinking and activity. This includes tasks set, questions posed, and an emphasis on metacognitive processing.

In any classroom, in any lesson, it is possible to analyse the activity in terms of the Teaching Triad. In my work with teachers we have also used it as a tool for developing teaching. Here are some of the ways in which this has been done:

• Teacher reflects on a lesson soon after it has ended: what domains of the triad can be recognised?

• Teacher thinks about the triad while planning a lesson: Who are the students? What are their particular needs? How will the topic be presented and why? What tasks will students engage with? What levels of difficulty? What are the difficult areas for understanding? What questions will be posed?

• Teacher looks back on a week's lessons. What has Management looked like over all? Are the same choices, approaches and strategies being used? Where different approaches have been used, how are these related to the needs of students? What challenges have been offered and how have students reacted? Where might students need extra challenge? Extra support?
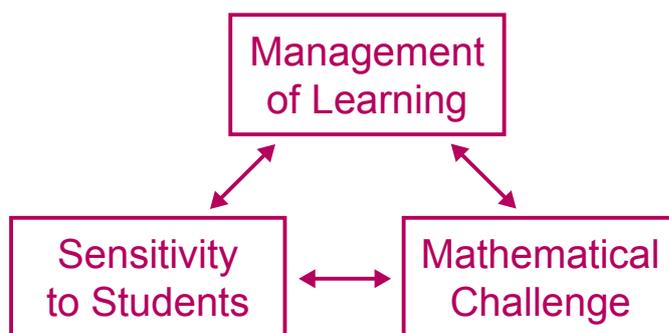
• Teachers reflect together on their teaching – perhaps sharing a video of one of their lessons, addressing some of the questions above.

Research has shown that a good balance between Sensitivity and Challenge is needed for effective teaching: a lot of Sensitivity, but little Challenge, can lead to good teacher student relations but low mathematical progress; a lot of Challenge but little Sensitivity can result in students feeling stressed or unable to succeed. When challenge and sensitivity are well balanced, the result is "harmony" – students are suitably challenged and stimulated while supported to achieve.

Analysing day to day teaching practices in these ways can of course take time. However, reflective thinking using the Triad can be stimulating and enable teachers to become more aware of issues, choices and decisions. Teachers can become more knowledgeable about their teaching and this can lead to teaching becoming more attentive to students' needs and ways of working with them on mathematics. I should be very interested to hear from any teacher or teachers engaging with the Teaching Triad.

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