BRINGING THE OUTSIDE WORLD INTO THE MATHEMATICS CLASSROOM – NEW APPROACHES TO THE USE OF VIDEO IN THE CLASSROOM

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Many countries are exploring different approaches to create a more relevant mathematics curriculum through the use of real world examples in the classroom. In this paper we will share some of the classroom video resources that have been developed since the last ICTMT: the series World of Maths (Teachers TV 2008) and i-Maths (British Broadcasting Corporation 2008). This also complements the UK's "STEM" (Science, Technology, Engineering and Mathematics) agenda (Her Majesty's Treasury 2004) which aims to promote STEM subjects to the populus and increase student uptake in STEM related careers and courses.

INTRODUCTION

In England and Wales a revised national curriculum for mathematics is promoting a wider range of contexts for mathematical learning and encouraging teachers to exploit opportunities to make links with applications of mathematics in other subjects (Department for Children Schools and Families 2007). This also complements the UK's "STEM" (Science, Technology, Engineering and Mathematics) agenda (Her Majesty's Treasury 2004) which aims to promote STEM subjects to the populus and increase student uptake in STEM related careers and courses. Resources exist which use still digital images as a context to explore mathematics (Eade et al. 2007-9; Phillips 2001; 2006) and a number of articles in teacher journals have described the potential for their use in secondary classrooms. Our presentation at ICTMT8 reported on three highly innovative multimedia projects in the United Kingdom which integrated the use of digital video resources to enhance and support mathematics education which were: *The Mathematical Toolkit* (Intel plc et al. 2005); *Teachers' TV*; and the *BBCjam* (British Broadcasting Corporation 2007). Unfortunately *BBCjam* has been subsequently

abandoned, while *The Mathematical Toolkit* has gone worldwide via Intel's Skoool programme. This paper reports on a number of recent curriculum development projects which use video to model real scenarios mathematically in ways which motivate and engage secondary school learners and some more recently developed classroom video resources, the series *World of Maths* (Teachers' TV 2008) and *i-Maths* (British Broadcasting Corporation 2008)

DEVELOPING MATHEMATICS PROGRAMMES FOR CLASSROOM USE.

The inspiration for the development of the television series *World of Maths* (Teachers' TV 2008) and *i-Maths* (British Broadcasting Corporation 2008) undoubtedly came from the work of Richard Phillips (Phillips 2001; 2006), whose creative and interesting sets of mathematical photographs have enhanced many mathematics' classroom walls and been used by teachers to stimulate students' mathematical enquiries. The production team began by considering a range of locations in which there would be inherent mathematical decision making taking place within an engaging real setting or location. The idea was to put a mathematical lens over the top of a documentary style programme in a way which provoked mathematical discussion. The locations developed were: *Ice Rink*, *Hotel*, *Night Train*, *Cricket Match*, *Barcelona's Big Church* and *The Mini Factory*. These programmes are all available for free download from the teachers' TV website www.teachers.tv in the secondary mathematics section.

For example, each Christmas in London a number of temporary ice rinks are erected at historical locations around the city. They appear apparently overnight and many young people enjoy going to them with friends and family. In December 2007, one such ice rink was erected at the Old Naval College in Greenwich and the programme was filmed both during the construction and when the ice rink had opened to the public. In preparing the filming schedule, the production team considered what would be interesting and appropriate aspects on which to focus the mathematical lens in this particular scenario. See http://www.teachers.tv/video/21594. The team decided upon:

- Exploring dimensions of the ice rink – surface area, perimeter, length of coolant pipes, volume of refrigerant, volume of water needed to produce the ice etc.;
- Constructing the access ramps around the ice rink;
- Setting the admission prices;

- Maintaining the ice surface;
- The stock level of skates to hire;
- Staying safe on the ice.

Each short sequence is less than three minutes in length and provides students with mathematical clues to enable them to begin to model the scenario mathematically. For example, a short sequence around the skate hire area establishes some facts which would provide enough information for students to begin to decide exactly how many of each size skate is needed to be able to meet the majority of customers' needs. The mathematical description of each scenario is deliberately understated as it is anticipated that the mathematical questions will come into students' minds as they watch the programme. The scenarios are aimed to promote rich mathematical discussion rather than arriving at the correct answer to a mathematical problem. The British Broadcasting Corporation commissioned a follow-up series *i-Maths* (British Broadcasting Corporation 2008) which developed a completely unmediated bank of clips in mathematically relevant contexts. The authors are particularly interested in knowing how these materials are being accessed and used by mathematics teachers and, in particular how the use of the video clips impact upon the role of the teacher, the nature of the classroom tasks and the classroom ethos.

MATHEMATICAL MODELLING WITH VIDEO CLIPS

Once prohibitively expensive, digital video cameras are now in common personal use – and most digital cameras have a video mode, as do the built in cameras on digital phones and computer Webcams. The National Science Foundation in the USA has supported the development of some open source software for video analysis mainly in connection with the teaching of physics. The first of these is the *Vidshell* package developed by Doyle V. Davis, which you can download together with a library of video clips from: http://webphysics.ccsnh.edu/vidshell/vidshell.html. The other is a Java applet called *Tracker 2* from Doug Brown: http://www.cabrillo.edu/~dbrown/tracker/. With *Tracker* you import a video clip, calibrate it, overlay axes and record data while tracking the position of an object. While the video is being annotated in one window, a table of data is generated in another, and a graph in the third. All the analysis and modelling can be done within *Tracker* itself. At Wildern School a group of Year 10 students produced a

DVD of their project which includes a section demonstrating how to use *Tracker*: http://www.ncetm.org.uk/files/362726/Wildern+clip+2.avi. Many students are now discovering how to use the free Jing software, http://www.jingproject.com/, to make such instructive videos for themselves and to share with their peers. New models of personal digital video cameras have recently been introduced which are capable of taking clear video clips at very high speeds – for example the Casio Elixim range will take clips at 210, 420 and 1000 frames per second. At such speeds students and teachers can observe phenomena that would otherwise have been impossible to see. A new project at Oakmeeds school, funded by the National Centre of Excellence in Teaching Mathematics, is looking at how high speed clips of sporting activities can be used as contexts for STEM work linking mathematics and physical science.

REFERENCES

British Broadcasting Corporation (2007) BBCJam (Mathematics 11-16), (Unpublished multimedia resource).
British Broadcasting Corporation (2008) i-Maths, in: P. Evans (Ed) (London, British Broadcasting Corporation).
Department for Children Schools and Families (2007) National Curriculum for mathematics, (London, UK, Qualifications and Curriculum Agency).
Eade, F., Dickinson, P., Hough, S. & Gough, S. (2007-9) *The Making Sense of Maths Project*. Available online at: http://www.partnership.mmu.ac.uk/msm/ (accessed 5th May 2009).
Her Majesty's Treasury (2004) Science and innovation investment framework 2004-2014, (London, Her Majesty's Stationery Office).
Intel plc, Clark-Jeavons, A. & Oldknow, A. (2005) The Mathematical Toolkit, (London, London Grid for Learning).
Phillips, R. (2001) Problem Pictures, (Evesham, UK, Badsey Publications).
Phillips, R. (2006) Problem Pictures: Themes, (Evesham, UK, Badsey Publications).
Teachers TV (2008) World of Maths, (London, Teachers TV).