

Guest Editorial

Embedding New Technologies in the Practice of Mathematics Education: Selected papers from ICTMT-7

Keith Jones and Federica Olivero

This issue of IJTME presents the fourth set of papers originally presented at the 7th International Conference on Technology and Mathematics Teaching (ICTMT-7) which took place in Bristol (England) in July 2005. As with earlier events in the ICTMT series, the seventh conference brought together educators, researchers, and developers, all with a common interest in enhancing the teaching and learning of mathematics (at any level) through the use of Information and Communications Technology (ICT). What was particularly noteworthy about ICTMT-7 was its range of innovatory features. First, the conference was a pioneering collaboration between the conference organisers and a school in Bristol, John Cabot City Technology College (www.cabot.ac.uk), an ultra-modern state comprehensive school for pupils ages 11 – 19 and superbly equipped with ICT resources that became the wonderful venue for the conference. Secondly, contributors to ICTMT-7 had the opportunity to submit a full version of their contribution for inclusion, following peer review, in special issues of this journal, again a pioneering collaboration between the IJTME editorial board and the ICTMT-7 organisers.

The papers contained in this special issue relate to the key theme of how the use of ICT might become more embedded in the day-to-day experience of learners of mathematics. Across the world, and after more than two decades of government initiatives and academic research, the optimal use of ICT in teaching and learning (in general, let alone in mathematics) remains only partially understood and, by all accounts, inconsistently practiced in schools. The papers in this special issue address the call for more research, both to inform the ongoing investment in new technologies for learning, and to aid practitioners who may be seeking evidence to support and develop their teaching.

The lead paper in this special issue originated as a keynote presentation at ICTMT-7 in which Ruthven took as his focus the conference theme of *embedding technology in learning*. In his paper, Ruthven draws not only on key findings from studies of the general place of technology in classroom practice and teacher thinking, but also practitioner ideas about the contribution of computer-based tools and resources in the teaching of mathematics (including, in particular, practice in using dynamic geometry software). Through this analysis, Ruthven concludes that the use of technology in teaching contributes to the evolution of teachers' practice, but only as one component of a complex larger system of ongoing practices.

Given the influence of the available ICT tools, Christou and team, in the second paper in this special is-

sue, provide insight into the theoretical underpinning of the design of an interactive package for use in teaching three-dimensional geometry across the middle school years (students are aged 8-12). Here, in this project, rather than pedagogy and software design being treated separately (as so often appears to be the case, with the result that pedagogy becomes based on what the technology appears to permit, rather than being fully integrated as a basis for technological design), Christou and colleagues present an example of how pedagogic theory can be integral to the development of the final software design. In this way, Christou and colleagues provide an example of how what can appear to practitioners as a gap between technology and pedagogy might be bridged. In its way, this might be one factor relevant to ensuring productive embedding of technology in learning.

In their paper on using the theory of Transactional Distance as a framework for the analysing the computer-aided teaching of geometry, Papadopoulos and Dagdilelis examine what they refer to as the 'distance' between, for example, what the students usually do in geometry (without a computer) and the way the software functions. Papadopoulos and Dagdilelis suggest, from their analysis of work with upper primary school students (Grades 5 and 6), that this 'distance' possibly functions not merely as an obstacle to learning but even more so as a source of new didactical obstacles, for example in the form of 'wrong' conceptions in students.

Insight into understanding both the conditions in which technology can integrate into the teacher's professional practices, and the reasons why obstacles to uses of ICT appear to persist, are provided by Abboud-Blanchard and Lagrange. Utilising evidence from the developing practice of trainee teachers, Abboud-Blanchard and Lagrange shows that teacher education systems (like their own IUFM in France) can have a productive role in enabling the greater embedding of ICT in the emerging practice of beginning teachers, but also that 'miracles' should not be expected.

To complement this, O'Reilly examines the reality of trainee teachers using graphing calculators in UK schools during their post-graduate training year. In analysing the problems and benefits experienced by trainee mathematics teachers, O'Reilly relates these to features of the educational setting. From the trainee teacher's perspective, the benefits of using graphing calculators lay in the way that learning and understanding were mediated - with some trainee teachers experiencing more successful co-operative learning and discussion in the classroom, and others finding improvements in the way children were able to work independently or pursue a higher level of mathematics. Problems that the trainee teachers experienced related to their own lack of familiarity with the technology, and

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to their apprehension regarding the time and planning needed for such lessons.

In the final research paper in this special issue, Trigueros, Lozano and Lage examine the process of developing and using a computer-based interactive package (software and teacher's guide) for teaching and learning probability at the primary school level, one component of a large-scale project in Mexico aimed at enriching primary school mathematics education by developing teaching resources that utilise technology. Trigueros and her colleagues illustrate how they work closely with teachers on identifying aspects of teaching that might benefit from the development of computer-based applications and how, through this close collaboration, they developed a set of resources based around a computer-based interactive package they designed. In researching the use of the package in classrooms, they found that despite enthusiasm for the resource, teachers were unsure about, and needed support with, integrating the use of the resources into their teaching. This echoes Ruthven's call for further sustained research into factors relating to the productive embedding of technology in learning.

At the heart of the set of research papers in this special issue are matters related not only to the affordances and constraints of digital technologies, but also, when trying to understand the educational integration of new technologies into classroom teaching and learning, the need to develop ways of taking into account the complexity of the ongoing practices of mathematics education. This illustrates that further research is required in order to gain better insight into the potential of technological tools in mathematics education and how the use of such tools might be productively embedded in the practice of mathematics teaching and learning. Further examples of such approaches are invited for submission to this journal.

To conclude this special issue, Vulis and Small argue that since mathematicians in industry need to have skills in formulating, modelling, and solving problems from diverse and changing areas, these attributes are also desirable for students on business courses and that, in this context, providing business problems for students to tackle using ICT can help to develop these sorts of skills. The intention of their paper is to stimulate discussion on approaches to using technology in the teaching of financial mathematics. Contributions on this topic are cordially invited and, if there is sufficient interest in this area, this may lead to a special edition devoted to the teaching of financial mathematics with technology.

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