



## The Government's strategy for ICT in education

# - what's in it for mathematics?

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The Government is proud to announce that it has committed over £1 billion to Information and Communications Technology (ICT) in education. It has even created a new Ministry within the Department for Education and Employment (DfEE) specifically for Technology and Education. The first such minister is Michael Wills who was moved from the Department of Trade and Industry (DTI), and who has a background in TV/film production. It has not just thrown cash at the issue - it has also intervened in the content of the curriculum. In this epoch of "joined-up government" there does seem to be a reasonably consistent message coming across from the DfEE and its agencies (QCA, TTA, BECTa, Ofsted) that ICT should be curriculum led, and should empower teachers, rather than threaten their existence (until the next election at least!).

We also hear quite a bit about expansions, and job vacancies, in the ICT industry (ICL has 4,000 vacancies currently), and a new period of skills shortages. This year the DfEE has made its contribution by doubling the number of civil servants directly involved with ICT in schools.

So let's identify some of the planks in the government's strategy.

Training  
Hardware  
Software  
Materials  
Curriculum  
Infrastructure  
Good practice

### Training

The New Opportunities Fund (NOF) has been created to channel funding from the government's National Lottery proceeds towards projects in public spending departments such as Health and Education. £230 million is being spent in 1999/2003 on training the vast majority of teachers and librarians currently working in maintained schools in the UK in the effective use of ICT. This training is being provided by around 40 groups (public, private and mixed) who received approval from NOF on the advice of the government's Teacher Training Agency (TTA).

The TTA has produced regulations governing this training which make it clear that the training must be subject focused, that it should take place with minimum disruption to teaching and that it should be tailored to the individual teacher's needs. The TTA has also brought in a mandatory National Curriculum in the use of ICT in subject teaching for Initial Teacher Training (ITT). The Expected Outcomes for each have now been published.

The TTA has produced CD-ROM and paper-based materials for Needs Identification, so that teachers can identify their main training needs before taking a NOF-funded course. The secondary school CD-ROM includes four case studies, which show the use of different ICT tools for teaching mathematics in a range of different classroom contexts and organisations. The tools include dynamic geometry software

(*The Geometer's Sketchpad*), a spreadsheet (*Excel*), a small program (a *SMILE* number game) and graphing calculators (TI-83). They also show the use of ICT in whole-class teaching by means of a data projector, a VGA/TV adapter, a VGA pad for an OHP and an LCD pad for use with graphing calculators and an OHP. The lessons span years 7 to 10, and the content involves geometry, data-handling, number work and algebra.

The largest NOF-approved training group is the partnership between Research Machines (RM) and the Open University (OU) called the Learning Schools Programme (LSP). This has contracts with over 100 LEAs in England & Wales. As part of the elaborate quality assurance (QA) mechanism imposed by the TTA, the LSP approached professional associations in school subjects to provide "critical readers" while their materials were in development. Ronnie Goldstein and I represented the ATM and the MA. The LSP reckon that the training occupies around 30 hours of a teacher's time, mostly in self-study. Their extensive materials include a Mathematics Pack with a 40-page "reader", a CD-ROM of case studies and videos. Teachers also belong to a conferencing and e-mail system through the OU's First Class system. The secondary mathematics case studies include examples of the use of graph-plotting software (*Omnigraph*), *Logo*, a spreadsheet (*Excel*) and a graphing calculator (TI-83) used with a motion detector (CBR).

The NOF training is supposed to be a one-off kick-start to bring all serving teachers up to the same standards as expected of new entrants. Its end-point is to be a teacher's individual ICT action plan in which future training needs are identified and prioritised. BECTa and Ofsted have also agreed a system of follow up inspections to evaluate the impact of the NOF-programme. So, by 2003 we should see that all 20,000 or so, secondary mathematics teachers have had around 30 hours of training in the use of ICT both to enhance teaching and learning, and to make them more efficient practitioners. What then, and what else?

The government's review of the first 3 years of the TTA was pretty critical. The policy now on all Continued Professional Development (CPD) - other than in ICT - is that it should move from the TTA to the General Teaching Council (GTC), with the professional associations playing a more central role. To this end the Mathematical

Association (MA) has appointed a Professional Development Officer, Ros Hyde. It was announced for the first time at the MA conference that the Mathematical Association is taking on the running of the Teachers Teaching with Technology (T-cubed) programme with Ros as co-ordinator. This programme provides low-cost training in the use of hand-held technology - such as graphing calculators (GCs) and data-loggers - as well as other ICT tools mainly for teachers of maths and science in secondary schools and FE. Talks have already been held with the Association of Teachers of Mathematics (ATM) and the Association for Science Education (ASE) about co-operating in the design and delivery of courses.

Although little is yet known about the future funding arrangements for CPD nationally, there is already funding available to schools which can be spent on ICT training outside the NOF programme. This is within the section B25, headed National Grid for Learning (NGfL) of the Standards Fund for Schools (DfEE circular 16/99): "... schools may purchase... associated technical ICT training which complements (but does not replicate) the pedagogical training for teachers which is supported by the New Opportunities Fund."

## Hardware

The main source of government funding for ICT to schools comes through the huge multi-purpose grant called the Standards Fund. This is where the DfEE influences what schools do by earmarking sums of money for particular purposes, which the LEAs are supposed to match. It was published to LEAs and schools as Circular 19/99, and can be found at the DfEE's web-site. Although the sub-heading is called "B25: National Grid for Learning", it can be used for a wide range of ICT-related purchases. It is increased to £205 million for 2000/2001, and is formula funded (not competitive bidding) for the next 2 years. £155 million is to improve ICT provision for schools and £50 million for broadband networks.

"Expenditure by schools benefiting from this grant should be focused on raising standards in the school curriculum and may also support the use of ICT by senior school staff and teachers for their professional development and for administrative work associated with the delivery of the curriculum ...

In addition (or as an alternative to NGfL-approved managed services) schools may purchase:

- local network infrastructure which is compatible with the external network connections described above;
- ICT equipment (this may include class sets of portable computing devices; whole class teaching aids such as projection equipment; digital cameras, scanners and digitisers and other equipment which can be used to help create educational resources);
- associated technical ICT training which complements (but does not replicate) the pedagogical training for teachers which is supported by the New Opportunities Fund;
- services and software to ensure best use of the infrastructure, including Internet services;
- on-line curriculum resources, software, and other curriculum ICT applications, including services relevant to the local creation and publication of educational content."

So here is one of the most closely guarded secrets in education! You can use this money to buy hardware for maths departments (including class sets of graphing calculators), to buy site-licences for mathematical software (like *Cabri* or *Derive*) and/or to buy additional training for ICT in maths (such as through T-cubed). But the LEA IT advisors/inspectors and the schools' Heads and ICT co-ordinators have probably got other ideas! Many Heads like the sales pitch of Integrated Learning Systems (ILS) (such as *Successmaker*) - but just a single licence for one workstation costs around £1600 - or the cost of about 30 GCs.

The government's other schemes, such as "laptops for teachers", and the current £20m for "computers for teachers", have also been taken advantage of for the benefit of mathematics in some schools.

## Software

Recently the government has come under pressure from the educational publishers to encourage schools to spend more money on software and other materials connected with ICT. Whereas most commercial and industrial firms

are used to spending more than half of their IT budget on software, schools are accused of having developed a culture of looking for free software. Certainly many secondary schools have installed computer networks where there is little software available other than the "bundled" software such as the Microsoft office tools of *Word*, *Excel*, *PowerPoint* etc. Also many schools expect the mathematics department to take over responsibility for teaching the use of generic software such as spreadsheets. As a move against this, the NGfL component of the Standards Fund states that a minimum of 15% of the money for ICT provision must be spent on "content". This may be for the purchase of software, or for subscription to service providers such as some of the new paying support web-sites for teachers.

At various times subject groups have been asked to review the software provision for their subject. An earlier example of this from the DfEE/NCET for mathematics can be found on the MA web-site at [www.m-a.org.uk](http://www.m-a.org.uk). At the end of last year the government's British Educational and Communications Technology Agency (BECTa) held a number of such subject seminars on behalf of the DfEE, mainly to identify gaps in the market which publishers could exploit! Although the mathematics report has yet to be posted on the BECTa web-site (or NGfL) here are a few extracts from it:

*The software list on p.36 of the DfEE/NCET document, modified in the light of the discussions above, still provides a suitable framework for the ICT requirements to support the mathematics NC at KS3/4 (and beyond):*

*Small Software*  
*Programming languages - such as Logo, Basic and Graphic calculators*  
*Generic software - particularly spreadsheets, but also databases*  
*Content-free, subject specific software:*  
*graph-plotters,*  
*computer algebra*  
*dynamic geometry*  
*data-handling*  
*Graphic calculators and data-loggers*  
*CD-ROM and the Internet...*

*The following items represent just a few of the kinds of developments in software that would enhance the teaching and learning of mathematics:*

*Dynamic Images*  
*Mathematics communication tools*  
*Data sources and tools.*

So the conclusion seems to be that by and large mathematics is not badly served, certainly with mathematical tools. In the days of the BBC micro, 380Z and Nimbus we had a rich source of "small software", such as from Smile, Shell Centre, ATM, Anita Straker etc. Only a small number of these now survive in common formats such as Windows. It is encouraging to note that there is a move to version some of that software stock for graphing calculators. It is also interesting to note that a new "mathematics communication tool" has been announced by TI, called TI Interactive!, which should be on the UK market this summer. The MA and ATM web-sites contain links to sources of many examples of free, trial and demo software under the above categories.

As recently as last week the DfEE ran a high profile conference for the educational publishing industry on how to build a world-class educational ICT business. So the government sees the export of UK educational software and other materials as a growth industry. It remains to be seen just what role mathematics might have in this!

## Materials

The government is also very keen to encourage the delivery of curriculum materials through ICT. They have encouraged projects on digital television and web-sites for GCSE revision materials and support. At the BETT show in January, Michael Wills announced a new pilot project to have KS3 schemes of study in maths, Latin and Japanese delivered using ICT. At the time of writing there are 4 groups in contention for the maths project, and an announcement is expected by the end of May. It remains to be seen whether it is just the medium that is ICT based, or whether the content actually illustrates the use of ICT in maths education.

## Curriculum

Last year saw the review of the National Curriculum 5-16. David Blunkett made it clear to QCA that he expected subject descriptions to be pared-down in general, but beefed-up in respect of references to ICT. Well, this seems to have happened in nearly all subjects – except for maths! The watchword in maths in general still seems to be that pupils mustn't rely on their calculators in case the batteries go flat! But at least in Years 5/6 the National Numeracy

Framework and NC revision makes teaching of confident use of calculators compulsory at KS2. Also it now seems pretty generally accepted that it makes little sense to tackle data handling without benefit of ICT. So in KS3/4: we find that the NC contains a few explicit exemplars of ICT use e.g. *ICT opportunity Pupils could generate functions from plots of data, for example, from a science experiment, using simple curve fitting techniques on graphic calculators, or with graphics software. Pupils could use software to explore transformations of graphs.* Although not yet published, the QCA proposals for GCSE criteria now include compulsory 20% coursework with an ICT supported data-handling project accounting for half of these marks.

At the same time the QCA revised its specifications for maths A-level. This brought in the ludicrous ruling about restricting the use of calculators to scientific or below in many of the examination papers. At least the new A/AS maths QCA criteria include a new assessment criterion: *use contemporary calculator technology and other permitted resources (such as formulae booklets or statistical tables) accurately and efficiently; understand when not to use such technology, and its limitations. Give answers to appropriate accuracy.*

In 16-19 education, all students will now have to cover key skills of communication, application of number and ICT. New Free Standing Mathematics Units (FSMU) are coming in from September many of which specify compulsory ICT use including GCs, and all have equal assessment weighting for examination and course-work. Another development from Mr. Blunkett is in making it easier for schools to take the International Baccalaureate (IB) as an alternative to A/AS. Here all students have to take a mathematics unit, choosing 1 from 5 alternatives. Four of these make the use of GCs compulsory and the fifth strongly encourages their use. There is also an ICT assessment criterion in maths with a compulsory coursework task.

More depressingly the National Numeracy Strategy has virtually nothing to say about the use of ICT to enhance mathematics teaching at KS1/2. The QCA commissioned them to write a scheme of work for year 7, which has now been published. Needless to say there is also virtually no reference to ICT except in the context of data handling and the critical use of calculators for computation. The lack of vision shown here is most regrettable.

## Infrastructure

The National Grid for Learning (NGfL) is the jewel in the government's ICT crown, with the target of connecting all schools to the Internet by 2002. A major element of the NGfL is the Virtual Teacher Centre (VTC). This is growing into a considerable resource base for teachers and there are already useful information, resources, advice and links for maths teachers. The government has also channelled small sums of money to the subject associations via BECTa to develop their own web-sites. BECTa has now appointed a subject officer for secondary school maths and numeracy: David Wright. It has also set up a mathematics curriculum group, which have representation from MA and ATM membership.

## Good practice

One interesting development over this last academic year has been a project set up by the DfEE to identify what constitutes good practice in the use of ICT in subject teaching. This is directed by Joyce Wood from Sussex University and has started by concentrating on KS3 teachers of maths, science and geography. It held a high-profile conference at the RSA last month during which 3 maths teachers made presentations. One of these was the use of a variety of data collected on a field trip to a Victorian fort for analysis at school using a variety of ICT tools such as spreadsheets and GCs. Another was on the development of a web-site with interactive geometry explorations using Java versions of a new dynamic geometry package called Cinderella. The third was based on pupils making simple animations using programming on a graphic calculator. The project involves a group of commercial sponsors (Post Office, RM, CGU, Pearson, Ordnance Survey, Marconi and Wellcome) and a group of subject representatives. We await news of how this project will develop in the future.

## Summary

There really is plenty of scope for mathematics to benefit from the majority of the strands of the government's ICT policy - but in some areas, particularly with regard to funding for hardware and software, we are going to need to be vigilant, and not be afraid of making nuisances of ourselves. There are exciting developments such as in new software for mathematics. The most

conservative elements are still to be found with regard to the curriculum at QCA, the exam boards and the NNS - but there are chinks of light between these, such as in the Free-standing Mathematics Units and the International Baccalaureate.

software

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Good practice

Adrian Oldknow works as a freelance consultant.

This paper was originally prepared for the Mathematical Association's Annual Conference in April 2000, but in the event Adrian was unable to attend.

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