

# What would it take to get ICT established in the maths department?

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The recent Ofsted report *Mathematics in secondary schools* (HMI 1978 Feb 2004) reports on schools visited in 2002/3. One of its main findings is that:

“ Despite significant government funding, the use of information and communication technology (ICT) to promote progress in mathematics remains a relatively weak aspect of provision. Its use is less effective than in many other subjects and is unsatisfactory in one school in three. ”

It continues:

**“The following are ... key issues identified over this period of inspection or in the last year, which some schools need to address in order to bring about subject improvement:**

...

The use of ICT to support teaching and learning within mathematics remains underdeveloped. While there are examples of good practice, there are significant inconsistencies between schools as well as within mathematics departments. A minority of teachers are still not confident in the use of ICT and require

further training. In some schools and colleges access to ICT facilities, including graphing calculators, is too limited and an appropriate range of software has not been made available. In other places, where resources are adequate, they are often not used frequently enough or to promote better teaching and learning.....”

So, if yours is one of the schools which might be classified as “unsatisfactory”, or if you feel you are not using ICT fully to promote better teaching and learning, then what can you do about it? Actually

quite a lot!! First we must start with the assumption that you want to do something about it, and that you are prepared to put together a development plan. In 1996 we produced the document “*Mathematics and IT – a pupil’s entitlement*”, perhaps now is the right time to produce “*Mathematics and ICT – a teacher’s entitlement*”?

In this article I will explore some of the sources of advice, hard cash, ICT software, hardware and CPD, as well as free goods, to see if we can make the sums add up!

## ICT... advice and information

The Becta website contains a collection of materials to help departments plan their development,

<http://curriculum.becta.org.uk/docserver.php?temid=293>

and these are being updated. There is a part of the Becta site devoted to ICT advice for teachers and this is being substantially developed in collaboration with Subject Professional Associations, including the MA:

<http://www.ictadvice.org.uk>

There is an updated audit buried in the ICT Advice site at

<http://www.ictadvice.org.uk/index.php?section=tl&cat=001002007&rid=1957>

The MA’s own website

<http://www.m-a.org.uk>

gives access to a number of other useful sources of guidance, such as the TTA-funded document: “*ICT and Mathematics: a guide to learning and teaching mathematics 11-19*”. This document is currently being revised and updated, and will be widely distributed as part of what is known as the DfES



“KS3 Offers to Teachers”. Initially these are being made in maths, science, English and MFL – with other subjects following shortly. The plan is that each department will have some sort of container (maybe a crate!) in which it can build up a set of physical resources to support its ICT development (books, CDs, posters etc.) – and that these resources will also be available electronically for downloading. The TTA produced some video case studies, including 4 mathematics lessons, on CD

for the NOF-funded training. These are still available, and provide a valuable resource in seeing how a range of software and hardware can be effectively used in mathematics classrooms. An on-line order form can be reached from:

<http://www.tta.gov.uk/php/read.php?sectionid=92&articleid=1074>

For the BETT show 2004, the DfES produced a CD pack "Embedding ICT @ Secondary" with further video case studies, including one maths lesson

showing dynamic geometry software used with an Interactive Whiteboard. As part of the KS3 Offer, the DfES are funding the provision of a wider range of video case studies in subjects including maths.

In summary then, there are already a good range of resources which are freely available, but for which you have to know where to look. In the near future this will be greatly extended and made much more accessible to teachers by Becta and the DfES.

# ICT... funding in schools

The DfES have been relaxing the rules over how funding can be used by schools to support ICT. For example schools are now free to use a share of their capital grant on ICT if they wish. The element of the Standards Fund which deals with all ICT expenditure is called "31 ICT in Schools Grants"

<http://www.dfes.gov.uk/ictinschools/funding/>



It consists of three elements with the following funding in 2004/5:

31a ICT Infrastructure and Services and Hands-on Support	£208m
31b Broadband Connectivity	£143m
31c e-Learning Credits (Curriculum On-Line)	£100m

Grant 31a is to cover a range of hardware and professional development. Grant 31c is only available for purchasing curriculum software and

digital resources. None of grant 31 can be vired for aspects of school expenditure other than ICT. The small print in this year's Standards Fund makes it clear that the same level of funding will be available in 2005/6. So discounting 31b, there should be £620m over the next 2 years to bring about improvements in ICT provision where most needed. In order to work out a "fair share" for mathematics I am going to assume about half the sum will be shared among c4,500 secondary schools in England – so my baseline figure is just under £70k per school of which we might expect around £9k to be a realistic figure for mathematics – perhaps more if it is seen to be lagging behind other subjects.

So the purpose of this article is to see if we can use that sort of funding creatively over a two year period to have a lasting improvement in a school's effective use of ICT in mathematics. In order to model the available expenditure I will consider a "typical" secondary school with 1100 pupils, a total of 7 fte maths teachers, and in which maths occupies 1/8 of the curriculum.

I will work on the principle that "one size won't fit all", and try to establish the case for some asymmetric distribution of the £9k cake which is more appropriate for mathematics. I will also assume that wherever possible schools would prefer ICT to be available in a normal maths classroom and to avoid planning "room swaps" to get maths classes into computer suites.

## ICT... software

The DfES provides cash to schools to purchase curriculum software and other digital materials through “e-Learning Credits”. Software eligible through this scheme is listed on the Curriculum Online website

<http://www.curriculumonline.gov.uk>

Also many publishers and suppliers use the Curriculum Online logo to show which of their products qualify for this funding. As we have seen, there is £100m allocated for each of 2004/5 and 2005/6 – and the formula for a school’s allocation amounts roughly to  $\pounds(1000 + 10n)$ , where  $n$  is the number of pupils. To make things concrete I’m going to consider a typical 1100 pupil school in which maths occupies 1/8 of the curriculum. So that makes £1500 of e-LCs the “fair share” for maths in each of the next 2 financial years. Around £300 each buys site licences for dynamic geometry software such as Cabri and Sketchpad, and graphing/data-handling software such as TI Interactive!, Autograph and Fathom. Other candidates for expenditure are schemes such as RM MathsAlive and suites of programs such as from Smile. E-LCs cannot be used to fund other ICT expenditure such as on hardware, CPD or generic software. Because of this I am going to suggest that maths does not spend its full allocation of e-LCs and that it swaps say half of this cash with one or more subjects which are relatively “content greedy” – and which probably already do plan to make regular use of computer suites. My solution would be to spend £800 in 2004/5 on getting site licences for major mathematics software tools, and a further £700 in 2005/6 on other maths curriculum materials. Thus releasing £1500 to be better spent on hardware and professional development.

Remember that in 2006 the BBC’s own Digital Curriculum materials will become freely available – and are designed to cover 50% of the maths content at KS3/4. There are also plans under discussion to include a range of new innovative software tools for mathematics within the DfES KS3 Offer – and hence make them free to schools.



In summary there is a wide range of good and relatively inexpensive software already available which can be purchased using e-LCs, and this will be extended through the provision of further free resources. The needs of maths will be better served by an uneven distribution of grant 31.



## ICT... hardware

The main element of the Standards Fund which deals with ICT expenditure is grant 31a. This money can be spent in a variety of ways, and it is up to the school to determine its priorities. No doubt these will differ between subjects. The hardest decision is going to be how to divide it between ICT equipment and ICT professional development for teachers. It's not much use either providing good resources which no one can use, nor training staff to use resources to which they do not have access!!

I am assuming my "typical" department should be entitled to £3000 from 31a for each of 2004/5 and 2005/6. Counting in "savings" of £1500 from 31c this gives £3700 in 2004/5 and £3800 in 2005/6. I am going to suggest setting aside £2000 for CPD (see the next section) and to leave £5500 for hardware in 2004/6 – but split asymmetrically with a higher proportion on CPD for 2004/5 than in 2005/6. There are several reasons for this – one being that you'll get more ICT kit for your money next year than this year, another being that you might have staff needing their ICT professional development to help progress through the pay threshold.

So how should our maths department budget to spend £2200 in 2004/5 and £3300 in 2005/6?

Candidates for ICT "kit" from grant 31a include:

- (a) more laptops for teachers,
- (b) hardware to support interactive whole class teaching and
- (c) hardware to provide hands-on by pupils in normal mathematics classrooms.

According to DfES figures, about 1 in 3 teachers have currently been equipped with laptops and this is expected to rise to 2 in 3 by 2006. So I'll make the assumption in (a) that our typical department has 2 laptops available and will buy 2 more in the next 2 years. I shall be heretical in (b) and say that you can get much better value for

money than going for Interactive WhiteBoards (IWB) as solutions. Of course if the PTA wants to buy you one, or if the school has extra cash it wants to spend on IWBs e.g. through London Challenge or being designated with Specialist status, then take it with grateful thanks! But to buy one or more from your £5500 will not leave enough for other important equipment. In order to get whole class computer displays you are going to need one or more digital projectors – so if you don't already have a maths room with one fitted, or access to a portable one, then you'll need to buy at least one. One way to encourage pupil participation with a whole class ICT display is to buy wireless mice (and maybe keyboards) – which are much cheaper than IWBs. Of course an altogether cheaper way of providing whole class displays which are sufficient for many aspects of maths is to use a teacher's graphical calculator with a simple display panel for projecting with a conventional OHP. Also, virtually every source of official advice for ICT in mathematics emphasises the need to provide the kind of access sought in (c) by having sets of graphical calculators. So here is my plan for spending my projected £5500:

2004/5: 1 portable data-projector (£940),  
2 wireless mice (£100), 15 pupil  
graphical calculators (£735), 3 teacher  
graphical calculators (£255), 1 display  
panel for GC (£90), 1 data-logger for  
distance-time graphs (£80) = £2200

2005/6: 2 laptops (£1500), 30 pupil graphical  
calculators (£1460), 2 display panels for  
GC (£180), 2 data-loggers (£160) =  
£3300

So if we already had 2 laptops and access to at least one data-projector, then we would now be able to equip simultaneously 5 rooms with whole class interactive teaching kit: 2 using PCs and 3 using GCs (assuming that there are 3 workable OHPs available in the school!) Also 3 classes at a time could be equipped with a GC between each pair of pupils. The data-loggers can be used with either the PCs or GCs. I have costed the 48 GCs above as

fairly high specification models with built-in “flash ROM” in which to store applications such as versions of Cabri, Smile and spreadsheet software. Such models are also capable of being networked and so should be recognised as portable computers, and hence contribute to reducing the school’s computer to pupil ratio if that has not already reached the 1:5 target.

In summary, by earmarking funding for CPD from grant 31a, and balancing it with the judicious use of e-LCs it should just about be possible to bring the ICT hardware provision for mathematics from a minimal baseline to one where every teacher and pupil should be able to have access to ICT for a reasonable proportion of their mathematics lessons.

## ICT... continuing professional development

The grant 31a is designed to support two new forms of CPD for mathematics teachers in the curricular use of ICT. These are known as ESTUIC and HOS. Enhancing Subject Teaching Using ICT is a programme of CPD containing a mix of face-to-face and on-line interactions based around KS3 materials available from web-sites developed through DfES funding. The programme for KS3 maths teachers is provided by the Mathematics Consortium:

<http://www.cpd4maths.co.uk>

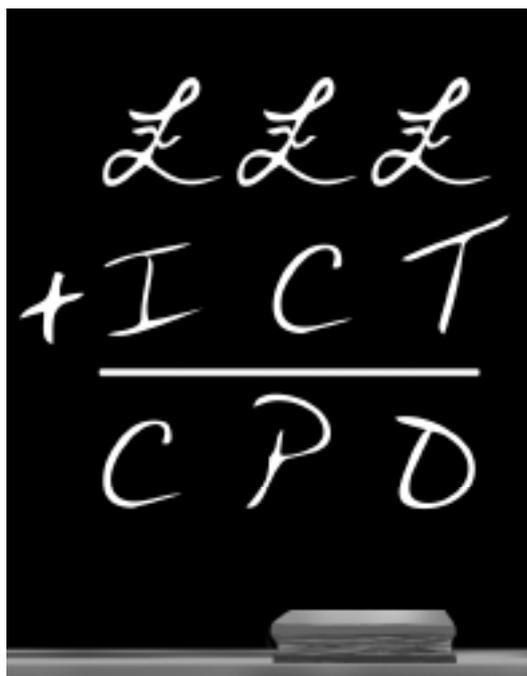
This consists of the Mathematical Association, the mathematics centre at University College Chichester (UCC) and New Media plc (now a Plato Learning company). The model is based on sustained contact with a school department for up to a year. I am going to assume that my “typical” school decides it wants to sign up for the programme in 2004/5 and identifies five of its maths teachers as being in a position to benefit from it. The Consortium will arrange to mount a one-day induction event for maybe 5 or 6 such schools in a convenient location, to which each school can send 2 teachers – one of whom will act as the local coordinator within the school. The school will be allocated an on-line mentor who will keep in e-mail contact with the 5 teachers. Each teacher chooses a lesson to teach using ICT for some or all of it. There are 18 such lessons to

choose from containing materials for each year group and for each part of the curriculum. These are supported by lesson plans, computer files, teacher notes etc. all of which can be downloaded beforehand. There are also guidance materials to give you tutorials in using e.g. spreadsheets, dynamic geometry software, graphical calculators etc. After teaching each such lesson the teacher completes an on-line reflection sheet and sends it to the mentor, who will make comments and suggestions. Each teacher is expected to complete up to 4 such lesson reflections. There are opportunities to develop the work further as part of a module accredited by UCC. Final costings have yet to be ratified at the time of writing but an indicative model is £450 per school plus £150 per teacher. For my “typical” department this would cost £1200 - plus the release and expense costs of attending the induction event – say £1500 in all. If the department made its projected software and hardware purchases in the Summer Term 2004, then it would be in a good position to make best use of the CPD opportunity in the school year starting in September 2004.

The other kind of CPD supported under grant 31a is called “Hands On Support” and enables LEAs, groups of schools or individual schools to buy in external help from a successful practitioner (maybe an AST from another school) to provide a hands-on ICT session for school staff within their own

school – covering any or all of the four Key Stages. Presumably the kinds of support offered by manufacturers such as Texas Instruments and Casio will also qualify. Under my suggestion for managing our department's budget I have allocated £500 in 2005/6 to provide maybe 4 "twilight" sessions on particular ICT needs the department has identified during its ESTU ICT programme in 2004/5.

In summary then there are mechanisms in place to provide good quality CPD for mathematics teachers in the use of ICT, and through careful management it should be possible to fund these while still improving the overall resource provision.



## ICT... conclusion

Overall, then, we have seen that there should be a base line funding of about £9000 over the next 2 financial years (2004/6) to improve the ICT provision in a typical secondary school's mathematics department. I have suggested one way of balancing this between the three major components of software, hardware and CPD, as shown in the table below, but there are many possible variations.

	2004/5	2005/6	Total
Software	£ 800	£ 700	£ 1500
Hardware	£ 2200	£ 3300	£ 5500
CPD	£ 1500	£ 500	£ 2000
Totals	£ 4500	£ 4500	£ 9000

While the sums money are relatively modest, their planned use should certainly enable most schools to make substantial improvements in their effective use of ICT in teaching and learning mathematics. The materials base will be constantly improving. Beyond 2006 who knows what sorts of

ICT resources we will have at our disposal? But at least under the current DfES initiatives and funding formulae it should just about be possible to ensure we have both a teacher force prepared to embrace it, as well as ensuring that we do not have cohorts of pupils who miss out on the benefits ICT can bring.



# ICT... other materials and support

These are provided from a variety of sources such as QCA

<http://www.ncaction.org.uk>

the KS3 strategy, manufacturers, the Subject Associations, Becta, DfES etc.



# ICT... quick reference



<http://curriculum.becta.org.uk/docserver.php?temid=293>  
**Becta website:** contains a collection of materials to help plan their development (page 22).

<http://www.ictadvice.org.uk>

**Becta website:** devoted to ICT advice for teachers (page 22).

<http://www.ictadvice.org.uk/index.php/section=tl&cat=001002007&rid=1957>

For updated audit (page 22).



<http://www.m-a.org.uk>  
**Mathematics Association website:** gives useful guidance (page 22).



<http://tta.gov.uk/>  
**TTA website**

<http://tta.gov.uk/php/read.php?sectionid=92&articleid=1074>  
Page on TTA website for on-line order form for video case studies (page 23).



<http://www.dfes.gov.uk/ictin/schools/funding/>  
**Dfes website:** for explanation of funding rules (page 23).



<http://www.curriculumonline.gov.uk>  
List of software eligible for 'e-Learning Credits' (page 24).



<http://www.cpd4maths.co.uk>  
Details of CPD for mathematics teachers known as ESTUIC - Enhanced Subject Teaching Using ICT (page 26).