The DATA Lecture 2001: Using ICT to enhance design and technology

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Introduction

I understand that a previous Education Minister used to harangue taxi drivers, amongst others, and ask, 'What is education for?' Easily asked but challenging to answer.

In the same way, and particularly in the context of National Curriculum design and technology for everyone, we should ask, 'What is design and technology for?' What makes it different enough to justify its place in a crowded curriculum? What are its distinguishing characteristics? If children were not taught design and technology, what would they miss?

Should design and technology be for everyone and, if so, should it be the same for everyone?

A brief look at the history of design and technology development indicates the need to reflect society's needs and to think about the world our pupils are entering. What are the needs of society today? How radical an impact will computers have? How shall we respond to the 'Information Age' – or the 'Third Wave' (as it is described by Alvin Toffler – see www.toffler.com).

The Internet, for example, only came into being in its current form with the development of Mosaic, the first web browser that could integrate graphics with text, in the early 1990s. There has been rapid development since, in terms of ICT in education, particularly in design and technology.

The children in our schools now have never known, nor will they know, a world without ICT.

During recent years, several initiatives have developed resources and practical teaching ideas that encourage design and technology teachers to make their particular contribution to the development of ICT capability. Equipment manufacturers have produced outstanding resources, often backed with high quality teaching materials. National agencies, including DATA, NAAIDT and TEP, and initiatives such as Nuffield and RSA have emerged to support design and technology teachers, together with countless web sites, many offering the opportunity to share and exchange ideas with others.

There can never have been a better time to be involved with design and technology education – but where next? What is IT (or ICT) for if not to enhance designing and making?

Looking back

...to Britain in the 1900s when schools provided manual training in manufacturing trades for boys – Great Britain was still 'the workshop of the world' with need for a steady supply of skilled, semi-skilled and manual workers in heavy manufacturing industries.

> ...while girls concentrate on cookery and needlework, both for making and mending at home and perhaps as preparation for 'going into service'.

Figure 1.

The colours, materials and textures of the practical rooms were typically black cast iron, beech and bare brick walls in workshops; earthenware, enamelled steel and scrubbed pine surfaces in cookery rooms.

The post war 1950s saw the end of rationing and the start of globalisation. Britain was still a manufacturing nation and 15-year-old school leavers could rely on an apprenticeship – often in engineering or construction trades.

The typical metalwork and woodwork shops in the 1950s, were equipped with long benches for metalwork and beech joiners' benches with tool-well for woodwork.

Woodwork and metalwork courses were skills each based and focused on a single material. The move to bring in more design thinking and broaden materials to include plastics, didn't really occur until the 1960s with the introduction of CDT.

Figure 2.

Health and Safety control has also progressed! Is that Andy Breckon? (see Figure 2).

In housecraft, girls learned to bake, to make their own clothes...

Figures 3 and 4.

...and acquire other skills required for home making – most HE departments came complete with a 'G Plan' furnished 'flat' in which girls could practise what they had learned. A focus on cooking a single dish to a well-tried recipe, shifted to designing whole menus in the home economics lessons of the 1960s

Figure 5.

Computers began to appear during the 1980s and national initiatives, such as TVEI, TRIST and GRIST, raised the level of training and understanding in electronics, systems and control for both boys and girls. BBC's computers were placed in all schools, but with no renewal policy (some are still in use today!). The BBC's were satisfactory (even good) for control but difficult to use for graphics. Printer quality was poor and it was difficult to predict the size and shape of graphical outputs.

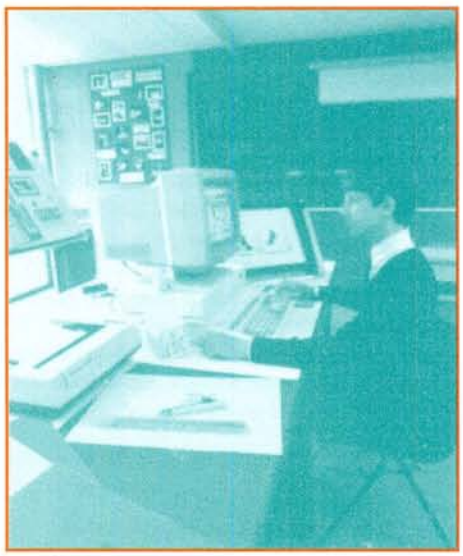

Figure 6.

CNC lathes were the most common computer controlled machine tool – so lots of chess sets! By the 1990s there was a growing acceptance in society that a job is not for life and some retraining will be necessary to serve society's need for a flexible workforce. This requirement would be needed more for the service industries and communications than manufacturing (it was predicted that, by 2000, 50% of the US population will have been trained by McDonalds!).

Design and technology advisers worked with Oak Solutions to develop Design Processor, exploiting the graphics potential of the new Acorn computers. Other companies, such as TechSoft, began to develop good, intuitive CAD software for schools and A3 plotters became commonplace – drawing shapes on screen and accurately printing or plotting them, was now easily achieved.

Figure 7.

Boys and girls now designed food products, yet the working environment still reflects the colours and textures of a domestic kitchen.

The National Curriculum was launched and shortly afterwards (yes, afterwards!), it followed the World Wide Web began to emerge. It followed the development of the Mosaic browser which, for the first time, enabled integration of graphics and led to the now familiar point and click on-screen navigation. Only three years after this, Design Processor, with the help of Dial Solutions, evolved into its current online incarnation: D&T Online (see www.dtonline.org).

The National Grid for Learning

In 1997, a Government Consultation Paper 'Connecting the Learning Society', contained the following Foreword by the newly elected Prime Minister, Tony Blair:

> *'By 2002, all schools will be connected to the superhighway, free of charge; half a million teachers will be trained; and our children will be leaving school IT-literate, having been able to exploit the best that technology can offer.'*

Thus began a national programme of investment to network all schools and connect them to the Internet with modern high-speed computers, to develop online educational content and to train teachers. As a result, secondary schools have one computer for every seven pupils and soon this will be one between five.

Changes to the National Curriculum have now caught up with the advent of the Internet and the NOF ICT training for teachers, and places heavy emphasis on ICT being used in all subjects. These factors, together with continued NGfL funding, should convince all design and technology teachers that ICT resources are available for them to make their full contribution to the development of ICT capability – it is just not possible to fit all these computers into ICT suites!

Using ICT to enhance design and technology

Most design and technology departments now have access to at least good quality ink-jet printers that can be used creatively to generate outputs in a range of materials, providing children with a rich experience of using IT to enhance their designing and making. Consider feeding coloured paper, wrapping paper, transfer papers and even thin wood veneer(!) into a printer and seeing the print-out as the start of a process: not the end. A4 printers are common but increasingly, design and technology departments are finding they need the additional capability of an A3 colour printer.

Making a start requires only a basic level of ICT capability and access to normally available equipment. For example:

- feeding a variety of materials through a printer
- using the print-out as part of a product
- using the photocopier and laminator
- images from CDs, scanner, digital camera and internet
- interfaces and sensors for control.

A feature of modern CAD and drawing software packages is that drawings produced to size in different applications can be used to produce components in different materials, on different computer controlled equipment, which can be accurately located one with another. (Schools should check that the software they are using can exchange drawings at true size – some computer controlled equipment software, scales drawings to fit its own machining area).

Increasingly, equipment such as plotters, embroiders, vinyl cutters and engravers will be needed, but their purchase is within the scope of normal design and technology development planning processes. Design and technology departments therefore can plan towards this level of activity with some degree of confidence that it may be achieved. More advanced software such as Pro/DESKTOP and XaraX (see www.xara.com) enables more sophisticated presentations, although adequate training is needed to make full use of their potential.

Figure 8 and Figure 9.

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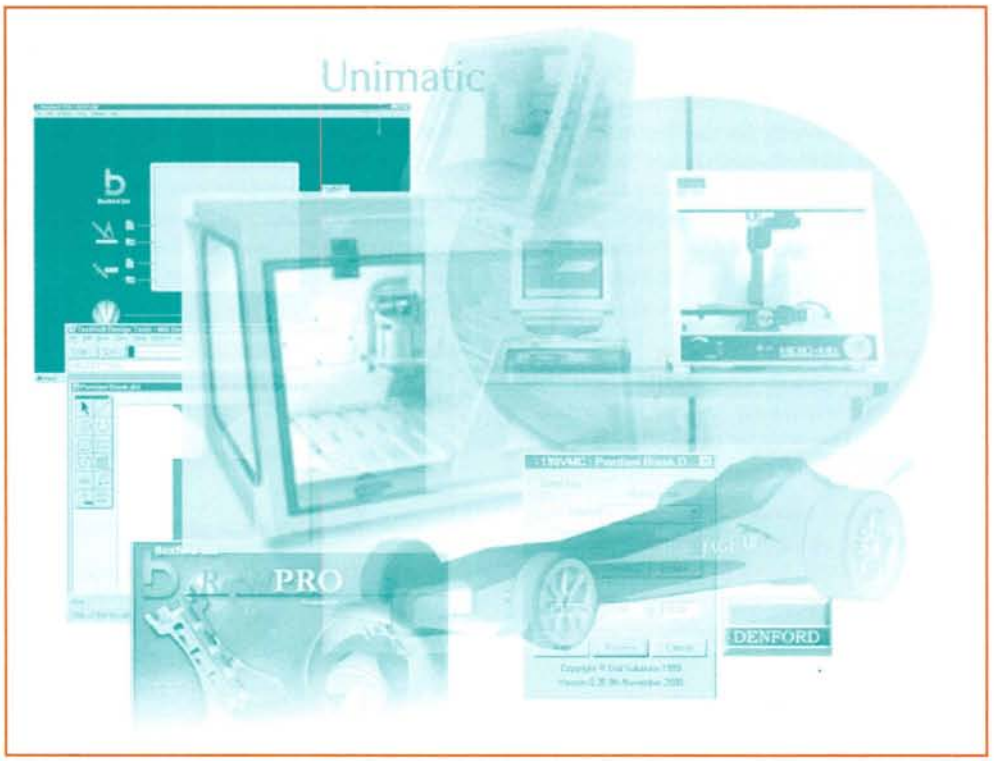
Figure 10.



Design and technology departments should now be able to plan for access to a wider range of equipment and obtain the necessary training e.g.:

- A3 X-Y plotter
- A3 colour printer
- computer controlled embroiderer
- vinyl cutters
- engravers.

Some departments have become sufficiently confident users of ICT to justify the purchase of high capital cost equipment such as:

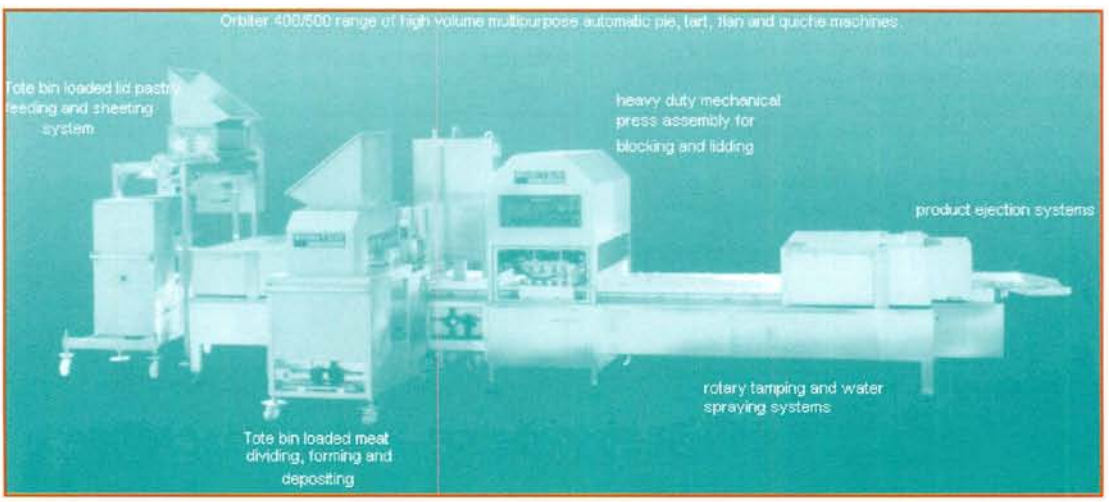
- CNC Lathe
- Vertical Machining Centre (miller)
- Router.

Technologies are beginning to merge and manufacturers are increasingly becoming more flexible regarding the software that can be used with their products. For example, Boxford CAD/CAM software is a TechSoft clone and is pre-configured for their miller.

Web cams are beginning to appear and the potential for the Internet to facilitate remote access to CNC equipment, has been made possible using e-mail templates, as described through D&T Online (see www.dtonline.org), and Denford Ltd have championed point-to-point video links using ProShare software.

And for those wishing to educate the CNC machine tool designers of tomorrow:

Figure 11.



Free and Easy CAD/CAM (http://freeandeasy.sourceforge.net/) is linked to from www.naaidt.org.uk. It provides a discussion forum and ideas exchange to consider how schools can construct their own innovative CNC machine solutions!

Where are we now?

Many design and technology departments have a 'feel' of openness and space – compare this with the departments of 100 years ago. ICT is now at the heart of design and technology, and Schemes of Work often prompt for ICT usage in each project.

In these schools, some new ways of working are being explored. Year 6 children from local feeder primary schools for example, design land yacht chassis, submit them electronically to the design and technology department and see them being produced via web cam. Later, they visit the department on a 'Year 6 Day' and assemble wheels, axles and sails to engage in a land yacht challenge.

Where to next?

We have moved from manual training areas, to workshops with a design area, which has evolved into to an ICT suite. In future, perhaps the trend away from 'heavy' workshops to a more open 'studio' type environment will continue and we will think in terms of several ICT suites being serviced by a few construction and food production areas. Food rooms have been modernised but still tend to be an assembly of kitchen-like food preparation areas, predominated by plastics, laminate surfaces and white goods. If we are moving to food product technology – what does the food industry look like? What would be the effect on our environment planning if we thought stainless steel and food production? What does the food industry look like?

How do we now define 'making'? Should we be thinking more in terms of assembling and finishing? The justification for making is to make ideas real and to test them in use, but with ICT perhaps we can be freed from some of the more time-consuming manufacturing tasks, to leave more time for thinking and designing. Is it these skills, relevant to the society of today, that design and technology can offer to all pupils in a way that no other subject can?

What will characterise design and technology in the next millennium? How will we recognise a design and technology lesson when we see one? What are its essential features? If a child's education did not include design and technology, what would be missing? What is design and technology for?

(Full presentation of the original DATA Lecture available from: http://www.naaidt.org.uk/spd/

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