

Supporting children's learning in primary design and technology with information technology: some possibilities and some teachers' perceptions

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Abstract

This paper considers some of the possibilities for supporting children's learning in design and technology with information technology in the primary school by looking at a range of published documents and the suggestions and advice which they outline. A report is made on the results of a small scale survey of practising teachers with responsibility for the coordination of design and technology in primary schools.

It appears from the results of the survey that although there are many potentially important uses to which IT can be put, in the context of learning in design and technology, these have not been taken up by teachers to any great extent.

Brief consideration is given to the possible reasons for this situation, and some thoughts are presented concerning working towards more rapid change.

Introduction

Over recent years, and in particular since the advent of the National Curriculum, advice has been offered from different authoritative sources about the various ways in which information technology (IT) has the potential to enhance children's learning in design and technology. The first section of this paper gives an overview of some of the published advice for integrating the use of IT into teaching and learning in design and technology.

Published material

1. Design and Technology in the National Curriculum. Information Sheet 1. How can IT support pupils' learning in Design and Technology? (NCET 1993)

Examples in this publication are related to the pre-Dearing Review version of the National Curriculum. Each of the five (original) strands of Information Technology (Communicating Information, Handling Information, Measurement and Control, Modelling, and Applications and Effects), is dealt with and suggestions and examples outlined. There is not a great deal of detail in this information sheet, but the starting points are all entirely satisfactory and worthy of more exploration. The use of desktop publishing (DTP) software is mentioned in

the context of designing packaging and publicity material. The use of database programs to help children deal with information which they have collected is suggested, both the simple branching type of database, (sometimes considered introductory), and also the use of programs at the next level of sophistication, where individual records are maintained for individual items included in the data file.

For the strand dealing with measurement and control, the use of floor robots is briefly explored and is developed into the computer control of electric motors and light bulbs.

The examples of modelling are concerned with drawing software, leading to the notion of computer aided design (CAD), in this case the design and layout of a kitchen. Also concerned with modelling, is the suggestion that the use of simulation software can, for example, "...allow pupils to analyse nutritional values in food, or look at energy use in food preparation." (NCET 1993)

Awareness of the applications and effects of Information Technology are covered in an example of children visiting a local shopping centre and being introduced to the ways and means of such things as: stock control, tills, banking, bar codes, car park monitoring, all in the context of design and control.

This information sheet is a brief but worthy introduction to the area of information technology supporting design and technology.

2. Design and Technology: A pupil's entitlement to IT at Key Stages 1 & 2 (DATA/MAPE/NAAIDT/NCET, 1995)

The Design and Technology Association (DATA), Micros and Primary Education (MAPE), The National Association of Advisors and Inspectors in Design and Technology (NAAIDT) and The National Council for Educational Technology (NCET) collaborated to produce a pamphlet which serves the purpose of outlining an entitlement to the use of IT in their learning in design and technology.

The suggestions for IT use in this pamphlet centre around the use of generic (i.e. content free) software, such as word processors, desktop publishers, drawing packages, databases and spreadsheets, to enable children to write, draw (and design) and to discover the answers to questions in the course of their *market research*.

The use of floor robots in the introductory stages of work on control is outlined, as is the use of specific software for the development of control work in Key Stage 2.

3. DATA News (DATA 1995, DATA 1996a, DATA 1996b)

Three successive DATA Newsletters carried articles which served to outline specific uses which could be made to support children's learning in design and technology. The linked articles considered three groupings of IT activities which are able to support work in design and technology. These are:

- as a source of knowledge;
- as a tool; and
- as a component.

Source of knowledge:

The notion of IT as a source of knowledge encompasses CD-ROM information systems, such as encyclopaedias, and the use of local (specific to one computer, or on-line databases (accessible over the e-mail/telephone network).

"CD-ROMs can support teaching and learning within D&T by:

- providing a versatile and stimulating environment which can support various areas of learning experience, and give access to unlimited amounts of information
- providing an easy-to-use and flexible educational tool to support designing and making

- providing a resource from which pupils can extract useful items to integrate with their own work

- stimulating discussion, design ideas and the evaluation of technology" (DATA 1995)

Tool:

IT can be used as a tool to support design and technology at any stage in the process of designing and making. In particular the article dealing with IT as a tool (DATA 1996a) considers:

- researching, analysing and presenting information;
- modelling; and
- manufacturing.

Under the first heading advantages which are noted are such things as more thorough planning and prioritising, the development of organisational and information handling skills, the speeding up of the research process and the enhancement of language and graphical skills in the presentation of information.

The use of IT as a tool for modelling can be divided into three groups. Firstly the group of programs which simulate specific situations – room layout, or nutritional values in particular combinations of food, for example. Secondly are the content free modelling programs such as spreadsheets which can be used to construct a more mathematical model of a situation, costs of raw materials and energy, for example. Lastly, the drawing and design programs which allow for such things as the design of patterns to be considered and tried out. All of these modelling programs add to the process of designing and making by allowing for pupils to ask, and in many cases answer, questions in the form of "What will happen if...?"

Manufacturing includes, especially at Key Stages 1 and 2, the production of posters, advertisements, templates, nets for models and patterns for printing. All of these can be

done with fairly standard drawing, painting and design packages as well as with more sophisticated software. The advantages listed in the DATA article include:

- the possibility of a more professional finish
- accurate reproduction of shapes for patterns
- patterns can be scaled, rotated, and repeated easily
- any number of identical reproductions may be made; and
- the element of human error is removed from part of the process.

Component:

This notion of a computer as an integral element of the finished product, rather than as a means to the end or as a tool for making the end more easily achievable, refers to the use of a computer to control, and sometimes take measurements, or at least, receive information, which will assist in the control process. This notion fits in well with the idea that a great many artefacts in everyday life are designed to include, and rely upon, the use of microprocessors.

The examples given for Key Stage 1 are: controlling the movement of a floor turtle; the use of an on/off switch in a model; designing a route for a turtle to go shopping; or controlling the light in a lighthouse. At Key Stage 2 the examples are: designing and making an animated scene which receives information from switches; the use of a control interface to design and control a sequence of events: e.g. a setting for a ghost train, or a treasure island which lights up different areas; or models of other fairground rides.

4. The National Curriculum (DfE 1995)

Although the National Curriculum itself gives very little advice about the means of achieving its aims, it is important to note here that each subject included in the National Curriculum, with the exception of

PE, has the same sentence written into its "common requirements":

"Pupils should be given opportunities, where appropriate, to develop and apply their information technology (IT) capability in their study of ... design and technology." (DfE 1995 p 57)

It is interesting to note here that neither the programmes of study for design and technology at Key Stages 1 or 2, nor the SCM exemplification of the "new requirements" for design and technology at Key Stages 1 and 2 (SCM 1995) make any mention of the use of IT – not even the pictures in the SCM booklet have any children using computers lurking in the background!

The survey

Clearly there are many advantages to be gained from using IT to enhance children's learning in design and technology, and *opportunities* to do this (at the same time as developing IT capability through design and technology!) should be given (DfE 1995). As we will see from the results of the survey of teachers of design and technology in Key Stages 1 and 2, it appears that the use of IT is not fully exploited at this level.

A small-scale investigation into the level of awareness and use of IT to support learning in design and technology was carried out with a group of seventeen serving teachers, from both Key Stages 1 and 2, who were attending a GEST funded five day course for design and technology coordinators. The course dealt with a whole range of areas of design and technology and included an element of input on the use of IT. The survey, by means of a questionnaire, was administered before any of the sessions dealing with the use of computers.

This survey was conducted with a very small sample of teachers and so it is not possible to draw firm conclusions from the results. However, if we extrapolate these results we will see a situation where published advice is not being acted upon and the potential for enhancing children's learning in design and technology and for developing children's IT capability through

Survey of design and technology teachers

Question One

Are you aware of any general uses of Information Technology (i.e. software which has not been produced with D&T in mind specifically) which can be used to support children's learning in D&T? Please list these uses.

	Yes	No	Comment
Question one	5	12	Two comments were made to the effect that a simulation/adventure game might be used as a starting point for work in design and technology in addition to the five positive responses.

Question Two

Are you aware of any specific uses of Information Technology (i.e. software which has been produced specifically with D&T in mind) which can be used to support children's learning in D&T? Please list these uses.

	Yes	No	Comment
Question two	5	12	The five positive answers were not the same five as in question one.

Question Three

Please list any uses of Information Technology, no matter how small, which you personally have made available to children with a view to supporting their work in D&T?

	Some	None	Comment
Question three	7	10	Two respondents mentioned that they had used a drawing package for design purposes, but did not mention this for either question one or two.

Question Four

Please list any uses of Information Technology, no matter how small, which have been made available to children in your school by another member of staff, with a view to supporting their work in D&T?

	Some	None	Comment
Question four	3	14	This suggests that very little IT for design and technology was going on in the schools as the respondents were all design and technology coordinators.

References

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the medium of design and technology is not being exploited.

To establish the reasons why IT is not widely used to support design and technology is not a simple matter. There could be many personal reasons for individual teachers or schools. There could also be more general reasons why teachers, who in many cases are working hard to deliver the latest model of National Curriculum design and technology (and IT for that matter), are not able, or prepared, to develop work which integrates the two areas of learning to good effect. Even after six years or more of National Curriculum requirement to teach and develop children's IT capability, it is still clear, anecdotally at least¹, that many teachers are not comfortable or confident with the regular integrated use of IT in their classrooms. For teachers who are in this position – where they do not feel able to work with the so-called simple applications like word processing, the challenge of making use of IT to support and enhance learning in design and technology could quite simply be too great. It is clear from the work of Campbell (Campbell and Neill, 1994 for example) that the workload of primary teachers is extremely high, and seems to be showing no signs of abating. This too is an important factor in the consideration of the reasons for teachers not being able to develop their awareness and confidence with IT to the point where they are able to build it into their planning effectively.

Solutions?

"Under the IT orders it is the responsibility of every teacher to encourage the use of IT within the classroom. But widespread IT awareness and confidence are unlikely to be achieved without concerned effort and planning at whole school level." (DATA, 1993)

This is a reasonable interpretation of the National Curriculum requirements which apply to all of our primary schools. Widespread IT awareness and confidence are not facets of professional expertise which are achieved easily for a great many teachers. (This is not to suggest that all teachers are deficient in this respect, far

from it.) If the situation is to come about where the overwhelming majority of teachers in primary schools are IT aware and confident, then not only must planning take place at the school level, but it must be supported externally too. External support must include good incentives to schools to prioritise IT and the use of IT to support design and technology. If the incentives are not apparent, and this implies the availability of money of course, then the required leap in teacher confidence and all that such a leap would lead to, will simply not happen.

Providers of initial teacher education have a role to play here too. New courses for would-be primary teachers which have been in place from the beginning of the academic year 1996/7 have, for the most part, a greater input for the development of students' IT capability, but the fruits of these particular changes will not have an impact on schools for some time to come.

It is possible that, despite the wealth of suggested uses of IT in the development of children's learning in design and technology, children's designing and subsequent making do not always benefit from using a computer at, for example, the initial stages of making sketches and trying out ideas. It could be that children's design skills could develop better if they were left with the traditional tools of paper and pencil in the initial stages. The use of a drawing program, for some children, in some circumstances – lack of familiarity with the program, or poor mouse or keyboard skills – could lead to inferior results, if they could be compared sensibly with the same work, by the same child without recourse to IT. Speaking as an enthusiast for the use of IT as a way of enhancing children's educational and learning experience, both in design and technology and across the curriculum, this is a difficult position to take. It is important though that we only use IT where it will enhance learning, in whatever the subject area, and not simply because we can.

Note

1. In informal discussion with teachers, whilst making school visits during students' professional placements for example, and by casual observation at these times. Also from feedback given by student teachers in response to observational tasks set as a part of University-based courses.