

## The Use of Information Technology in the Teaching and Learning of Design & Technology in Schools

During 1993–4, the Government set aside funds for IT in D&T totalling £110,000 in order to support the Grants for Education Support and Training (GEST) programme in 1994–5. A Consultation Conference organised jointly by the DFE, DATA and NAAIDT was held in November last year to identify current practice in the use of IT in D&T and how that might be improved. A report of the conference was written for the DFE by John Smith of Loughborough University. With the DFE's permission, extracts from the report are reproduced here.

There were four aims set for the Conference:

- i. To identify what constitutes good practice in the use of IT in D&T and the extent of it, and to determine how IT might make the fullest contribution to the teaching and learning of D&T in all schools
- ii. To discuss practice based in (i) above as an appropriate preparation for the use of IT as part of D&T in working and social life and what might be the implications of the increasing use of IT in the relevant professional, industrial, commercial and research spheres of the use of IT in D&T in schools
- iii. To identify constraints to progress, the means to overcome them and the roles of participants in this
- iv. To make recommendations to the Department for Education on the materials, guidance, courses etc. to commission which would best support the GEST programme for developing IT use in D&T in 1994–5.

### ■ Characteristics of Good Practice

Current practice is effective where:

- the school has a stated policy for IT which acknowledges that experience in all subject areas can assist the development of IT capability, and which includes the particular contribution which should be made by D&T.
- a whole-school approach ensures that pupils are taught transferable IT skills to provide a capability to select appropriate software and use it without being unduly constrained to any one particular computer system. Pupils learn to use IT and when to use other, more effective, alternatives.

- IT is used to support D&T. It enhances pupils' learning and empowers them in the designing and making of high quality outcomes which can be tested and evaluated in use. The purposes of activities involving IT in D&T are rooted in the aims and objectives for the subject. The IT is used to reduce the work involved, time to produce it and/or improve the quality.
- pupils have access to a range of IT systems including a range of computer-operated equipment. This enables them to realise their design ideas in a variety of materials and to produce outcomes of higher quality.
- the D&T projects over a key stage provide a progression of designing and making skills matched by a clear development of IT capability.
- pupils have easy access to sufficient appropriate, reliable computer systems during their lessons.
- the IT relates to the 'real' world.
- IT provides pupils with a 'hands on' experience of automatic control of systems, simple robotics and modelling. It enables pupils, through modelling, to discover the effect of design decisions.
- software used in the school can be used at different levels according to the ability of the pupils, and is robust and user friendly.
- the teachers are enthusiastic and capable of using IT in the teaching of D&T.
- teachers are given technical support so that software and equipment work and any faults are remedied quickly.
- the use of IT in D&T is structured to ensure that the pupils are successful so that they gain enjoyment in using IT and grow in confidence.

### ■ Impediments to the Application of IT within D&T

Teacher background:

- lack of sufficient training in the use of IT
- lack of conviction that it is worthwhile introducing IT in D&T
- inability in some teachers to translate personal IT skills into teaching competence with IT
- reluctance of some teachers to transfer from the model of their choice to one which would suit pupils better.

**Software:**

- bad experiences caused by unreliable or difficult packages
- the high cost of much software for D&T
- the inappropriateness of some software in a school context
- poor choice of software and incompatibility with school hardware.

**Hardware:**

- lack of sufficient micros and peripherals such as Computer Numerically Controlled (CNC) machines
- lack of teaching materials, caused by wide variation of computers used in schools
- high cost, which is often too high for D&T departments
- under-utilisation of some equipment, caused by poor location, obsolescence, inability to run current software, lack of teacher materials or training.

### ■ Future Policies for Increasing the Implementation of IT in D&T

Five broad requirements were identified in order to effect significant change in schools:

- Acknowledgement and support from school management
- A school policy including IT in D&T
- Positive attitudes and beliefs on the part of the teachers
- Appropriate hardware, software and teaching materials
- Focused in-service courses linked to the particular resources mentioned above; these should include classroom management skills and follow-up support.

### ■ Summary of Key Findings

- While the best work using IT in D&T is impressive, the quality and experience of many pupils fall below that which is all pupils' entitlement.
- IT in D&T should be part of a whole-school policy for IT.
- IT is successfully used in D&T when it is rooted in the aims and objectives of D&T with the computer being used as a 'tool' when appropriate. IT can be successfully used to aid designing and to enable higher quality products to be made.

- CNC machines are valuable in helping pupils to produce good quality outputs, especially those with impaired motor skills.
- The designing and making of products containing electronics and using computers for control exemplify important aspects of IT.
- There is a shortage of suitable teaching resources for using IT in D&T. These should demonstrate to teachers how IT can be used in D&T and provide them with materials to support their own teaching. Resources are required for all aspects of IT in D&T; there is an immediate need in the areas of control and manufacturing.
- The use of IT in modelling (2-D, 3-D and mathematical) is an important aspect of designing simulation and analysis which requires further development in D&T in schools.
- IT in D&T can only be taught competently by teachers who are themselves 'IT literate'. Many teachers are not yet competent in the use of IT and need encouragement, support and training.
- Computer software and hardware are continually developing. Continuous provision of in-service training of D&T teachers in IT is required.
- While Conference warmly welcomed the GEST funding for IT in D&T for 1994–5, it will still leave many teachers without support. Courses based largely on distance learning materials are urgently required to raise the standard of teaching in IT in D&T.
- Ready access by pupils during their D&T lessons to sufficient suitable hardware and software is essential. Access to computers depends not just on the number available but on their location and the management of them. Not all equipment is being used effectively.
- Appropriate software for D&T which is easy to use, reliable, robust and user friendly, is very successful, but its cost is beyond the budget of most D&T departments.
- Some good software runs on one computer system only.
- Much of the latest software requires powerful machines which most schools do not have in sufficient numbers.
- Extra technical support is needed as the number and range of computers increase.

- IT in D&T will only be supported in schools if it is written into the National Curriculum for all children from 5–16 years of age and is assessed.
- The National Curriculum requirement is the minimum entitlement. There should be broader goals.
- There are gender issues at all levels which must be addressed.
- Pupils in D&T often work on their own projects requiring individual knowledge or skills to complete the design and manufacture of their products. Computer-based multimedia learning systems should soon have a significant role in the teaching of D&T.
- Industry, commerce and the public services can, by working with teachers, help create materials which are appropriate to both educational needs and contexts of the 'real' world.
- There is a continual innovation and development of IT in industry, thus the IT gap between education and industry is increasing. To bridge this gap, schools will need to review the curriculum regularly and there will be implications for resources and teacher training.

## ■ Main Recommendations

For the development of the use of IT in industry, adequate resources of software, hardware and teaching materials are required together with a teaching force that has been trained and is updated so that it is computer literate, enthusiastic and knowledgeable about the importance and opportunities IT can provide for pupils in D&T. Such provision will require to be reviewed continually by the DFE with the help of industry and teachers as IT continues to move forward.

In particular, it is recommended that:

- IT in D&T be part of a whole-school IT policy.
- finance be provided by the DFE and schools for an adequate number of appropriate computers and peripherals such as printers, plotters and CNC machines, to be readily available for pupils to use in D&T.
- the DFE commission (or otherwise enable) high-quality software to be produced where it does not already exist, and existing good software to be reversioned for the main machines found in schools.

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- teachers with few if any IT skills be encouraged and helped to become IT literate.
- a number of centres or agencies should support IT in D&T nationally and locally based on existing institutions.
- teaching resources should be produced and supported by in-service training including distance learning materials.
- accredited courses in IT in D&T should be set up.
- research into the effectiveness of teaching materials for IT in D&T should be undertaken by teachers supported by higher education and the DFE.
- research be undertaken to identify strategies for IT in D&T to be equally motivating for girls and boys, especially in the areas of control and manufacture.
- consideration should be given to developing individual computer-based learning materials for IT in D&T.
- links be made between education and industry to help make resources up to date and relevant to the 'real' world.
- IT must be written into the revision of National Curriculum design and technology.
- IT capability through IT in D&T must be assessed in order for it to be supported by schools, governors, parents and pupils.
- to help education to close the IT gap with industry, the support of the CBI and other local agencies such as the TECs and BEPs must be actively sought by the DFE.

## ■ Proposals

It is recommended that the project 'Support for IT in D&T' should be split into two parts. The first (which should have priority and the major funding) is IT in Control and Manufacture; the second is IT in Modelling.

For the Control and Manufacture strand, it is proposed that four regional one-day seminars should be held and materials produced in the form of an INSET pack for both the seminars and schools.

To support the IT in Modelling strand, a two-day working conference should be held in order to identify resources to be developed.

## ■ Conclusion

It is clear that all teachers of D&T and their pupils need to have a capability and confidence in using IT in D&T. They also need an understanding of what can be achieved using IT, the implications of IT and a willingness to continue to learn new skills and knowledge. Where IT is used appropriately in D&T it can improve the pupils' learning experiences and the quality of work they produce. At the same time their IT awareness and capability are increased so that they can use IT confidently and fluently wherever it is appropriate.

Although some teachers use IT in D&T successfully, many teachers of D&T urgently need encouragement and support to be able to introduce their pupils to such work. These teachers need training in IT and in its application in D&T. They need teaching resources, technical support and sufficient access for their pupils to good quality hardware and software to aid designing and making. It is hoped that this Conference Report will encourage the Government, industry and education to place a higher priority on supporting IT in D&T in all schools.