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Design and technology on-line: more than just a web site!

G Howard
North Yorkshire County Council

The aim of D+T Online is to link school D&T departments via the Internet. The project currently is being developed by the National Association of Advisers and Inspectors in Design and Technology (NAAIDT) in North Yorkshire and was sponsored initially by the Technology Enhancement Programme (TEP). The purpose of D&TOnline is that students and teachers should be able to access advice or information from databases within their own school and elsewhere, from staff and students in other schools and colleges and from contacts in local industries. Also that students should be able to have components produced, to their own designs, at remote sites if their own school lacks a particular manufacturing capability. The remote manufacturing process itself will lead to a further exchange of advice and comment on the design proposals to ensure successful production.

A pilot project initiated by North Yorkshire design and technology advisers in partnership with Dial Solutions and sponsored by the Technology Enhancement Programme. The results of the initial trials involving local schools, colleges and industrialists, were presented to the National Association of Advisers and Inspectors in Design and Technology at their Harrogate 1996 conference. Continued development now involves industrial partners, other LEAs and Netherhall School as part of the leading edge "Cambridge Trial.'

Background

The general concept embraced by D+T Online is that students should be able to access advice or information from databases within their own school and elsewhere, staff in other schools and colleges and contacts in local industry as they develop a design idea. Also that they should be able to have components produced, to their designs, at a remote site if their school lacks the manufacturing facility. The remote manufacturing process itself may lead to a further exchange of advice and comment on design proposals to ensure successful production.

It is the concept of sharing expertise, information and capability which is uppermost and much of this can occur using post and telephone contact. Email on InterNet, however, offers additional advantages:

- Students will gain fast and economical access to a wide range of information sources.
- Students are motivated to exchange ideas with their peers and seek advice from local industry, schools and colleges.
- The project has the potential to expand the range of contacts and users world wide.
- Students and advice providers can interact at times to suit the individuals concerned.
- Students will experience a real-life model of how some modern manufacturing industries now operate.
- The project presents positive images of industry, design and manufacturing.
- The project will promote joint working within the D&T community and encourage partnerships with industry.
- Students gain access to a wider range of manufacturing processes than any single school is likely to be able to countenance.

The Structure of D+T Online

At its simplest, D+T Online comprises a group of schools, colleges and contacts in local industry who have exchanged Email addresses

and agreed to share expertise, information and manufacturing capability. The D+T Online project has been able to develop the required procedures, formats and task sheets to enable pupils easily to exchange designs and to communicate with others.

At the optimum level of operation, D+T Online comprises a series of World Wide Web pages which have the potential to provide each D&T department with a window on to the world of design and technology, to link all departments to each other and to D&T agencies, colleges, suppliers, industry, individuals and to the World Wide Web in general.

- D+T Online is helpful to teachers in that they may exchange management information, project ideas and share technical advice.

- Students are able to exchange ideas with students in other schools, to have direct contact with other teachers, lecturers and adults other than teachers in local industry and elsewhere.

- Schools have access to a wider range of manufacturing capabilities. By extension, other subject departments can make use of the D+T Online network - to share photographs from weather satellites for example.

- Ultimately, it is intended that D+T Online will provide all schools with FREE D&T data, FREE D&T software and the capability to have DESIGNS MANUFACTURED ONLINE.

The Experience of the Initial Pilot

An initial planning meeting on March 16th 1996 was organised by the North Yorkshire LEA Design and Technology education adviser and funded by the Technology Enhancement Programme. The meeting was attended by the D&T adviser from the City of York LEA, personnel from Dial Solutions and Boxford Machine Tools, D&T Co-ordinators from Rossett High School, St.Aidan's CE High School, Richmond School, and York Sixth Form College. Invitations were extended also to Stokesley School, King James's School and Claro Precision Engineers Ltd who were unable to attend the meeting but have remained in contact with the project. To gain further advice from local industry, a number of Yortek companies including GSM Graphic Arts Ltd, GSPK Circuits Ltd and Tunstall Group plc were also contacted.

Initial responses to the concept outline and the invitation to the inaugural meeting included the following comments:

> "I have no doubt that this is the way we have to go, and not just in Technology.....I would love to be involved in the pilot and I am sure we have the necessary support mechanisms." - Mr J Whittle, Headteacher, Rossett High School

> "The project concept models very closely our operation at GSM Graphics Arts Ltd. GSM use four networked terminals at the Thirsk, North Yorkshire factory connected via modem link to three terminals at our Brecon, South Wales plant. Designs are transferred between sites on a daily basis. All artwork is outputted directly from computer to film using a laser image setter located in Thirsk." - Mr B Dodds, Managing Director, GSM Graphic Arts Ltd.

> "We have long established links with schools in the Harrogate area and will be pleased to assist with the development of D+T Online. We have found that students are interested to know about our machining centres at Claro Precision Engineering and this could enable our staff to extend their contacts with schools". - Mr H Chadwick, Managing Director, Claro Precision Engineering Ltd.

> "The basic principle behind what is proposed appears to be a valid use within schools and for pupils to see this sort of modern communication actually being used, or indeed have access to, is one which should be encouraged. To date the explanation given to pupils of what is possible using the links set up has met with enthusiasm and excitement." - Mr D Wilson, Design and Technology Department, St.Aidan's CE High School

The initial meeting established general procedures and a number of tasks were agreed. Richmond School is developing a metal casting project in which patterns are machined at a remote site for later casting in school. St Aidan's are setting up a CNC Lathe online machining service and both Rossett and York Sixth Form College co-operated to further develop an existing TEP injection moulding module by offering an online moulding tool cutting service.

The pilot uncovered some difficulties, not all of which are yet resolved. Richmond operates on a different computer platform than others in the group and, although text and fax exchanges have been successful, transfer of vectored drawings has yet to be achieved. Rossett High School has had problems gaining InterNet access from the D&T department because of their internal telephone system. This difficulty is currently being overcome by the rather crude expedient of simultaneously hand dialling the InterNet Provider on a line shared with the modem connection!

These initial problems are now being worked on. Dial Solutions are looking at how, in the absence of an agreed standard for vectored drawing files, we can over come the cross-platform issue. We are formulating advice for schools on how to deal with different telephone systems, including if necessary, storing each day's communications on disc and taking them to the school office for transmission.

The pilot enjoyed successes also. A particularly fruitful exchange between Rossett and York Sixth Form College enabled Rossett year 9 students to seek advice and have parts made at York to produce injection moulding parts for a mechanical 'buggy' project (a 'Mechathlete' for a local SATRO 'Mechathlon' schools competition.).

One of the year 9 pupils involved, reported his experience as follows:

> "I am interested in small robotic vehicles and I was working on a project for my Young Engineers Club to make a standard chassis for some small robots. These little vehicles needed wheels which I thought I could make on an injection moulding machine, the problem was I needed a mould.
>
> The mould for the wheels could easily be made on a vertical milling machine, but ours at Rossett was out of action. I was told that York Sixth Form College had a CNC Milling Machine like ours and that they had some new software for programming it. I contacted the college by Email and was able to send some drawings for the wheels done on my computer drawing package. He was then able to programme his Miller and produce the mould for me."

It has become clear that it is the sharing of information, advice and ideas which is the strength of D+T Online and, during the initial pilot, ideas have emerged to reinforce this. The creation and management of WWW pages will, for example, enable posting of thumbnail pictures of graded D&T coursework, complete with teacher's comments. The thumbnails can be browsed by schools and individual photographs expanded to full screen size to facilitate sharing of good practice and moderation of standards.

A Mailing List has been established to link those present at the initial meeting and, in Autumn 1996, the list will be opened up to D&T Departments nationally. In addition, it is hoped that students in colleges will find it beneficial to become involved by responding to the enquiries posted by pupils. If extended to colleges, this will provide a powerful resource for schools and good training opportunities for students.

One of the Advisers in the pilot was able to use the Mail List to assist a primary school where computer drawn maps were required for a school project. A request posted to the pilot recipients generated no less than five responses within a few hours. This experience highlighted several issues which may pertain when the project is extended: pupils' requests for information are likely to be responded to provided there are sufficient participants; schools will have to learn to manage the possibility of receiving many responses (and some of them possibly contradictory); D+T

Online will need to develop procedures which enable users to target requests and limit the number of responses (eg geographically, by aspects of D&T, by education phase).

The context of this single experience also opens up the possible future extension of the project into primary education. The immediate next steps however, are to establish a national D+T Online Mailing List and to extend the remote manufacturing pilot to 20 more secondary schools in the North Yorkshire region during the 1996 Autumn term.

Getting Started

To access the facilities offered by D+T Online, schools will need a computer with a modem, InterNet software, a connection to an InterNet provider, appropriate design software and a World Wide Web browser if required.

Ideally, design and technology departments should have a direct telephone line through which to make the connection but wired links within a school (or simply taking a disc containing each day's requests to a central point) will enable some participation within any school.

Email containing students design work and requests for support is cached in school and exchanges of information typically take place during a once each day local telephone call. This ensures teacher control and limits telephone charges.

The design software initially should be capable of exporting agreed common file formats in the first instance, but eventually a wide range of CAD software will be supported.

Schools are able quickly to download relevant sections of the WWW pages (eg the template or 'OUTline' files provided by the remote manufacturing sites) to enable most working to occur off-line. Also, a directory of frequently used D+T Online resources can be stored on the school's own 'local' disc drives.

Current estimates suggest that getting started can cost a school as little as £350 during the first year and £150 per year thereafter. These minimum figures should be increased to £500 - £650 and £200 - £350 respectively to allow for software costs and increased telephone usage for schools wishing to access the D+T Online World Wide Web pages - dependent upon how much online time a school chooses to occupy.

How it works

- Students initially access information sources to explore possibilities for design ideas; these might include: their own teacher, books, letters, existing and analogue solutions, user surveys and investigations, and computer databases such as Design Processor and CD-ROM.

- Having formulated a general approach, students may have specific questions which require expertise not available within school (eg the materials and processes used in a related commercial product or a pooling of advice from other schools or colleges who have attempted similar projects).

- Information exchanges might take several forms. Text based exchanges are the simplest and easiest to achieve across all computer platforms. For graphical information, agreed software formats are used in the first instance, because of the lack of an existing standard for vectored drawing files. Also, since FAX modems are used, bit-mapped faxes of sketches can also be exchanged.

- The final design proposal is translated into the agreed export format and part manufactured using in-school facilities where possible. For those elements requiring external manufacturing support, students may access D+T Online WWW pages containing a directory of possible manufacturing process providers, choose a machining method, note any design constraints resulting from the particular machine or process and modify their final design accordingly.

- Remote manufacturing is facilitated by the concept of templates or OUTlines. Each manufacturing site decides on a range of stock material blanks which can readily be

machined and makes details of these, including a drawing file of the blank, available to prospective site users. Students download these template OUTlines and produce their designs to fit within the defined shapes.

- To further minimise online time, by both student and provider, the aim is to test out final designs in-school on simulation software associated with the chosen machine tool. After modifying and testing, the file of the student's design, drawn within the template OUTline provided by the chosen site, is returned for manufacturing.

- Detail design modifications (such as alterations to minimum material thickness) may still be needed at this stage and these can be achieved by text, drawing file or FAX exchanges using the agreed protocol that areas under discussion would be circled (in red) and Emailed back with text support.

- The timing of communications is targeted to be in keeping with the rhythm of school life in that enquiries might be sent out after one lesson in the expectation that replies could be down-loaded for a lesson the following week. The requirement for real-time communication would be minimised or avoided totally if possible. In this way, contacts in local industry would be able to respond to enquiries at a time which suits their production schedules and pressures.

- Student communications would be stored on school based computers and Emailed daily. Schools would also down-load replies daily for distribution within school (each class allocated a unique Email address). This would minimise Online costs and be under teacher control to avoid abuse of the system.

- Completed components are sent back to the students in time for the next lesson where possible. Video can be sent Online where wideband network connections are available, but, in most circumstances, it is hoped that a disc containing a video of the machining process would be available instead. This could be a library disc of the actual school based machine in use, a comparable machining operation in local industry, a video of the students' own component being manufactured or a combination of these.

- Users of D+T Online have a wide choice of participation level ranging from simple postal and telephone exchanges up to and including live video conferencing. The optimum participation level is currently regarded as browsing WWW pages for information followed by Email of text and drawings with video discs posted on as required.

- To help students become acquainted with using D+T Online, a number of introductory projects are available, including TEP projects, which introduce students progressively to the required procedures. In addition, help sheets are in preparation which take students step by step through the process sending designs by Email and searching for information on the World Wide Web.

Paying for D+T Online

Beyond the initial pilot, the following possibilities to cover costs may be considered:

- Participating schools within a local area are organised into a duty rota so that each provide technician time for 'x' hours to service general enquires and/or to be available for machining operations. This would be in return for the benefits of being a member of the local group mailing list.

- Costs of the materials blanks, advice time, use of equipment, etc. could be logged (perhaps electronically and automatically within the system) and each participant would accrue credits and debits within the group. Net losers and gainers could target a zero cost option then adjust their participation accordingly.

- As above, but a termly account could be settled by cash transfers.

- All or some of the costs might be met by sponsorship, sale of related documentation and project ideas, charging a mailing list membership fee.

Next Steps

1 to improve existing WWW pages and place them on a server to enable wider dissemination of the project concept and stimulate comment;

Note: several agencies or companies have already expressed a wish to include D+T Online on their servers. The D+T Online team are anxious that the first posting should be of the required quality and be sustainable in terms of updating. We therefore await the opportunity to cooperate with appropriate D&T organisations. The D+T Online team have already been given encouragement from North Yorkshire, NAAIDT, Dial Solutions. TEP, NCET and West View to do this work. We now need to secure funding to finally edit the work done thus far.

2 to establish a dedicated D+T Online server linked to other known servers in the D&T community;

Note: the D+T Online team have now been offered a large UNIX server by Sun Microsystems Ltd, (valued at £13,000) on which to program D+T Online using JAVA. Support is now required to fund programmer time.

3 to seek sufficient sponsorship to enable programmers and educationalists to work to create all remaining WWW pages in a form which allows interactive use on different computer platforms;

Note: the requirement is not simply for WWW pages but for interactive CAD programs to be written in such a way as to be available across all computer platforms. The D+T Online team estimate that ultimately this would require the equivalent of two programmers and one educationalist working full time for one year if all aspects of D+T Online are to be fully realized but some phasing may be possible.

4 to attract sponsorship through advertising of equipment and materials suppliers to enable the continued use of D+T Online to be self-financing with free access to all schools.

Note: continuing sponsorship or advertising revenue is required to pay licenses for any software used in the project and to maintain a live connection of the D+T Online server to WWW. In addition, the D+T Online team estimate that one full time equivalent (programmers and educationalists) will need to be funded each year to maintain the WWW sites, produce newsletters and provide training in its use.