

Abstract

Providing the right learning environment in design and technology is not an easy task. An ideal environment is one where pupils have maximum autonomy and are working on self directed projects and where teachers are constantly assessing with pupils where they are and where they need to go. As a result, teachers have a complex management task providing multi-media resources and multiple paths for learning to suit individual needs. Our current situation does not make this easy and one can already begin to see how ICT (information and communications technology) will have an important part to play in lifting the barriers to quality learning.

This article begins by envisioning a 'parents' evening' and 'food technology lesson' in the millennium and then considers how well prepared design and technology teachers are for the changes that this scenario presents and what skills will become central in the future.

It was a normal day at work, as I logged on to my computer my daughter appeared before my eyes with a message she had recorded earlier.

"Don't forget your parent teacher conference is today will you?..."

I clicked on the school symbol on the screen and seconds later I was greeted by the receptionist and the head teacher. The welcome was then followed by a video tour around the new parts of the school's facilities, and an opportunity to stop and look more closely at some of the pupils' work on display. I paused at an interesting poster depicting the impact of global warming and the computer menu asked me if I would like to:

- leave a comment card about the piece of work
- talk to the pupil on-line about their work
- ask the teacher a question about the project
- read the project objectives and assessment criteria.

Not wishing to become side-tracked, I moved on quickly to find my daughter because I needed to talk to her teachers. Her face appeared on screen together with her current piece of work from food technology.

"Hi, mum, I was just discussing my work with my design and technology teacher and remembered that you used to teach food technology didn't you?"

"Yes, but it wasn't called that then, some time ago I was a Home Economics teacher. I used to teach my pupils to follow recipes and make things to eat and bring home."

"Why was that important?"

"So that children learnt and practised skills to cook for themselves."

"Oh! You mean that you couldn't access that information via the IVT (interactive video teaching) system?"

"No, I demonstrated it to each class."

"Every week! Wasn't that boring and repetitive, how did everyone manage to keep up with the class?"

"In those days, lots of people made their own meals at home instead of buying them, it was important and we had no other way to doing it then."

"Well, I guess you will see a few changes in my food technology then, I'll take you to the room and show you around my work – I've produced a multi-media presentation about my progress this year for you to see."

The room was clean, bright and airy and divided into different areas. There were about 10 pupils of different ages present in the room and about the same number working on-line remotely. First of all we went to the design area. This looked nothing like my classroom, there were tables and chairs, soft chairs, a bookcase and boxes full of resource material, old flip charts of brainstorming sessions, posters of fruits, vegetables, breads, herbs and spices and mood boards depicting a whole range of lifestyles covered the walls. One pupil had a virtual reality headset on. This software enabled pupils to experience people's lifestyles and habits. This pupil was designing baby food products and was experiencing what it was like to be a baby again – how difficult was it to chew? What did the baby like to feel in its mouth?

A team of pupils were examining their market research results and justifying their proposals. They could talk on-line to check any of the answers to their market research questions and to invite a potential group to taste their first ideas. They discussed their mood boards which were modelling their design ideas.

Then we went to the development area. Here there was a practical kitchen area. Pupils were working with ingredients to make trial samples of their ideas and work on them further. There were tasting booths to one side for sensory analysis. Computers were used to record recipes used and changes made as the

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trials progressed. They were also used to analyse sensory results. One team was working on a new basil sauce and was using a computer to profile the flavour and smell of the sauce. They were trying to get the samples to be as close a match as possible to the profile that their evaluators favoured. Another pupil was struggling to get a sauce as thick as she needed and was consulting an on-line cooking encyclopaedia for some food science and process insights. Digital cameras were used to record the products as they were developed and to present their ideas. Sometimes they were lucky enough to work with commercial product designers. Some designers worked from home and popped in to see what the pupils were working on and share their expertise, and others worked part time or had retired early. One designer had sent in a batch of new modified starches for them to try out. A local supplier had brought along a new apple breed for them to taste and consider. The pupils noted their thoughts and displayed them on the website for others to read.

Then we went to the testing and analysis area. This resembled a well equipped laboratory. One team was testing the shelf life of a new cake product with different package samples. Another small group were working out the 'best before' labelling information, predicting the bacterial growth using a computer program and confirming the quality of the samples they had kept. Another pair were testing how much yeast would be needed to get an adequate rise with their sweet bread dough. A food scientist from a local company was working on a new type of low fat spread, using the school facilities, as the company production line. She was trying to solve several problems: the mixture being too runny, the mixture to extrude well and hold a good shape, and changed the recipe formula and tried the production again. She was still having difficulties and then talked on-line to the production manager at the plant, who suggested that she added a cooling step to the process and tried again. She modelled that and it worked, but it added cost to the overall biscuit production and she now had to go back and work out where she could save the money elsewhere.

Another team was simulating high volume production of pre-packed school lunch dishes

to see where the high risk parts of the procedures occurred, then to write the quality checks that would be needed if the product was going to be safe to manufacture and re-heat at school.

Another team were having a video conference with a technical manager at a pasta factory in Italy and a tour around the plant to see how bulk production of pasta takes place before embarking on their own product development.

After my tour around the classroom it was time to see my daughter's multi-media presentation about her progress and talk to her teacher...

How well prepared are design and technology teachers for the changes that the scenario presents?

Much of the current classroom life of a design and technology teacher prepares them well for what they may face with new technologies. Design and technology teachers are already experienced in managing multi-activities simultaneously. Their classrooms are multi-dimensional environments where the teacher is very rarely dealing with one situation or event in isolation. Go into any classroom! It is an explosion of activity – practical working, discussing, thinking time, presenting and questioning, demonstrating ... They use multi-media resources, such as books, worksheets, videos, slides and posters, visits and speakers. They provide multi-paths for learning for pupils of all abilities and interests. The pace is hectic and fast, and events are unpredictable in the design and technology classroom.

The kind of skills teachers need to prepare schemes of work and lessons that incorporate and motivation

- evaluating and assessing performance
- using resource based learning appropriately – providing a variety of learning materials and information that can be accessed by pupils
- promoting self supported study effectively – pupils being responsible for their own learning

The government plans to introduce a National Grid for Learning, linking all schools to the Internet. The Standards Fund Initiative is providing more ICT equipment for schools.

As a consequence of these initiatives all teachers will need to have skills in using technology in their design and technology teaching. The approach to updating teachers is being planned very carefully so that teachers are better equipped to face these issues in their own schools and classrooms. The National Lottery New Opportunities Fund (NOF) is providing £230 million over three years to train serving teachers in ICT to deliver the National Curriculum. This initiative starts in April 1999 with some 450,000 teachers in all schools in England, Wales, Scotland and Northern Ireland to be trained to meet the Teacher Training Agency requirements based on Expected Outcomes for teachers in England, Northern Ireland and Wales and SOEID Guidelines on the Use of ICT within Courses of Initial Teacher Training.

Lifting the barriers to quality learning in design and technology

“The average person in the street has a clear picture of teaching. It consists of a teacher standing in front of pupils in a classroom telling them. It is simply a matter of teachers talking and pupils listening. If only teachers would tell them more and make them listen, educational standards would improve. Teachers know that the reality is different.” (*Classroom Management* P. Waterhouse 1990)

Providing a rich experience in design and technology for every pupil in every classroom is a challenging task for teachers. If you were to ask teachers about the kind of learning experiences they would like to provide they would reply:

- giving pupils a sense of ownership, of their learning and progress, of the purposes behind each project and their future directions
- involving pupils in planning their own progress and encouraging pupils to take responsibility for their learning. Sharing goals with them. Providing opportunities for greater autonomy and negotiation as they become ready. Allowing pupils to take the lead and intervening when necessary.
- encouraging pupils to stand outside themselves and look objectively at their learning, how well they have done and what they need to do to get better
- allowing maximum autonomy, where projects are flexible and allow a spontaneous response, so that the pupils

identify and follow their own purposes, pursuing what they think is interesting and creative, and valuing it

- giving opportunities to work on topics that are motivated by personal interest and therefore meaningful in the pupil's world
- negotiating lesson outcomes with the pupil
- allowing pupils to work on projects of their own choice but being able to monitor progress and assess their work easily
- providing work that is differentiated and suitable for each individual's ability, needs, potential and preferred learning style
- stretching each pupil to the limit, acknowledging, and developing from, a prior learning base
- giving support as and when a pupil needs it, on request, with intervention only when it is in the pupil's best interests, allowing constructive 'failure' and ensuring eventual success
- giving feedback at regular intervals on progress and setting targets
- promoting opportunities for pupils to see what good work looks like, exploring expectations and learning from others
- using experts from inside and outside the classroom, actively involving teams of teachers, the community and parents
- encouraging people to work together.

Whilst to provide this is the goal of every design and technology teacher the reality of the classroom does not make this easily achievable and we can begin to see how information and communications technology will have an important part to play in lifting these barriers to quality learning.

For most teachers these ideals are frustratingly difficult to achieve, for example, where their class sizes are too large for much individual attention to happen, and much time is then focused on technical 'how to do it' matters. The pupils they teach are not accustomed to individual negotiation of purpose and activity as it is not widely used in other curriculum areas. A class working on individual project work often requires a wide range of knowledge and skills and the teacher becomes overwhelmed by the queue at the desk or the sea of hands on the air! Our perception of the teacher's role is that of transmitter of knowledge rather than being a facilitator of learning and the school structure results in grouping pupils by age, dividing knowledge into subjects, with slots on timetables and

specific rooms for delivery. We assume progression in learning is an orderly process when in reality it is often patchy, partial, scattered with big leaps forward, frequently moving forwards slowly and even backwards.

ICT may help us deal with some of these issues because there is potential for more learning to become self-directed. It should be possible to provide easily accessible information and expertise for a pupil to tap into rather than having to rely just on the teacher and this may therefore help to free up the teacher's time for planned intervention and negotiation. ICT may help teachers and pupils track progress and assess what has been learned more readily. ICT may also help provide differentiated programmes that cross subject boundaries and are not timetable restricted, motivating pupils because the work meets their individual learning needs and helps them to apply their learning from one area to another.

We are already seeing some simple uses of ICT to address these issues. For example, putting project work and assessment guidance on the school's web pages so that the pupils can access information and guidance outside school hours and are aware of their own progress in learning, setting up e-mail or fax links with community and other experts to help pupils gain particular pieces of information or to act as a helpline, downloading information from the web or giving key words to focus searches when researching ideas, using word processing to adapt worksheets for particular needs of pupils such as reading levels, setting up video clips or slide sequences of key processes or skills so that pupils can access them at any time needed, using a database to monitor pupils' marks and attendance and individual achievement to generate records and reports at a glance, using digital images of the work of others (for example, GCSE projects to introduce topics or expectations of standards) allowing pupils to work on joint or team projects with other year groups, with other schools, or with other countries facilitated by the use of shared software, 'whiteboarding', fax, e-mail or video conferencing.

Successful design and technology teaching is a complex art. Central to the art is the ability of the teacher, through their personal interactions with pupils and through good management of pupils' activities and learning resources, to help individuals adjust the demands of the work to suit them. These skills will become central with the increased use of ICT.

Each pupil's progress is different because pupils have different learning experiences in life and have different personalities. Ideally, therefore, teachers should be constantly assessing with pupils where they are and where they need to go. To make this manageable, however, we have to lump together pupils much of the time, in pairs or in small groups, or all too often as whole classes. The only person who can consider the individual's unique position all the time is the pupil him/herself. For this reason, if for no other, we must involve them as fully as possible in determining how they can progress in the future.

The development of pupils' responsibility for self direction is both necessary to the subject and for manageability by the teacher. When achieved it clears the ground for the teacher to intervene selectively with pupils to negotiate with them the appropriateness of the demands their work is making on them – a core procedure in differentiation. Self direction, assessment of progress and effective intervention may be enhanced dramatically by the use of ICT for the benefit of all pupils.

References

Waterhouse P (1990) *Classroom Management*.