

## Is design and technology education still interesting to our students?

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I begin with three propositions, all of which seem self-evident:

1. Every individual wants more of the products of technology for their personal satisfaction, security, comfort, leisure and entertainment. The goods that consumers in every town and city desire are remarkably similar.
2. Every society and every government wants more technology education because it is seen to be the key to a developed economy and to growth in national income.
3. In consequence every education system is trying to develop technology education from the early years through to higher and post graduate education for boys and girls.

So why isn't it working? Why are there empty places in most technology degree courses in most countries? Why are many children switching out of technology in many schools and switching into subjects they find more attractive? In France the under-use and low capability of the university and technology institutes (IUTs) has led to major, even desperate, attempts by Francois Fillons, the higher education minister, to enhance their attractiveness.

One of our most cherished beliefs is that almost all students enjoy technology, eagerly await technology sessions and work enthusiastically therein.

In my work I visit many technology classes in many schools. Many projects are good but many are uninteresting and only modest in their results. I watch the faces of the students, many are involved but many more are dead. Alas, it is the same in science, maths and most other subjects. But why is it so in technology, I ask?

Kimbell of Goldsmiths' College, London (1994) has explored the matter. In a paper yet to be published he has identified three categories of involvement in technology:

- Motoring (active learning)
- Poddling (non-committed learning)
- Static (inactive).

In the best lessons motoring was dominant for a maximum of 30% of the time. In most, poddling was the norm — an average of 75%. In many there was a disturbing amount of static behaviour.

In our search for answers let us be clear from the outset that human capability in technology, as in most other areas of knowledge, is for all practical purposes, unlimited. I can give many examples. When I have the tyres changed on my car the young worker at the tyre depot has no pretensions about being a technologist. His school record in technology was minimal, but with the aid of his pocket calculator and reference books, he can work out the specific requirements for the tyres I need. He can deduct the discounts, the special offer terms and the association membership concession, add on the tax and get the price right in seconds. He can operate the technology to fit and service the tyres with total reliability — also with impressive speed.

Young people who appear to have little capability in school technology have amazing ability to tune motor cars and motorbikes and know exactly how to enhance performance. They are able to develop hi-fi systems, using sophisticated science and technology capability.

One of the most exciting things in my career is to be Chairman of the Judges of the Young Electronic Designer Competition, a major national competition in Britain, sponsored by the Texas Instruments and Cable and Wireless companies. Entries come from children all over Britain, and the candidates' capability to devise useful, practical electronic devices is breathtaking. What is so astonishing is how few of the entries are coming through the schools. Most of the candidates learn about the competition through the electronic magazines and the components manufacturers' bulletins. We invite their teachers along to the finals and candidates often astonish their teachers by what they have been able to achieve. A very common remark from teachers is, 'I never knew that boy or that girl had the capability to do this'. Children have a secret world of achievement and capability that we as teachers very frequently do not recognise. Let me emphasise that I am talking about girls as well as boys: many of the successful candidates in the Young Electronic Designers competition, and in many similar competitions, are girls.

What can we do about it? We have the need and the human potential, why can't we get two things together? I think there are three areas to which we have to attend. They are ones that we are all very familiar with — teachers, industry and students. Those are the three raw materials with which we have to work.

## ■ The Role of Teachers

Let us look at the teachers first. We have a major problem in many, many countries. First of all there is difficulty in getting able students into teacher training courses for technology. As Cotton (1995) confirms: 'In many countries the most able students are tracked into pre-science and other 'high status' subjects and discouraged from technology and 'practical' studies.' That means that there is a relative shortage of graduates, and particularly good graduates, in this subject in many countries.

Secondly, the demand for those technology graduates is growing from industry, and industry, commonly, is able to provide a more attractive salary and incentives than the teaching profession. So therefore the supply of good, interesting, lively, graduates to technology teaching is often very limited. It is a vicious circle, because that means we are less likely to produce many good school technology students and so we enter a declining spiral.

At the university and polytechnic level we can often recruit highly able lecturers in technology, but there is a very similar problem. Once one gets a post in a university or polytechnic institution the emphasis is not on good teaching but on research. I speak as the person who chaired the teaching methods programme at my university for many years, trying very hard to ensure good teaching as well as good research. But at the end of the day, promotion is almost wholly determined on research and publication, teaching is one of the minor criteria. At a university I am familiar with (not my own) one notorious lecturer delivered an essential part of one of the technology courses. Students were obliged to attend because it was a core part of the syllabus. But their boredom was so great that they not only carved their names on the lecture room tables, they also amused themselves by floating paper aeroplanes and launching pellets at the lecturer. He was totally indifferent, as he stood writing away at the chalk board, not noticing what was taking place behind him. The university used to have two cleaners standing by to clean up the lecture room after each of his performances. In no time at all he shot through the ranks and was appointed full professor because his research was brilliant. He is now chairing a university department and the teaching of his department, I am sure, is not one of his major concerns. And so in the

university system too, the fall-out rate of students in technology is high and we are losing, yet again, more of the potentially able people who could deliver effective technology education.

There are other major problems about technology teaching. At my university, we make technology an obligatory course for all our teacher training students. But that is because of our enthusiasm, not because it is required by law. Many teachers are, frankly, scared of teaching technology. A recent survey taken of British teachers, conducted by Wragg (1989) found that something like 70% of all primary school teachers were alarmed and felt ill equipped to teach technology even though, by law, they have to do so. Even more to the point, they have great difficulty when they do actually teach technology to make it interesting, attractive and involving.

Many teachers are making real efforts to engage children by involving them in decision-making, helping them to think creatively to solve problems rather than simply getting the right answer. But many teachers still give higher grades to children who get the right answers, rather than those who try to achieve an interesting and original way of working. For many teachers it is hugely important to get the right results; I have seen many children working hard to devise a way of solving a problem, only to find that it is not the way that delivers the right text-book result or the right combination of processes and so they achieve only low grades. The most able children find it boring and unrewarding.

Why do you think technicians are in schools? If we are perceptive we may agree they are there not so much to provide the equipment, but often, covertly, to help children to produce the right result by suggesting answers, offering them tools and equipment. It is the same as in the universities: if I go round many Engineering Departments I see students conducting experimental projects, with the aid of technicians. They are the same projects that are required every year, and the 'correct' results are known to the technicians and the students before they begin. There is no element of creativity or of imagination which is, after all, what we claim technology is supposed to be about.

In university, just as in school, the laboratory technician's job is all too often to suggest to the student, 'you do not want to do it like that, you will not get the right result', and the right result is the same year after year. It is not an exciting experience, it is simply getting by. And as a result, the enthusiasm, the spark, the imagination, which many students bring with them because of their school experience, gradually get lost. And if those students become teachers they are conditioned to repeat the same kind of experience.

Of course, if we are not obsessed with the right answers, we will not obtain the conventional results and we have to adjust the process of assessment so that we can recognise the new, different things we are getting instead.

The way that technology is portrayed on television with programmes like *Young Inventors*, *Tomorrow's World* (all countries have these types of series) attempt to do something about it. Young Scientist Clubs, electronics magazines, hi-fi journals, are all talking a language that young people can respond to and commonly lead to high standards not only of creativity but also of skill and 'finish'. It is not a simplified, easy language, it is sophisticated, but young people can use it and do respond. We do not always spark that sort of enthusiasm in the schools or in universities. I know it is difficult for schools to match media resources — but we should try to make positive links with them.

In the technology area, there is a particular problem. Many people feel sad that the conventional levels of skilled performances are sometimes not as high as they were, because students are not focusing as zealously as they once did on absolute precision and quality of finish. One cannot have it all. But certainly the goals we have been going for in the past have not always served us as well as they might have done. The essential feature is for students to be able to feel proud of their product and if skill is necessary, we must help them to acquire it.

## ■ The Role of Industry

Now let me turn to the second of my headings. We do not always require industry to share as fully in the process of technology education as fully as we should. This is despite many attempts to engage schools and industry more closely as described by Innes (1995): 'There is no doubt if one want to show students the

excitement, interest, attractiveness, and the economic rewards of being a technologist, then one has to find a way to introduce them to people who are actually working as technologists'. We have to get far more of those people in to the schools and help them to relate closely so that children will understand what technology is all about. This includes not just the excitement but also the routine work so they will really feel that they can understand the whole picture. We cannot eliminate boredom from industry any more than from schools. But we must justify it, not impose it.

Benson (1995), has described the key work in economics and industrial understanding at the University of Central England. At Warwick University too we have a large Centre for Education and Industry. We are running, with a number of other bodies, a whole series of schemes where we are getting industrialists into schools. In return we are getting teachers into industry, not just in some 'observing' role but to actually undertake projects in technology. We are also developing 'compact' arrangements, whereby children do not just go and spend time in industry, but actually get involved in an ongoing relationship with a local industry, which guarantees employment, if they achieve specified results in accreditation. It is very easy to say that there are unfilled needs for more technologists but actually turning those needs into jobs which students can obtain is not as easy as it seems. There has to be a real prospect of employment and it only becomes real when there is an understanding and engagement between industry and students, when each side knows what is really on offer. It is pointless hyping young people up for technology if we do nothing to ensure a reasonable level of certainty, of employment, a reasonably level of financial reward and status. All too commonly we have a situation of highly qualified, unemployed school and university leavers, and yet plenty of vacancies in industry. There is no point whatever in developing better technology education, unless we do something about linking it with the career, employment and labour market structure. It is a huge effort, but it is absolutely vital. And of course we need to realise that not all industrialists are unequivocally enthusiastic about young workers who know too much about how enterprises work, how wealth is created and profits distributed. We must also teach diplomacy and sensitivity.

## ■ The Role of Students

Now I am going to my third area, and that is the young people themselves. Not because they are the least important, but because they are the most important. I am always uncertain whether to talk about pupils, students or young people. If I use all those terms, it indicates nothing more than my uncertainty rather than my confusion.

Somehow, one has to make technology related to their lives. This must include delivering not only jobs but feasible jobs, rewarding jobs, worth-while jobs and status giving jobs. It must also be related to their lives as consumers, parents and citizens. Putting it simply, technology has to be perceived by young people as life enhancing and only then will they have the motivation and enthusiasm to learn effectively. In our best schools and colleges we know that technology is motivating young people, not just through self-interest in being more effective consumers, having more interesting hobbies, or having a chance of a better job, but as a means of actually helping other people. For example there is huge enthusiasm among young people on technology courses for developing all kinds of strategies, aids and devices, that will help handicapped people, young and old, that offer better equipment in their homes and hospitals. Similarly, the enthusiasm of young people for environmental preservation technology and green technology generally is widespread and contagious. Technology can empower them. Here and elsewhere the altruism of young people is a hugely motivating factor, and we can help them to be more effective in their caring through technology.

I must end with some comments about the role of girls, because often it seems easier to achieve the kind of things I have been saying with boys who work with motorbikes, high-performance cars and hi-fi. I do not want to do anything to diminish the technological enthusiasm of young men in our society, but we are often less effective in involving women in technology. Yet, we have, with enthusiasm, the capability to do something about it.

Research (Dale, 1972) shows that girls are usually much more involved and much more successful in technology in girls' schools rather than in mixed schools. There are many reasons, but one simple and obvious one is that they are often 'put down' in mixed schools by the boys, who see themselves as more likely to be

successful, and who crowd out the girls in their bid for teacher attention.

I was at an excellent technology lesson recently in a comprehensive school in Manchester. But when the teacher put the apparatus out she said, 'When you are ready, come forward and collect the apparatus. There is not quite enough for everybody, so those who are ready can use it first and those who are not quite ready will be able to use it next.' There was a rush for the apparatus. At the end, all the boys but only two of the girls had apparatus. This happens time and time again. It is hardly surprising that some girls find technology less interesting. We have to do something about that and as most education is now in mixed schools it is a major problem.

So there are fundamental problems in helping students, boys and girls, children of all abilities, to see themselves as being able to succeed in technology and of course, assessment procedures, guidance procedures, support systems and the way in which we organise classrooms are crucial in ensuring that that takes place. It is exactly the same at the universities: we have many women science students but they are mostly biologists. At graduation day every year there are two or three brave young women, who have succeeded in obtaining an engineering degree. Because they are so exceptional they get a special cheer as they come to receive their award, otherwise the ranks are solidly male. They get almost the same cheers as handicapped students when they come to the rostrum.

Let me reiterate, in conclusion, that I am impressed by the initiatives in many schools and colleges, but alas they are not enough. The only way in which we can really progress, is to engage technology in the education and self-image and life-style of every citizen, in their roles as workers and as consumers in a modern society. We have to make every citizen technologically capable and literate. It is just as vital as all the other basic life skills that are taken for granted.

In the twenty-first century those life skills have to be enhanced by what we, specialists in our subjects, can offer. Only then will any country be equipped to move forward as a fully developed twenty-first century society. If we fail, we imperil our societies. If we achieve, we can all go forward together. Let me finally

remind you, lest you ever think otherwise, that there is no basic human deficiency. We are all of us, at our different levels, capable of achieving: remember the examples I gave you earlier. Human capability can deliver it; as teachers we can interest, motivate and engage. Putting children on the leading edge of the learning curve is a vast responsibility, one that I take more seriously than anything else in my professional career. We have a million miles to go, but it is a journey that we can and must accomplish.

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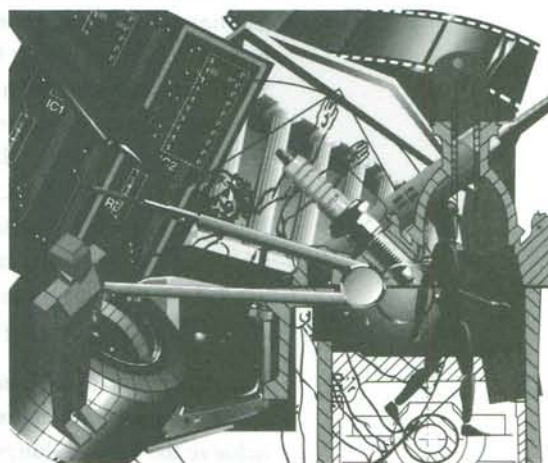
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