engineering council

TECHNOLOGY IN SECONDARY SCHOOLS

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GETTING IT RIGHT

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Foreword

The Engineering Council has consistently argued the importance of technology in the school curriculum. It is beyond debate that our future as a highly competitive and innovative manufacturing nation rests on the technological understanding and capability of the young people who are in our schools today. But technology in schools is more than this. Well taught and well resourced, it develops in young people the skills of problem solving, team-work and time management that are fundamental to their adult future in a complex and rapidly changing world. Good technology, in other words, is good education - and the Engineering Council is delighted that technology is again a required subject throughout the four key stages of compulsory education.

But good technology education demands good resources. In particular it requires specialist accommodation, equipment and materials, and it makes significant demands upon the time and management skills of highly trained teachers who are still, over much of the country in conspicuously short supply. The Engineering Council therefore asked Professor Smithers and Dr Robinson, in the fourth of the Technology Reports we have commissioned from them, to carry out a survey into the level of resourcing currently available for the teaching of technology in secondary schools in England and Wales. ***Technology in Secondary Schools*** *is their response.*

Michael S. Heath
Director General
The Engineering Council

Summary

Technology is an expensive subject and schools are not being given enough money to run it properly. A survey of a representative 10 per cent sample of 344 maintained secondary schools in England and Wales revealed:

- ***The average technology departmental grant in 1994-95 was £5.86 per pupil. In 88.7 per cent of schools it was below the £9.30 recommended by the Design and Technology Association. The amount received per pupil varied from 40p to £21.10.***
- ***In 1995-96, 39.2 per cent of technology departments actually received less than in 1994-95, while DATA's estimate of what was required increased to £9.60.***
- ***63.3 per cent of technology departments reported that they were inadequately equipped to deliver Key Stage 4 of the new curriculum order.***
- ***The average technology group size at Key Stage 3 was 21.1 and at Key Stage 4, 20.2, both above the maximum recommended by the National Association of Advisers and Inspectors in Technology. In some schools average group sizes were touching 30.***
- ***Many of the workshops were not large enough to cope with such numbers nor were there enough specialist rooms. Over a fifth of schools were having to overspill into ordinary classrooms. 71.2 per cent reported unsatisfactory or no space to store pupils' projects and 62.9 could not provide satisfactory office space for staff.***
- ***Staff expertise was not sufficiently aligned with the requirements of the new curriculum and 77.6 per cent of schools wanted more inservice training in technology.***
- ***45.1 per cent of technology departments did not have the equivalent of a full-time technician, including 10.2 per cent with no technician at all.***
- ***Only 13.9 per cent were planning to put on short courses and 17.4 per cent general national vocational qualifications. The staff were generally punch drunk with all the changes to courses and examinations which they had had to take on board.***

Not all the schools were poorly resourced. The City Technology Colleges were examples of what could be done. The 316 Technology Schools or Technology Colleges had received grants towards improved accommodation and equipment, but even so did not always receive enough for running costs. Some grant maintained schools had benefited from the capital fund and there were also local authority initiatives. But the great majority of schools were under-funded both with respect to recurrent and capital costs.

It would take a relatively modest £10 million per year to bring recurrent funding up to an acceptable level and a rolling programme of £100 million per year for ten years to provide the necessary capital investment. If the government is serious about applied learning for all it must find ways of making the money available.

Recommendations

This is the fourth in our series of reports on school technology. The first, ***Technology in the National Curriculum (1992)****, identified an urgent need to clarify the nature of technology, and that has now been addressed. The second,* ***Technology at A-level (1992)****, recommended that the qualifications framework for 16 to 19 year-olds be adapted to allow students to take more subjects, and that has been partly met through Sir Ron Dearing's review. The third,* ***Technology Teachers (1994)****, showed there was a severe staffing problem and that has yet to be taken fully on board.*

Four years on from the first report we find that technology – a resource intensive subject – is not being adequately funded, and what is on offer is often what can be afforded rather than what was intended. As part of a national strategy to enable technology to be taught to ***all*** *pupils we, for the reasons discussed in chapter 10, Resourcing the New Order, recommend:*

- ***The government should be asked to fund a rolling programme over, say, a ten year period to make good the shortcomings in capital investment in accommodation and equipment identified in this report.***
- ***The government should find the relatively modest extra £10 million per year to meet the day-to-day running costs of school technology.***
- ***Governors and headteachers should address the variability of technology capitation allowances and compare their school with others and the national average, and the level recommended by the Design and Technology Association.***
- ***The government should earmark funds for the recruitment of technology teachers and their training, both initial and inservice.***
- ***Governors and headteachers should act to ensure that the good technician support which is essential for the successful implementation of school technology is provided.***
- ***The senior management of schools should actively seek support from their community, including business and industry, Education-Business Partnerships, Training and Enterprise Councils, and from national programmes such as the Technology Enhancement Programme, Nuffield and the Royal College of Arts.***
- ***The Engineering Profession, together with organisations like DATA, TEP, Nuffield and RCA, should lobby for the proper resourcing of school technology.***

Contents

Introduction

1. It has not been easy to establish technology as a school subject. It burst on the scene in 1988 when it became compulsory in the national curriculum for all children aged five to 16, on an equal footing with other subjects. It did not emerge fully fledged, however, and since receiving statutory backing it has been in continual flux. In this report, the fourth in our series[1] on school technology for the Engineering Council, we describe school technology seven years on, through a survey of a representative 10 per cent sample, 344 of the 3,440, of maintained secondary schools in England and Wales.

2. The difficulties school technology has had seem to be for two main reasons: it is unclear what it is, and it is expensive. In *Technology in the National Curriculum* we traced the transformation of craft, design and technology (itself a portmanteau subject, with the fashionable sixties subjects of design, and technology added to traditional craft skills), through the addition of home economics, business studies, art and information technology, to become generalised problem solving without a specified knowledge base. That approach was severely criticised[2] and the need for reform accepted. Her Majesty's School Inspectors were asked to undertake a review[3]. Their proposals were further revised by the National Curriculum Council[4], itself much changed. NCC's revision got caught up in Sir Ron Dearing's review of the whole national curriculum leading to yet another version[5]. This latest one, adopting the view that technology is in essence about designing and making quality products, made it to the statute book.

TABLE 1: Curriculum 1994-95 *per cent*

Curriculum	Year 7	Year 8	Year 9	Year 10	Year 11
First Order	58.6	60.4	63.3	63.6	83.3
New Order	40.0	38.3	34.6	10.4	8.2
Pre-National Curriculum	1.4	1.3	2.0	26.0	8.5

3. At the time of our survey there were therefore at least three versions of school technology. There was the existing Statutory Order based on problem solving, there was the new Order emphasizing designing and making, to come into force for 11 to 14 year-olds in 1995 and 14 to 16 year-olds in 1996 and 1997, but there was also the suspension of the requirements for those starting Key Stage 4 in 1994 and 1995 allowing schools if they wished to revert to pre-national curriculum arrangements. Table 1 shows the pattern of provision in 1994-95. About two-thirds of schools stayed with the existing Order, rising to over four-fifths in year 11, the examination year. Most of the rest applied, as they were able to under section 16 of the Education Reform Act, to work to the new Order from September 1994. But about a quarter of the schools reverted to pre-national curriculum arrangements for year 10 under which subjects included within technology became optional once more.

4. The upheavals have exacted a price. Across the range of schools, those in charge of technology commented, as we can see in Box A, on the adverse effects of the changes on, among other things, staff morale, planning and budgeting.

BOX A: Changes and Uncertainties

"The greatest difficulty is keeping pace with developments. As the dust settles on the national curriculum it looks possible that we may be able to invest in text books to reduce the pressure on staff time and energy (and inventiveness)."

Technology, LEA

"We had developed a system on the old Orders, computer recorded, everyone INSET trained, now my staff are being shocked into re-doing what was working well."

Comprehensive, LEA

"Staff getting fed up with the six years of change and still being no further forward. Yet again more new paper work, courses and syllabuses. We are told no change for five years, but obviously the 1995 arrangements will be modified to improve or change delivery. 'Fed up' is not a strong enough expression."

Comprehensive, LEA

"From the start of the national curriculum the teaching schemes of work have been fluid and unstable. Key Stage 4 GCSE June 1995 has proved to be a nightmare to teach and assess. Final assessment of coursework and its moderation left department staff with no Easter break."

Comprehensive, GM

"Our present Year 11 (now in exams) have had a dreadful five years with upheavals and changes and I feel very sorry for them. Staff in the department are dedicated but enthusiasm at the present time is low and re-writing the scheme of work for all of KS3 is yet another mountain we have to climb - at least we can use these Orders which is some consolation!"

Grammar, GM

"Owing to staff changes, shifting priorities, assessing and responding to new Orders, coping with internal funding changes, provision of new buildings, uncertainty of outside agency grants, etc, it is difficult to plan coherently for budgets, rooming and staffing."

Secondary Modern, LEA

BOX B: Nature and Image of Technology

"Technology is now largely applied science. It all too often manifests itself as a Heath Robinson way of doing physics. There is little time available to teach students to do things properly - whatever material they are working in. The problem-solving approach is seriously flawed. The idea that children can be taught to design and create things from the depths of their inexperience before they are fully conversant with the limitations of materials and equipment is misconceived, and is likely only to produce shoddy results."

Comprehensive, LEA

"Still thought of as 'woodwork' - whole attitude of science and maths teachers needs changing, as well as some staff and governors. Very difficult!"

Comprehensive, LEA

"The demands on the staff are immense considering what still needs to be covered. The core consists of three subjects - wood, metal, plastics - which were taught as separate subjects, plus food & textiles. In addition electronics, mechanisms, structures, systems, control, CAD, CNC etc."

Comprehensive, LEA

5. Even with, or perhaps because of, the revisions there are still uncertainties about the nature and image of technology, as we can see in Box B. This is reflected in the wide variety of titles given to the 'technology' department or faculty in a school. Most often it was technology, or design & technology, but it was also variously called science & technology, materials science, art & technology, technology & business studies, enterprise, design & technology, expressive arts & creative design, design, the Creative Faculty, while some schools retained the old labels of CDT, home economics, textiles, and information technology.

6. Table 2 shows what was included in technology in the schools[6]. In nearly all it was based on wood, metal and plastics plus food and textiles. In over two-thirds, it also comprised electronics and graphics. Computing/information technology is taught as part of technology in about 60 per cent of schools, in about half as part of the department and in half elsewhere. Relatively few incorporated business studies and art.

TABLE 2: Technology Taught *per cent*[1]

Area	Within Dept	Involves Another Dept	Total
Wood, Metal, Plastics	96.5	1.8	98.3
Food	85.0	5.3	90.3
Textiles	74.3	6.2	80.5
Electronics	65.2	5.6	70.8
Graphics	65.2	4.8	70.0
Computing/IT	31.9	28.9	60.8
Business Studies	9.7	6.5	16.2
Art	9.7	5.6	15.3
Other	7.1	0.0	7.1

1. N=339, 5 missing cases.

7. But it is not enough to agree the ends, it is also necessary to will the means. It was largely the costs of establishing technical schools that turned the planned tripartite approach of the 1944 Education Act into a *de facto* grammar/secondary modern split. Once again technology has become caught up in a policy to establish specialist schools and the selective funding which that implies carries the risk that the subject will not be properly resourced for all pupils.

Technology Schools

City Technology Colleges

8. The government's first attempt to set up specialist technology schools was through a network of privately-financed City Technology Colleges (CTC)[7]. Mrs Thatcher had been persuaded that this is what business wanted and there would be no difficulty in securing the funds for 200 or more. In the event, following the passage of the legal framework in the 1988 Education Reform Act, sponsors were slow to come forward, and some potentially major players like Sainsbury's and BP refused to participate on the grounds that they thought the initiative divisive.

9. The first CTC opened in Solihull in 1988 and since then the total has crept up to 15, including one school devoted to the performing arts. However instead of most of the capital cost being provided by business, government was left to pick up the tab. Only about £37 million of the £150 million needed came from industry with the rest being provided from public funds. Recurrent costs are also met by the state. Although difficult to get off the ground CTCs have proved popular with parents offering as they do free independent education with a special emphasis on maths, science and technology to pupils across the ability range.

Technology Schools Initiative

10. The interest shown in CTCs led the government to look for other ways of establishing specialist science and technology schools. The first was the Technology Schools Initiative or TSI[8]. In 1991, LEAs in England were invited to select up to two bids from their secondary schools to receive grants for capital development. Separate bids were allowed from grant maintained and voluntary aided schools. The initiative was spread over two rounds, 1992-93 and 1993-94, and altogether 222 schools, 163 LEA, 46 GM and 13 VA were successful. In Wales, TSI was launched later and 27 schools received funding.

11. Capital grants totalling approximately £25 million in each round in England were provided by the Department of Education and Science as it was and the Department for Education as it became. In the second round, the criteria seem to have been tightened and targeted at accommodation and equipment. Sometimes supplementary sponsorship from industry was obtained also. However, the funding was only for capital development and it did not contribute towards running costs, for example, consumables. There was also the challenge of sustaining the use of the resources beyond the initial funding.

Technology Colleges

12. After the two rounds of the Technology Schools Initiative, the emphasis shifted to developing Technology Colleges[9] from existing schools. Launched in 1993, at the time of the survey, 67 Technology Colleges had been established in England. (There are now 151.) Originally the initiative was limited to grant maintained and voluntary aided schools, possibly to encourage schools to think seriously about GM status, but following representations from local authorities

the Secretary of State opened up the initiative to all secondary maintained schools in the November budget statement of 1994.

13. The financial support of Technology Colleges differed from the TSI in requiring matched funding from sponsors, though not necessarily as a cash donation. Up to £100,000 can be provided by the Department for Education and Employment, as it now is, for an initial capital grant and further grants of £100 per pupil can be made available for two years in the first instance if certain performance criteria are met. In addition to buildings and equipment the new money can be spent on teachers and technicians, but consumables still have to be provided from general running costs.

BOX C: Technology Initiatives

"We have recently been awarded Technology College status which will dramatically affect the availability of resources. We are also undergoing a three-year refurbishment programme and therefore envisage improved teaching accommodation."

TSI School then Technology College, 13-18 Comprehensive, Mixed, LEA

"As a TSI school in general we are well-resourced. But capitation for consumables is very poor We exist on recycled materials in the workshops and textiles area. We do not have enough money to buy consumables to last out the next academic year. We could do with an extra member of staff and another food room to cater for students who opt to do food at KS4. This would also help to reduce the numbers in each teaching group. We consider ourselves lucky in regard to our facilities."

TSI, 12-16 Comprehensive, Mixed, LEA

"The resourcing is not the problem. Staff are inventive and hard working. What is missing is the planning time to allow for a properly integrated curriculum of design and technology. If all six staff could be released for one day, followed by a two week gap, followed by a further two days everything would be sorted out. But what we get is the odd 1hr faculty meeting plus whatever time we can make between ourselves."

TSI, 11-16 Comprehensive, Mixed, LEA

"As the Technology Schools Initiative in Wales was launched much later than in England, we were in a much stronger position to calculate the probable outcome of the new Orders. Our grant (£245,515) refurbished the equipment of two multi-media workshops, one CAD/DTP room and the control technology room."

TSI, 11-18 Comprehensive, Mixed, GM

"Although we have really appreciated the updating of our facilities, the process has been marred by serious defaults on what we asked for and very bad quality of building and equipment. Two years gone and still things are not fixed or are missing."

TSI, 11-18 Comprehensive, Girls, GM

"Two new resistant materials rooms as from January 1996 from Technology College money and possibly food/textiles facilities enhanced if future money allows. Inadequately resourced re materials, consumables, money for text books, etc."

Technology College, Girls, Voluntary Aided

"Since gaining Technology College status, many things are being put right under health and safety, new equipment, etc. Depending upon the money required for building, our allocation for new equipment may be less than generous, but it's too early to say."

Technology College, 11-18 Comprehensive, Boys, GM

14. Some schools were evidently plugged into obtaining selective funding of this kind and in our sample four schools had first become grant maintained and then successively a TSI school and a Technology College, and one LEA school had

similarly transformed itself. For example, one mixed 11-18 comprehensive, with about 1,100 on the roll, including 100 in the sixth form, had become grant maintained, then in 1992-93 obtained £208,000 in TSI money which it had spent on refurbishment of buildings, furniture and equipment, and in 1994-95 it became a Technology College receiving a further £100,000 capital grant, matched by industry, which it spent on furniture, equipment, curriculum development and an information technology network. It also stands to receive around £110,000 per annum based on pupil numbers for two years in the first instance. Not all the money goes to technology; science and maths benefit as well.

BOX D: Selective Funding

"Even though applications were made for TSI funding they have not been successful. Lack of specialist equipment in areas like computer control, electronics, and pneumatics, mean that the experiences the pupils will get in these important areas will be minimal for the foreseeable future. Initiatives like TSI, although they reward few schools (one in this LEA), take a lot of time in preparing applications and merely frustrate schools who wish to develop but have no funding to do so."

Comprehensive, LEA

"Grants going just to the select few is unfair. We are finishing a new food room this summer paid for from school money £28,000. No help from anybody. Paid out £40,000 over the last five years on IT equipment, which is now slowly going out of date with no prospect for any major investment or grant to carry on building on the resource."

Comprehensive, LEA

"The TSI funding would answer all our prayers - but only eight schools in Wales can be successful. I do feel that additional funding for all schools is a necessity if education is to keep pace with the real world of work."

Comprehensive, LEA

"Our construction materials rooms consist of two refurbished classrooms in huts. We have applied to the LEA for a purpose built Design and Technology block, but they claim to have no money. We have also applied to the millennium fund and large industries to no avail."

Comprehensive, LEA

"We are a rural school. Although we have a very positive management team, the department is denied opportunities that many town/city schools enjoy. We have a very supportive Parent/Teacher Association and Neighbourhood Engineers group, but we have found considerable problems when applying for external assistance, eg the current Education Department Technology initiatives where we are experiencing considerable problems gaining any industrial support."

Comprehensive, LEA

"We are an expanding school and have recently received CTC affiliation and are seeking Technology College status. As such we have relatively large class sizes (up to 26) and operate on a tight budget. Retrospective funding is having its effect - successful schools suffer."

Comprehensive, LEA

"We are presently working on the details of a technology bid to enhance the delivery of design and technology. The bid will include building, office space, storage and computer update with peripherals. Also pneumatics."

Comprehensive, GM

15. Not unnaturally, as we can see in Box C, schools that bid successfully for either or both of the initiatives tended to be delighted. But those left out in the cold were inclined to question the fairness of this kind of selective funding,

commenting as in Box D. In addition to the national initiatives, there were schools that had benefited from the grant maintained schools capital fund or local initiatives (Box E).

BOX E: Local Initiatives

"This is a newly-built school. All areas have been designed and equipped specifically for technology."

Comprehensive, LEA

"We are very well resourced across all areas of design and technology due to support for our subject area from the head teacher and the fact that we did not follow the trend, a few years ago, of removing specialist equipment. In fact, at this time we were buying it in very cheaply. We also acquire many consumables free of charge from local firms."

Comprehensive, GM

"We are pleased to inform you that we have been awarded a capital fund grant of £783,000 in order to build a new technology centre. The school will contribute £200,000 for an additional two rooms. Our anticipated completion is September 1996."

Comprehensive, GM

"Due to a building programme completed three years ago we are in the fortunate position of having obtained a wide range of equipment. Additionally we have been successful in gaining money to buy control equipment from a County Technology initiative. Through TVEI and the Technology initiative we have CAD/CAM facilities in the textile area – knitting machines and a POEM embroidery machine which links to the Acorn network we have in the department."

Grammar; LEA

16. The differential funding of schools and their different histories led us to adopt four main types as the basis of comparisons in this report:

- **Technology (N=38)** - Technology Schools plus Technology Colleges, but *not* City Technology Colleges which are classified as independent;
- **Comprehensive (N=275)**;
- **Grammar (N=17)**;
- **Secondary Modern (N=14)**.

These were cross-tabulated with grant maintained (N=65) and LEA (N=279), with sixth form (N=190) and without sixth form (N=154), and girls' (N=23), boys' (N=21) and mixed (N=300), and the results are given where interesting differences were found. The sample is fully described in the Appendix.

17. Technology schools would have, and grant maintained schools could have, received some extra capital funding but with regard to day-to-day running costs they were liable to be in the same boat as other schools. The management team of the school described in para. 14, which was not only grant maintained but had received a cash injection from both TSI and Technology College initiatives, was, for example, able to make available only £5.50 per pupil aged 11-16. This is just over half that estimated by the Design and Technology Association as necessary to run national curriculum technology successfully[10].

Running Costs

18. The running costs of a school department, in this case technology, have to be met mainly from that part of the school's income set aside by the headteacher and the senior management team for this purpose. The actual sum delegated can be arrived at in a number of ways – on a historical basis, in response to bids, or by formula. Sometimes it is for the different components of technology and sometimes an overall integrated figure. It usually covers materials, hand tools, textbooks, software, photocopying and stationery, but can also include machine tools, hire charges, minor works, equipment installation and library books[11].

19. Expressed on a per pupil basis[12], or capitation, we can see from Table 3 that in 1994-95 it averaged out at £5.86. This compares with the £5.03 per pupil found by the Design and Technology Association (DATA)[13] in its self-selected sample of 178 maintained secondary schools, and Ofsted's[14] figure of just over £5.00 for 1992-93.

TABLE 3: Capitation 1994-95

School Type	Mean (£)	Range (£)
Technology (N=36)	6.04	1.40 – 21.10
Comprehensive (N=268)	5.74	0.40 – 15.30
Grammar (N=17)	5.77	2.80 – 14.00
Secondary Modern (N=14)	7.59	2.60 – 15.50
Total (N=335)	**5.86**	**0.40 – 21.10**

20. The technology schools (TSI and Technology Colleges) as a group seemed only marginally better provided for in this respect than other schools. But there were striking differences between schools of the same type. For example, the technology department in one comprehensive was having to manage on 40p per pupil (the school had virtually run out of money in the wake of the budget settlement) while, in another, the technology capitation was £15.30. The technology department in one technology school was receiving £21.10 but in another only £1.40. Nearly 90 per cent (88.7 per cent) of schools were receiving less than the £9.30 estimated by DATA as necessary in 1994-95.

21. Although there were no appreciable differences between the technology schools and the rest, grant maintained schools tended to do better than their LEA counterparts, with average capitation at £7.50 compared with £5.45. The higher levels in GM schools may reflect greater departmental responsibility for such things as equipment maintenance, hire charges and minor works.

22. The fact that nearly 90 per cent of technology departments were receiving less than DATA's estimated requirement has severely limited the implementation of the national curriculum. Many of our respondents commented, as we can see in Box F, that the capitation provided did not allow the purchase of quality materials for projects, and much of the work had to be done on the cheap. Technology teachers had to spend part of their time begging, borrowing and scrounging resources, even to the extent of scrabbling about in industry skips.

The technology department grant has not generally kept pace with the subject becoming compulsory for all pupils, and there were fears that 1995-96 would bring further cuts.

BOX F: Consumables

"The delivery of national curriculum requires all students to design and make a number of artefacts. This is becoming difficult as the price of consumables and materials is increasing and budgets are decreasing. We try to contact firms for off-cuts, etc – hardly professional."

Technology, LEA

"Capitation is poor and we use a lot of reclaimed materials. My department's capitation has remained at a level between £1890 and £2700 since 1987. We do a lot more 'cheap' work now ie. modelling with paper/card, kit work in electronics/Lego Technic etc."

Comprehensive, LEA

"Capitation does not allow me to provide quality materials for projects. We rely on collections made from local industry skips! The workshops need refurbishing and old equipment needs replacing – not possible without a substantial grant."

Comprehensive, LEA

"Over the last year in design and technology we have lived on reclaimed timber including old desk tops!"

Comprehensive, LEA

"With 1,200 students designing and making across five or six media areas each week for three hours the amount of consumables required is quite daunting. The range of resources, adhesive fixings, foodstuffs, textiles, papers, etc, etc, is wide and catering for individual design projects takes a great deal of time. The hardware, machinery and handbooks are also numerous and need constant management. It is like managing a factory with an unruly workforce sometimes!"

Comprehensive, LEA

"A generous chunk of the schools money comes our way but not enough to fund repair/replacement of tools/equipment, never mind materials. Our department works very hard to beg, borrow, and scrounge resources. Many firms help out and we have excellent industrial links. Nevertheless courses are restricted by lack of some very basic equipment. Staff often buy what they need out of their own pocket to keep us running. We deliver quality because we can't do anything else. What other industry runs this way? And this is a school with plenty of enthusiasm and a supportive management team!"

Comprehensive, LEA

"Our biggest problem in the year ahead (1995/96) will be funding for consumables as the capitation is over 30 per cent down on last year"

Comprehensive, GM

"Resources are generally poor and the numbers taking technology have increased dramatically in the last year or so, without corresponding increase in capitation."

Grammar, LEA

23. The comments of Box F also bring out how much the teaching of technology is having to look elsewhere for cash and kind. This can lead to healthy co-operation with the community, but also to schools feeling that they have to continually go cap in hand. Table 4 shows that nearly 60 per cent of schools were receiving support from industry. The technology schools seemed to be doing particularly well, over and above what they obtained to facilitate their TSI and Technology College bids. About a third of the technology departments were being helped by Parent/Teacher Associations (PTA), but only just over 10 per cent had tapped

into the Training and Enterprise Councils (TEC). Again it was the technology schools, along with the secondary moderns, which have been most successful in this respect. None of the grammar schools was apparently receiving TEC support.

TABLE 4: Sources of Support *per cent*

School Type	Bus/Ind	TEC	PTA	Other
Technology (N=38)	65.8	23.7	34.2	28.9
Comprehensive (N=275)	55.6	9.8	34.2	25.5
Grammar (N=17)	58.8	0.0	23.5	17.6
Secondary Modern (N=14)	57.1	21.4	42.9	21.4
Total (N=344)	**57.0**	**11.3**	**34.0**	**25.3**

24. The nature of the support varied with the source. Industry seemed to give relatively little financial help but contributed mainly through materials, teaching as with the Neighbourhood Engineers scheme, and the donation of prizes. PTAs most often helped through equipment purchase and cash donations. Support from the TECs was mainly for training, but with some financial help as well.

25. The departments are also obtaining some income by selling completed articles to pupils. This has to be voluntary since following the Education Reform Act (section 106) it is illegal to impose a direct charge. Recovery is however very uneven. Table 5 shows that about one in six schools was getting back over 10 per cent of the budget in this way. One school, for example, was recovering £1,380 out of £7,642 (18 per cent) from pupil contributions. But in 60 per cent of the schools the return was minimal.

TABLE 5: Payments by Pupils *per cent return on budget*

School Type	2.5% or less	2.6% - 10.0%	More than 10.0%
Technology (N=38)	73.7	13.2	13.2
Comprehensive (N=274)	58.8	23.7	17.5
Grammar (N=17)	47.1	35.3	17.6
Secondary Modern (N=14)	64.3	21.4	14.3
Total (N=343)	**60.1**	**23.0**	**16.9**

26. As difficult as things were in 1994-95, the situation in 1995-96 is not any better. In fact, Table 6 shows that 40 per cent of technology departments said they would be receiving less in 1995-96 than 1994-95, and only just over a quarter, more. The effects of these further cuts are spelled out in Box G. The consequences for equipment, staffing, group size, and having a safe working place are all picked up again later. But especially disturbing is the view, frequently expressed, that what is being taught - the switch from practical to theory, and the use of materials like paper - is being determined more by what can be afforded than what was intended.

TABLE 6: Income 1995-96 *per cent*

Compared with 1994-95	More	Same	Less
Technology (N=33)	24.2	24.2	51.5
Comprehensive (N=251)	27.5	34.3	38.2
Grammar (N=16)	37.5	31.3	31.3
Secondary Modern (N=14)	35.7	28.6	35.7
Total (N=314)[1]	**28.0**	**32.8**	**39.2**

1. 30 schools did not know at the time of the survey.

BOX G: Cuts

"The situation in 1995/96 will be markedly different owing to budget cuts in the school. Our group sizes will increase by approximately 15 per cent and this will have obvious effects throughout the department. Our capitation will be cut by 20 per cent."

Comprehensive, LEA

"Due to an overspend and the current cuts going through Education we are losing six staff (early retirements, not being replaced, etc, etc) but we are having a new intake which is up by 90!"

Comprehensive, LEA

"The increase in group sizes resulting from staff loss does create our biggest problem."

Comprehensive, LEA

"Staff in technology have been reduced by three in the last four years in my school."

Comprehensive, LEA

"For 1995-96 our capitation has been drastically cut to preserve staffing (2 F/T teachers lost to staffing in school, however)."

Comprehensive, LEA

"Due to a 23.5 per cent cut back in capitation we are finding it increasingly difficult to run a balanced design and technology course next year. Loss of staff due to cutbacks, increased class sizes (up by 20 per cent), lack of facilities, tools, safe working space, these are obviously all contributory factors."

Comprehensive, LEA

"Money now is so tight that corners have to be cut. Group sizes must increase. Less money than last year. More theory and less practical due to cost. More paper work required – more work, less staff. Very difficult all round."

Comprehensive, LEA

"I am concerned that the school as a whole, and the technology department in particular, is having to rely on fund-raising activities in order to provide adequate resourcing."

Grammar, LEA

Equipment

27. The national curriculum also implies major equipment needs. Table 7 shows that about half the schools regarded theirs as inadequate to deliver Key Stage 3 and two-thirds Key Stage 4. In those schools it became a matter of what could be taught not what should be taught.

28. There were appreciable differences with type of school. The technology schools which had enjoyed extra investment through the TSI and Technology College programmes were more likely to rate their equipment good than were other types of schools. Four-fifths of the grammars and two-thirds of the secondary moderns and comprehensives, on the other hand, rated theirs as inadequate for Key Stage 4. Grant maintained schools seemed somewhat more satisfied with their equipment than were LEA schools. The concerns of the heads of technology departments are spelled out in Box H.

BOX H: Equipment Concerns

"As a department our main resource problem is in the area of CNC work. We have an old, unreliable Boxford CNC that the pupils, especially lower ability, find difficult to use due to the 'G' coding. We need a more user-friendly version so that all ability levels can succeed."

Technology, GM

"We have had to set up two food technology rooms in the last two years - this has been a drain on budget. We now have to purchase cookers, etc. In 1996-7 we are hoping to reintroduce textiles, but once again we need to start from scratch buying and setting up a new area."

Comprehensive, LEA

"In terms of equipment and consumables - we are only able to keep going (often using reclaimed materials). Buying new or replacing worn equipment is impossible."

Comprehensive, LEA

"Investment is required in the hard technology areas of the new Orders, including products and applications. Existing machinery and equipment is also in poor condition following increased loading over the last 5 years."

Comprehensive, LEA

"Capital equipment is sadly lacking and no prospect of remodelling to cover the national curriculum is in sight. We are now well-resourced on consumables but need thousands of pounds to properly apply the national curriculum."

Comprehensive, GM

"We find that much time is spent trying to raise money (for equipment) from industry in order that we can trigger matched funding from other bodies, eg, TEC. If the Government stipulates that certain courses should be followed that require specific items of hardware to deliver the courses, for instance computer aided design and CAM machines, then they (the Government) should provide the funding."

Comprehensive, GM

"We have been able to make no provision for items of a large capital expenditure or to replace expensive items."

Grammar; GM

"We use equipment which appears archaic to our students, since we can't afford to replace it and we see little hope of help in the future."

Secondary Modern, LEA

TABLE 7: Equipment *per cent*

School Type	Key Stage 3		Key Stage 4	
	Inadequate	Good	Inadequate	Good
Technology (N=37)	13.5	35.1	29.7	21.6
Comprehensive (N=271)	53.5	5.2	66.8	3.7
Grammar (N=16)	50.0	12.5	81.3	nil
Secondary Modern (N=14)	50.0	14.3	64.3	7.1
LEA (N=275)	52.0	6.9	64.7	4.4
Grant Maintained (N=63)	34.9	19.0	57.1	11.1
Total (N=338)	**48.8**	**9.2**	**63.3**	**5.7**

29. Table 8 shows the technology heads' views on equipment needs for the new Order. Three-quarters indicated that the prime requirement was for equipment for the systems and control area, and two-thirds, for materials and components. Health and safety, products and applications, and structures also all featured prominently.

TABLE 8: Priority Needs

Area	Per Cent (N=344)
Systems and Control	75.0
Materials and Components	64.8
Health and Safety	45.1
Products and Applications	39.0
Structures	38.4
Other	37.2

30. Conversely, nearly half the schools had equipment they did not use. Table 9 shows that about one in six, in each case, had equipment not used because it was out of date, the staff were not trained to use it, they were unable to repair or maintain it, or it was no longer relevant to the curriculum. Secondary moderns were most likely to say the equipment was out-of-date, grammars that they were unable to repair it, and technology colleges to have equipment their staff were not trained to use.

TABLE 9: Equipment Not Used *per cent*

School Type	Reason				
	Out of Date	Staff Not Trained in Use	Unable to Repair/ Maintain	Not Relevant to Curriculum	Other
Technology (N=38)	10.5	21.0	10.5	13.2	13.2
Comprehensive (N=275)	14.9	15.6	17.5	17.8	14.9
Grammar (N=17)	11.8	5.9	23.5	5.9	17.7
Secondary Modern (N=14)	21.4	14.3	14.3	14.3	21.4
Total (N=344)	**14.5**	**15.7**	**16.9**	**16.6**	**15.1**

31. Technology is expensive to run and requires appropriate equipment. Without it the curriculum becomes an unattainable aspiration. Ways have to be found of equipping all schools to a good standard.

Accommodation

32. The chequered history of technology in schools has left a legacy of poor accommodation. Many heads of technology departments mentioned it as an even greater problem than capitation (Box I). The more successful technology is, the greater the pressure.

BOX I: Accommodation

"Single greatest problem faced by this department is the rooms in which we are housed. These are wooden buildings gifted to the school in the 1950s. The only purpose built specialist room is the food room. All other rooms are converted/adapted classrooms. The lack of storage space is a real concern."

Technology, GM

"Our rooming is spread out all over the school. No money has been spent to update rooms since they were first built in the 1950s. The department never has any capital to buy any new equipment, and maintenance of new equipment is an increasing problem. Class sizes have increased by a quarter in the last two years."

Comprehensive, LEA

"The largest problem is coping with big group sizes in the cramped accommodation. The school was designed and built for a total roll number of 240 and with the current roll of 320 the workshops are very crowded. We need additional accommodation (a technology/graphics/ resources area). Workshops need to be updated from a health and safety aspect."

Comprehensive, LEA

"Accommodation for the delivery of design and technology has not changed since well before the introduction of the national curriculum. We have one workshop and one makeshift room in which we attempt to run practical projects. We are in desperate need of a technology purpose built block in order to group all the subject areas within technology."

Comprehensive, GM

"The accommodation in the technology block was originally temporary and for almost five years now (that I have been here) plans have been submitted and refused to rebuild the faculty. I and my colleagues are concerned as to whether we can meet design and technology and computing entitlement in 1996."

Grammar, GM

"The outstanding problem is that specialist rooms are lacking both in availability and facilities. It is unacceptable that practical lessons should be taught in the foyer of the technology block."

Grammar, GM

"Information technology resources possibly the best in any school in Great Britain. CDT resources have lacked investment since 1986. Only one specially built CDT room, other two converted from classrooms."

Secondary Modern, GM

33. The transformation of CDT for some boys and home economics for some girls into technology for all pupils has posed problems for most schools but especially the single-sex:

> *"We are an all-girls school. Our construction materials rooms consist of two refurbished classrooms in huts, and a third room set up for computer control. The workshops are extremely cramped and we often have groups of more than 20 in a 50m^2 room."*
>
> ***Comprehensive, LEA***

"We are an all-boys school and have no tradition or expertise/facilities for food/textiles. The school should see this as a desirable feature of design and technology, but how can it possibly be resourced and funded ie, a new room and a new member of staff or two. I think it is still the case that schools should be working to the highest standards possible in their field of expertise and not diluting the quality of education by trying to do everything – basically an element of realism."

Grammar, GM

34. Table 10 shows that while just over a third of all schools thought their accommodation for working with resistant materials was inadequate, this rose to over half for girls' schools at Key Stage 3. Food was less of a problem for the boys' schools since it will not be a compulsory part of the secondary curriculum. As might be expected, girls' schools had less difficulty than other schools in putting on food and textiles at Key Stage 3. But the somewhat surprising finding that graphics and electronics were apparently no problem either is perhaps explained by the fact that over 60 per cent of girls' schools did not offer them at either Key Stage 3 or 4.

TABLE 10: Rooms *per cent inadequate*

Area	KS 3 Girls (N=23)	KS 3 Boys (N=21)	KS 3 Mixed (N=297)	KS 4 Girls (N=23)	KS 4 Boys (N=21)	KS 4 Mixed (N=295)
Resistant Materials	56.5	28.6	35.4	39.1	28.6	34.2
Food	26.1	28.6	30.6	30.4	33.3	28.8
Textiles	13.0	14.3	23.2	26.1	14.3	22.0
Electronics	21.7	33.3	15.2	13.0	38.1	15.9
Graphics	17.4	38.1	14.5	13.0	52.4	16.3

TABLE 11: Overspill into Non-Technology Rooms *per cent*

School Type	Key Stage 3	Key Stage 4
Technology (N=38)	18.4	10.5
Comprehensive (N=270)	20.4	21.5
Grammar (N=17)	29.4	41.2
Secondary Modern (N=14)	28.6	35.7
Total (N=339)	**20.9**	**22.1**

35. The inadequate accommodation led to overspill into non-technology rooms in a fifth of the schools (Table 11), with all the limitations that imposes on the delivery of a practical subject. Forced use of non-technology rooms was particularly prevalent in grammar and secondary modern schools, which frequently occupy older premises. Relatively few technology schools had to make use of non-specialist rooms, reflecting the greater level of investment they have enjoyed.

36. The storage of the products of the pupils' projects emerged as a particular issue. Table 12 shows that 70 per cent of schools reported a lack of satisfactory storage accommodation. Nearly 50 per cent also had no or unsatisfactory display space. Staff too seemed poorly provided for. One in five of the schools had no office accommodation for them and in a further 44 per cent it was regarded as unsatisfactory.

TABLE 12: Accommodation *per cent*

	None	Unsatisfactory	Satisfactory	Good
Display Space	5.3	42.1	43.8	8.8
Storage	0.9	70.3	23.5	5.0
Office Space for Staff	18.8	44.1	29.1	7.9

37. The technology accommodation in many schools, especially the older ones, is well illustrated in these comments from the head of what is now an LEA comprehensive:

> *"We have just completed the KS4 GCSE with 203 pupils in facilities designed to cope with 100. Each student has produced two 20hr practical projects - 406 projects which require storage until September. There is nowhere to keep them, so I have had to commandeer a disused toilet which we were repairing to put them in. The whole department was designed for boys' crafts and girls' crafts as per the old secondary modern regime. It is totally out of date as a design and technology department but we have to cope. Ideally, the whole department wants a complete re-fit and cleaning up, with an additional workshop built on."*

The accommodation issue must be addressed.

Staffing

Teachers

38. The staffing of technology departments, including recruitment and qualifications of the teachers, was explored in detail in the third report of the series, Technology Teachers. In that survey we found for 1993-94 an average of 5.6 full-time technology teachers per school; in this new survey, as Table 13 shows, for 1994-95, we found 5.4. The estimates are satisfyingly close, indicating if anything a slight drop in full-time staffing levels. When part-time teachers – part-time either because they do not work full hours or because of their commitments in other departments – are expressed as full-time equivalents, the staffing works out to 7.89 per 1,000 pupils. Grant maintained schools were no better off in this respect than their LEA counterparts, but up-to-18 schools had, on average, 0.3 of an FTE more for their 11-16 pupils than schools without sixth forms.

TABLE 13: Technology Staffing *mean*

School Type	Full-Time Teachers	Full-Time Equivalents	Full-Time Equiv Per 1000 Pupils
Technology (N=38)	6.13	7.25	8.29
Comprehensive (N=275)	5.53	6.44	7.89
Grammar (N=17)	3.35	4.38	6.99
Secondary Modern (N=14)	4.14	5.34	7.98
Total (N=344)	**5.43**	**6.38**	**7.89**

39. About a third of the heads of technology departments would like to have had more staff as indicated in Table 14. This included over 40 per cent of the grammar schools which consistent with their traditions, as Table 13 shows, tended to have fewer technology teachers. But over three-quarters of the respondents thought the prime need was more in-service training. This concern to align staff expertise with the demands of the national curriculum is underlined by the comments of Box J.

TABLE 14: Staffing Needs *per cent*

School Type	More Staff	Different Specialisms	Inservice Training
Technology (N=38)	34.2	21.1	78.9
Comprehensive (N=274)	31.3	28.4	78.2
Grammar (N=17)	41.2	29.4	64.7
Secondary Modern (N=14)	28.6	28.6	78.6
Total (N=343)	**32.0**	**27.6**	**77.6**

BOX J: Staff Expertise

"By far the biggest problem in this school is ageing staff traditionally trained. Most expect to retire in 3-4 years and so are reluctant to teach new aspects of courses – weak in design process, graphics presentation, electronics, mechanisms and structures."

Comprehensive, LEA

"We are expected to be an expert in too many fields these days and a lot more INSET needed."

Comprehensive, LEA

"Many staff are still not multi-skilled and do not have sufficient knowledge to cover the KS3/KS4 requirements, which affects quality delivery."

Comprehensive, GM

"A massive retraining for four of the five full-time teachers urgently required."

Comprehensive, GM

"There is now a broad spread of skills and activities which need to be taught by teachers and a wide range of equipment required to do it with. Staff training is always a problem."

Secondary Modern, LEA

40. Not only were the heads of technology departments concerned about expertise they also felt strongly that they and their staff did not have enough time to implement the national curriculum properly. Some, as we can see in Box K, put it even above money.

BOX K: Staff Time

"Time from the school day for staff to experiment/build projects, develop teaching styles would be of benefit (use of advisory staff has been useful here)."

Technology, LEA

"The most essential element is time. Every member (full-time) works the whole day plus many hours after school, unfortunately too often on other career based responsibilities, meetings, profiles, additional paperwork. Much of the essence of innovation and skill development which has been the hallmark of technology is now becoming secondary to needs of administration. INSET is used for school needs not staff needs."

Comprehensive, LEA

"What we need most is time together as a staff to put together the structure for the new order."

Comprehensive, LEA

"We never seem to have the time to plan and think about the work while maintaining current courses. Time is our scarcest resource."

Comprehensive, LEA

"The most valuable and lacking resource is that of time!"

Comprehensive, LEA

"Time is also at a premium. Increased pressure from the school means that non-contact/ preparation time is minimal. Until more time is available D&T will always be under pressure."

Comprehensive, LEA

Technicians

41. One factor in the amount of time a teacher has to think, plan and prepare is the availability of technician support. Table 15 shows that ten per cent of technology departments, including those in technology schools, had no technician help at all. A further 35 per cent had some access but not up to the level of one full-time equivalent. Only just over half had one technician or more, with the technology schools strongly represented in this fortunate group. Some of the technology departments with a low level of support looked enviously over their shoulders at the science departments which sometimes had the support of two or three technicians, and from whom they had to beg the occasional hand. Grant maintained schools were no better provided for in this respect than LEA schools.

TABLE 15: Technicians *per cent*

Type of School	None	Some Access	One or Equiv	1.5 or Equiv	Two or Equiv
Technology (N=38)	10.5	18.4	42.1	26.3	2.6
Comprehensive (N=275)	9.5	35.6	39.3	13.1	2.5
Grammar (N=17)	11.8	58.8	23.5	5.9	0.0
Secondary Modern (N=14)	21.4	35.7	35.7	7.1	0.0
Total (N=344)	**10.2**	**34.9**	**38.7**	**14.0**	**2.3**

42. The urgent need for more technician help is brought out in the comments of Box L. Sometimes there was no technician because there was no post; in other cases the wage offered was too low to attract applicants. Where a department did have access to a technician this could be to no more than the school handyman, the reprographics assistant or an audio-visual aids technician.

BOX L: Technicians

"I think that our major requirement is a qualified workshop technician able to maintain/repair/ recycle equipment and also prepare materials as required by our scheme of work at the required time."

Comprehensive, LEA

"We are in need of technicians but cannot get one despite many requests to the head for help."

Comprehensive, LEA

"We desperately need a full-time technician for maintenance of equipment and machines, preparation of materials, making teaching equipment, making demonstration models, sharpening tools, managing consumable stores and maintaining to sufficient levels of classroom support."

Comprehensive, LEA

"Lack of technician makes life very difficult, but difficult to appoint part-time help."

Secondary Modern, LEA

43. If the technology national curriculum is to be successfully implemented not only do the right teachers need to be recruited and retained, but they must also be given adequate technician back-up in what after all is a practical subject.

Group Size

44. The size of school classes generally has been an issue much discussed recently with no firm conclusion about its bearing on performance. But technology is a practical subject with a relatively high requirement for individual tuition and supervision so, on commonsense grounds, there are reasons for supposing the optimum group size would be lower than for desk-bound subjects. The National Association of Advisers and Inspectors in Design and Technology has been campaigning for a maximum of 20 pupils per technology class.

45. Table 16 shows, however, that the average group size, across both Key Stages 3 and 4, is above this suggested limit. The average is above 20 across all types of school at Key Stage 3 and only dips below in the grammars and secondary moderns at Key Stage 4 where at the time of the survey technology was not a statutory requirement. The technology schools had the largest classes, on average, presumably because as specialist schools they had more pupils taking the subject and better facilities. Classes in grant maintained schools were just as large as in their LEA counterparts.

TABLE 16: Group Size

School Type	KS 3		KS 4	
	Mean	Range	Mean	Range
Technology (N=38)	21.8	18 – 29	21.0	15 – 28
Comprehensive (N=269)	21.0	13 – 30	20.2	14 – 27
Grammar (N=15)	20.4	16 – 28	19.1	15 – 24
Secondary Modern (N=12)	20.4	15 – 24	19.8	15 – 25
Total (N=334)	**21.1**	**13 – 30**	**20.2**	**14 – 28**

46. Not only were the overall averages above what is thought desirable, but the mean class size by school varied enormously. Whereas it was as low as 13 in one school at Key Stage 3 it also reached 30; at Key Stage 4 the range was from 14-28. The consequences of over-large groups for the teaching of technology are described by the heads of department in Box M.

47. A particular issue raised was health and safety, clearly important when pupils are using, perhaps for the first time, potentially dangerous tools and equipment, and potentially hazardous materials. These concerns are expressed in Box N. Thoughts about safety alone are enough to focus attention on the need for more technology teachers. However, with the dispensation to treat technology as optional at Key Stage 4, the pressure was not being fully felt. From 1996-97 all pupils will be involved and, unless staffing levels are improved, group size may well increase to above what is manageable.

BOX M: Group Size

"In recent years class sizes have increased and now can be 24 or more. This is too large to safely carry out a number of processes and has resulted in a narrowing of the curriculum on offer. Some action is now being taken to limit class sizes to 20 but it will be some time before staff are free to offer a full range of technological activities."

Technology, LEA

"The 'absolute max' recommendation of NAAIDT and HSE of 20 is in fact a target figure because of budget restrictions (KS 3). There is not scope for small low ability groups (budget). KS 4 (year 10 94/95) class sizes are slightly better but this is because there is a relatively small take up of D & T subjects compared with year before (approx. 30 per cent). 96/97 begins full pressure."

Comprehensive, LEA

"Owing to the increased class sizes, work stations are short (initially the rooms were designed for 20 pupils)."

Comprehensive, LEA

"ln order to maintain staffing levels and provide a good balanced curriculum, group sizes in design and technology have steadily risen over the past six years. As more pupils enter the school, group sizes increase. Accommodation is overcrowded which places stress on staff and results in underachievement in pupils. Often projects have to be shared, preventing individual work. No technician support places an unacceptable burden on staff who endeavour to maintain highest level. A-level courses are taught in mixed upper and lower VI and on two to three hours per week. Food A-level has one timetabled lesson. We have been given an ultimatum – smaller groups or A-level – we try to do both."

Comprehensive, GM

"Shortage of money means inadequate staffing and very large groups at Key Stage 3. This will not give an adequate grounding for compulsory design and technology at Key Stage 4."

Comprehensive, GM

"We are a very small school of about 250 11-16 year-olds. Numbers fluctuate and classes range from 17-29. With the larger groups it is (a) impossible to seat them; (b) not enough work stations; (c) with very low ability students it is very dangerous. What resources we have are stretched to the limit with these classes."

Secondary Modern, LEA

"Groups getting larger due to funding troubles in LEA are the last straw. However, we still offer quality teaching, motivate students and enjoy it. Nil desperandum."

Secondary Modern, LEA

BOX N: Health and Safety

"Of most concern for 1995/96 is the vast increase in pupil numbers in year 7. This will reduce the quantity of work that can be safely undertaken in practical sessions."

Comprehensive, LEA

"Trying to run a department on a budget of £2.42 per head is impossible. Add to that the pressure of trying to conform to ever-changing subject criteria and it really becomes unbearable. We cannot even provide safe environments in which to work let alone anything else."

Comprehensive, LEA

"Last November we had an Ofsted inspection and it found 'serious health and safety concerns'."

Comprehensive, LEA

Curriculum, Courses and Exams

48. However necessary the introduction of technology as a national curriculum subject and the revisions to the Order may have been, the state of continual transition has been very uncomfortable. A common complaint has been: do we have to invent yet another curriculum? There was also general concern, as we can see in Box O, about the lack of guidance and support.

BOX O: Curriculum Support

"Text books need updating – £500 needed."

Comprehensive, LEA

"Lack of suitable text books at affordable prices specific for KS3/KS4 (Nuffield very expensive) plus need to be photocopiable."

Comprehensive, LEA

"The DATA resource pack has been most useful."

Comprehensive, LEA

"We do not possess one set of text books – most theory uses reprographic sheets."

Comprehensive, LEA

"We have found the material from TEP extremely useful."

Comprehensive, GM

"In order to collate the information I felt necessary for the technology GCSE exam I used texts from 12 different books including some A-level sections. What is required is one affordable text book that fully covers all of the required background theory for a GCSE course in design and technology, resistant materials. There should be extra books for the extension areas such as graphics, food."

Grammar, LEA

"Guidance is lacking from School Curriculum and Assessment Authority in the form of non-statutory guidance, particularly a standard form of recording achievement. Do we have to make our own system up for the second time? Surely a common form, compulsory, within the national curriculum would even up the playing field and make the recording more relevant for national purposes."

Secondary Modern, GM

49. A number of major curriculum development projects are underway like those of the Technology Enhancement Programme, Nuffield and the Royal College of Arts/DATA. Table 17 shows that at the time of the survey they had helped about one in twenty of the schools. Over 90 per cent of the schools, however, said they had had to develop their own materials in house. When looking to the future, Table 18 shows, over a quarter were hoping to draw on the support of curriculum development projects.

50. Where the school had experienced the Technology Enhancement Programme or used the DATA resource pack, as Box O shows, there was often favourable comment. The lack of stability in the curriculum and exams has meant, however, that there has been a lot of catching up to do with regard to text books and curriculum support generally. The examinations are changing dramatically too.

TABLE 17: Course Materials *per cent frequently used*

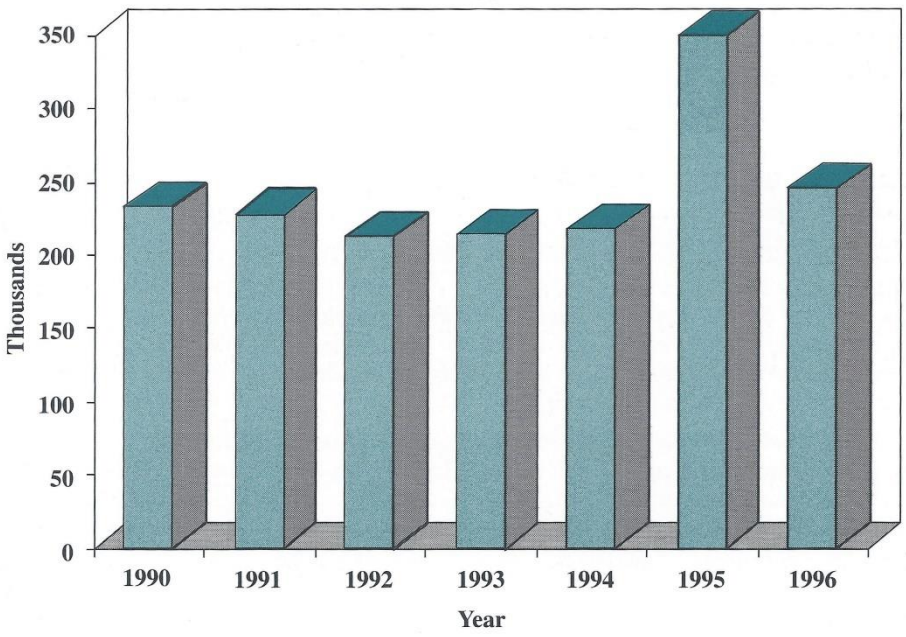
School Type	In-House	LEA Advisory Service	Textbooks	Curriculum Development Projects
Technology	92.1	7.9	44.7	10.5
Comprehensive	93.5	4.7	46.5	5.1
Grammar	82.4	5.9	70.6	17.6
Secondary Modern	85.7	7.1	35.7	7.1
Total	**92.4**	**5.2**	**47.1**	**6.4**

TABLE 18: Anticipated Increased Use of Course Materials *per cent*

School Type	In-House	LEA Advisory Service	Textbooks	Curriculum Development Projects
Technology	7.9	13.2	10.5	39.5
Comprehensive	2.9	3.3	6.5	26.5
Grammar	0.0	0.0	17.6	29.4
Secondary Modern	7.1	0.0	21.4	21.4
Total	**3.5**	**4.1**	**8.1**	**27.9**

51. What is taught at Key Stage 4 is determined as much by examination syllabuses as by the requirements of the national curriculum. As Chart l shows, GCSE technology entries began to take off in 1995 helped by some re-definition of technology to come into line with the national curriculum. In 1996, however, entries fell back as a consequence of suspension of the Key Stage 4 Order and the reversion to pre-national curriculum arrangements shown in Table l (p.l).

Chart 1: GCSE Technology[1] Entries



1. As defined by the Joint Council for the GCSE. From 1995 includes all previous CDT syllabuses and major parts of Home Economics.

52. From 1996 all Year 10 pupils are required to work to the new Order and there will be a major revision of GCSE syllabuses. Out goes the present core and extension structure, itself a recent replacement for the old style courses in CDT and home economics, and in comes 'focus areas'. The new approach is designed to allow for some specialisation in an aspect of technology like resistant materials, systems and control, graphic products, textiles or food, with opportunities for combinations.

TABLE 19: New Courses *per cent*

School Type	Short Courses		GNVQs
	D & T	IT	
Technology (N=38)	13.2	5.3	34.2
Comprehensive (N=275)	13.7	11.1	15.6
Grammar (N=17)	11.8	11.8	5.8
Secondary Modern (N=14)	21.4	14.3	14.3
Total (N=344)	13.9	10.6	17.4

BOX P: Courses and Examinations

"We are experiencing problems in fitting GNVQs into KS4 and with staffing combined courses in D&T blocks. Whole school review of planning is taking place in relation to the whole curriculum at KS4 with the purpose of addressing these issues."

Technology, LEA

"In my role as head of department and examiner for one of the exam groups my experiences would suggest that the fundamental problem that design and technology is experiencing is not down to resourcing, nor lack of time, nor groups that are too large. It is the fact that the courses in their current form are too broad. Thousands of students must have been very distressed with their design and technology exams at GCSE. I fear that this will adversely affect students progressing to A-level and beyond."

Comprehensive, LEA

"GCSE short courses are a disaster creating too many candidates with too few staff to cover the lessons. I have taught six separate GCSE groups this year."

Comprehensive, LEA

"We are a brilliant centre for design and problem solving and would like to deliver all the national curriculum in this way. We fear that this is no longer possible and technology is becoming an academic subject with only one design and make project in the two years at GCSE level – a bad trend."

Comprehensive, LEA

"Time is one of the problems. Until it is stated that technology must have 10 per cent then we will continue to be squeezed by a second or third language. With the revised national curriculum order allocated time for a large number of pupils in years 8 & 9 is only 5 per cent."

Comprehensive, GM

"Much more information about what the exam board requires eg. good marking scheme, would be very useful. Things should improve when the new orders (two attainment targets, etc.) come into force (we hope!)."

Comprehensive, GM

"The choice of Design and Realisation and Food as exam courses has been brought about by a change in teaching staff. My predecessor has been retired through illness. The children have therefore not had sufficient design experience to support the new courses. It is felt that the old style courses will enable them to be more successful."

Secondary Modern, LEA

53. Three kinds of course will be available – full, short and combined – with the full GCSE based on ten per cent of curriculum time. Short courses are generally sub-sets of the equivalent full syllabuses designed for five per cent of the timetable over two years or ten per cent over one year. Combined courses will include design and technology plus business studies, information technology or art. As well as the changes in GCSE, part one general national vocational qualifications equivalent to two GCSEs are being piloted, and some like manufacturing and engineering could be expected to be offered by technology departments.

54. Schools on the whole were cautious about the new developments (Box P). The heads of department were wanting to teach technology as a full subject. Table 18 shows that only about one in seven were thinking of offering the short courses. A number wrote remarks against the question of whether they would such as *"I hope not"*. The main objection appears to be the belief that they would undermine school technology's newly-found status and relegate it to a supporting role. Reactions to introducing GNVQs varied with school type. Over a third of the technology schools were wanting to put them on, but only one grammar school was considering doing so.

Technology in Five Schools

55. Not all schools have insufficient technology resources, nor do those with shortages always lack for the same things. In this chapter we turn from the general issues to look at how technology is operating in five particular schools: a City Technology College, a LEA comprehensive, a GM comprehensive, a TSI School and a Technology College.

56. The City Technology College described in Box Q stands out as a beacon of what is possible. The head of technology found it hard to think of any gaps in provision. *"No we are not lacking in very many things. We've got an adequate resource."* He was keen to point out how much the success of the department was due to the staff not money. *"You can't just throw money at things and expect it to work. The commitment of staff is fundamental."*

57. At the other end of the scale is the school in Box R, a split-site inner city LEA comprehensive. The difficult financial position of the school is compounded by the fact that the head does not like technology. It has borne more than its fair share of cuts losing half its teaching staff, its technician and it is expected to manage on £2,500 a year for 850 pupils. Technology has been so reduced that it is to become part of the art department. It has contracted to what has to be rather than what was hoped for, often working from what's shown in textbooks and cancelling practicals for groups which are too large to be taught safely.

58. The capitation of the GM Comprehensive described in Box S is not much higher than that of the LEA Comprehensive of Box R. Technology in this school does however have the support of the headteacher, a clear sense of where it is going, a full complement of well-qualified and committed teaching staff, and a technician. Its excellent examination results show what can be achieved on limited resources.

59. The LEA Comprehensive in Box T had benefited from a TSI grant of £205,000 which enabled it to refurbish its design and technology block and buy equipment but it is still struggling to find the money for technology. The department has also lost its technician. *"The joke of it is we're getting very little money, we're getting no technician and we say we are a technology school."* The head of department also wonders about other schools. *"The basic equipment we have got now through TSI should be in every school."*

60. The Technology College in Box U is a tribute to entrepreneurism. The school has quickly adapted to the market place and obtaining what funds and support is available. It has good equipment, staffing and technical back up and it has gained from being involved in curriculum development projects like in the Technology Enhancement Programme. It has achieved much but is ambitious for more. *"It is well resourced for a slightly bygone era",* was how the head of department put it.

BOX Q: City Technology College

City Technology College built several years ago on derelict factory land bordering a city centre. A co-educational school for pupils aged 11-19 of all abilities from a defined inner city catchment area. Roll not yet fully established, but 906 pupils in years 7-12.

In this bright modern building design and technology occupies a purpose-built suite providing specialist accommodation for resistant materials (two workshops), control (computer control and pneumatics), a specialist CAD/CAM area, an electronics room with workshop facilities, and two design studios for graphics. There is provision for home economics, with an adjacent catering kitchen equipped to commercial standards, and a studio for working with textiles. These facilities are laid out around an open resource area. A further room is used for post-16 work (at present Year 12 only).

The department has eight full-time teachers (one is shared with art) with broad and complementary skills and from varied backgrounds. Four have industrial experience – a graphic designer, an ex-factory manager, a former mechanical engineer re-trained through the Smallpeice Trust, whose main interest is resistant materials, and an ex-radiographer turned textiles specialist. There is a CAD/CAM specialist with strengths in control and resistant materials, and two food specialists. The head of department has a strong interest in electronics and control, and is one of two staff with a general design and technology teacher-training background.

In addition, the department has four support staff, two full-time and two part-time. Three of the four work as teacher-technicians providing help in the classroom as well as general back-up.

The impressive accommodation and staffing is matched by the equipment and materials. The CAD/CAM area is particularly good and is equipped to industrial standards, mostly through company donations. The head of department found it difficult to identify any gaps in provision. *"No we are not lacking in very many things. We've got an adequate resource."*

The resourcing of design and technology is sustained by a high level of capitation, five or six times higher than the average maintained secondary school. But this budget has to cover site maintenance in addition to spending on consumables. Recent examples include expenditure on electrical work, and improvements to the ventilation and re-painting of one of the workshop floors which had become slippery and dangerous.

The head of department believes that the key to success is not just about resources; it's also about the quality of teaching and learning. *"You can't just throw money at things and you can't just put resources in and expect it to work. Some of the things which have worked here have been down to the team of people. The commitment of staff is fundamental and the teaching resource is a priority."*

He takes a can-do attitude to children's learning *"I think it's a kind of ethos, it's pushing back the barriers and saying, yes, these students can do this. We call it the take-home value. We're aiming at the end of the unit of work that youngsters have produced something they are really proud of. It's faith in what the youngsters can do but you can't just let them out there to have a good time. We provide a structured way through for them – it's called in-built success".*

BOX R: LEA Comprehensive

A split-site, mixed comprehensive school located in the inner city. LEA maintained with approximately 850 pupils aged 11-16 on roll.

Design and technology in this school is beset with poor resourcing, the prospect of further cuts, and lack of interest on the part of the school's senior management. *"The headmistress has made it quite clear she doesn't like technology basically because she doesn't understand it. I feel that in the time she has been here technology has dropped off the cliff-face. If she were staying, I could see technology being non-existent. I don't know what the new head will do. It is a difficult one."*

Staffing is being reduced from four full-time to two, as a consequence of the school's decision not to replace those retiring. This will leave the department with a specialist in construction and resistant materials, and one in graphics/design, but without expertise in electronics and computing. The home economics teacher has left and will not be replaced. Textiles is included in art which is to become a joint faculty with technology. *"Unfortunately since technology is seen as a global thing rather than a specialisation, the head of art says that he can provide courses in technology and as a department we will be under the umbrella of art."* The department has also lost its full-time technician although the art and science departments do have technicians - art has one and science two.

At present, the specialist work areas are duplicated on the split site – one each for electronics, construction and graphics. At the upper school site, the workshops are large enough for the teaching groups of about 15-16 at Key Stage 4, but are inadequate on the lower school site where the rooms are smaller and teaching groups at Key Stage 3 can exceed 25. The problem will be exacerbated when the school moves completely on to the lower site. Staff have taken their union's advice not to do practical work with groups over 20 because of health and safety risks. In practice, it is said management relies on pupil absenteeism to bring the numbers down for practical sessions.

Spending per pupil is about half the national average for capitation. The annual budget is £2,500 and is unlikely to increase. Key Stage 4 will be a major difficulty as it comes on stream, particularly the provision of materials and components. *"The list for these is endless, we're ok for control, and structures is all right. We do have kits – Lego kits, construction kits. As for health and safety, guards for machinery and so forth, that needs a complete overhaul, I haven't got a clue really. I think the whole school needs to be brought up to scratch."*

Technology teaching has become the art of the possible. *"Initially we all set out with the one aim of giving every pupil a decent technology background, visits to firms to show them what's going on basically in the world of technology. Unfortunately it's contracted so much that we're working from textbooks, we're working from whatever's been shown in textbooks."*

The department is battling against the odds, marginalised, underfunded and in a difficult inner city environment. *"Ninety per cent of our pupils come from the catchment area. We take a lot of Section 11 pupils and it's basically anybody who walks past the door can come in. We take a lot of pupils that have been refused by other schools."*

A recent Ofsted inspection report acknowledged these resourcing difficulties and commended the department for its efforts. *"But it was all tainted with 'you're doing well' – 'the department's doing well, the pupils are learning within the constraints that they're allowed', and that's it really – we're working within the constraints basically."*

BOX S: GM Comprehensive

Grant maintained boys' comprehensive school serving the fringes of the inner city. Approximately 860 pupils aged 11-16 on roll.

This former grammar school has a clear view of what technology should be *"solving practical problems by designing and using a range of technologies – mechanisms, electronics, materials, graphics, whatever is needed"*; and how it should be taught. *"You can 't just give pupils a problem and hope that they will come up with a solution without any skills, but if you just give them skills for the sake of skills it becomes boring. So it's a tightrope making sure they have enough skills to do a particular project but enough of an opportunity for their own input. There is a school of thought which says, give them a problem, tell them where the tools and materials are, and after a few weeks they will come back with something acceptable. I'm not convinced. If you structure things, make it clear what it is you want the pupils to do, they will respond with a quality product."*

The department has five full-time teachers and some part-time help. Three of the five, including the head of department have previously worked in industry, in electronics, construction and engineering maintenance. Another has a science/technology background. The fifth has expertise in textiles.

Resources are modest – capitation is somewhat below the secondary school average – but careful thought has been given to managing them effectively. There are four multi-media workshops which have benefited from some refurbishment since they were built in the 1930s. With class sizes topping 22 these workshops are cramped. Two new workshops under construction will reduce the need to use non-specialist accommodation for teaching at both Key Stages 3 and 4. The current accommodation has satisfactory display areas but has insufficient storage and office space for staff. A large cupboard, ingeniously converted, serves as the only office and from it the head of department manages his team.

Although the department has good access to reprographics there is a considerable shortfall in the range of materials and components available to deliver the new Order and similarly with equipment – for example, in control, to allow for whole class teaching. Provision is inadequate also for teaching structures, products and applications.

Unlike nearly half of secondary schools this department is fortunate in having the support of a full-time technician who prepares materials, maintains equipment and tools and develops teaching aids. The technician also operates the stock system - the brainchild of the head of department. A booklet listing materials and components stocked, their size, cost and availability is given to each pupil. This gives them the opportunity to cost their own projects and discourages them from choosing unsuitable items. Each piece is individually computer coded which provides a record for stock control. *"With year groups of over 150 you can't run stock control on an ad hoc basis. Instead with my system when I come to ordering at the end of the year 1 can do a check on the computer to see which things went well. Rather than just guessing what I need for the following year I have accurate information on which to base a decision. I try to get things as organised as possible to get the most out of the money."*

The department has excellent examination results and getting the best out of the available resources is a key factor in its success. The present accommodation is barely adequate, and to do the job properly additions to materials and equipment are required. It does however have a technician, a full complement of well-qualified and committed staff, and a sense of knowing where it is going.

BOX T: TSI School

Mixed comprehensive, LEA maintained. A TSI school located in the inner suburbs but with a wide catchment area stretching to the suburban fringes of a city. Approximately 860 pupils aged 11-16 on roll.

From its participation in the early years of TVEI this school has developed technology as one of its strengths. It bid successfully in 1993 for TSI funding. The grant of £205,000 (which did not allow any new building and precluded expenditure on consumables and curriculum development) was spent on the refurbishment of the existing design and technology block, new furniture and equipment. An IT network was installed with additional computer hard ware. The department has a generous allocation of space and does not have to use non-specialist accommodation. *"We've got three construction rooms and two technology labs. There is an IT/CAD area, another for graphics and two food technology rooms (textiles is separate in the art department)."* There is some concern about the size of teaching groups for practical work and health and safety issues, especially at Key Stage 3 with groups of over 22.

TSI funding has meant the department is okay for furniture and equipment (other than for structures – strain gauges etc). The main problem is the lack of money for consumables which has been compounded by a savage cut in the school's budget. *"The head's got incredible difficulties with the budget and he was talking about no capitation at one stage. The school's having to lose staff this year just to balance the books again."*

Capitation is less than £2.00 per pupil. With plastic for vacuum forming priced at £1.00 per sheet, the shortfall in funding for materials and components can only be met by outside donations. *"We've got a fair amount of wood that comes in from two sources – both from parents who own their own firms and they are very generous in their off-cuts. We have a selection of metal saved from years gone by but the range is limited. Our stock of plastics is really low but I can't afford to replace it."*

By some clever juggling between full and part-time staff and the contribution from a student teacher, the department has managed to retain its staffing level - the equivalent of eight full-timers. With these arrangements there are the staff in place to teach the curriculum and in the specialities required - these include a physics graduate for systems and control, an electrical/electronics specialist, two teachers for construction/resistant materials, one of whom is from an industrial background, a home economist and a food technologist. The graphics teacher is shared with art, as is the textiles specialist.

But it has lost its technician. *"We had a full-time technician until the end of last summer. He was an ex-engineer so he was 'metal', but he was very good with all sorts of materials. He did some electronics as well, plus odd jobs round the school for other departments. The joke of it is we're getting very little money, we're getting no technician and we say we are a technology school."*

There is adequate display space and an office for staff. As in most schools, the main problem is storage. This has been solved by the use of a 40 foot walk-in metal container parked immediately outside. The head of department is generally pleased with the way things are going in his school but is concerned about the future of technology. *"I had a second-in-department here who's now at another school, and he's so frustrated because he knows what he wants to do, but the money's not there. The government has created TSI schools and Technology Colleges, but is that really so they can say 'they're succeeding, they're doing it well, everyone should do this'. It's not very fair on the others. The basic equipment we have got now through TSI should be in every school."*

BOX U: Technology College

Grant maintained, mixed comprehensive set in a rural area on the edge of a medium sized town. Awarded Technology College status in 1995. Approximately 1020 pupils aged 11-18 on roll, of which 155 are in the sixth form.

This is a strong department with effective leadership and committed staff. It is also relatively well resourced. Technology College status will enhance its provision still further. Even before achieving specialist status, the department has sought and gained support from industry and other organisations like the local Training and Enterprise Council and Science and Technology Regional Organisation.

Design and technology's share of the successful technology college bid will mean an extra £150,000 of capital funding or the equivalent in equipment from the industrial sponsors. This money will be spent in several areas, for more advanced CAD/CAM machinery, software and peripherals to support industrial standard equipment, for refurbishing food technology, new furniture and re-equipping with stainless steel commercial catering equipment. The embroidery facilities will be computerised also. The technology lab will be upgraded and the two workshops will have new voltage provisions and improvements to pneumatics. The aim is to develop electronics throughout the workshops and not just confine it to a specialist area. A graphics studio is planned also.

A Young Engineers Club has recently been launched (part of the Royal Academy of Engineering's Engineering Education Scheme) and there is active participation in the Engineering Council's Neighbourhood Engineers' Scheme. Pupils from Years 12 and l3 have gained national and regional honours in the Young Engineer of Britain awards. The department was in the first batch of schools to participate in the Technology Enhancement Programme and the Mechanics in Action Programme.

This wide programme of activity is co-ordinated and carried through by a full-time teaching staff of five, a part-time teacher and two technicians, one full-time, one part-time. The teaching staff have specialist skills in electronics, product design and graphics, textiles and food technology as well as a more traditional CDT background. The department is fortunate in its technical support, which includes the two technicians working with pupils and teachers during lesson time.

On the face of it, the department would appear to be well off. Capitation is around the national average. The head of department would argue that *"it is well-resourced for a slightly bygone era and there is an ongoing need to update the equipment and facilities"*. There are other shortcomings, work areas are too small for teaching groups of more than 18, but most are 20-22, the "storage is horrendous" and there is very limited office space for staff. *"We have an office which is a converted pantry with no windows. We built it ourselves and call it the pigeon loft. It's just an upper floor area where we used to store timber. It's a space but the heat rises and it gets extremely hot. We don't have any general office space."*

In return for Technology College funding the department will be offering a wide range of qualifications including advanced GNVQs in catering and manufacturing, the Tech Bac and new A and AS examinations in electronics.

In comparison with many other secondary schools the department is well provided for. Much of this is due to enterprising staff who have managed to tap into opportunities as they have come up.

61. Schools vary greatly in their capacity to teach technology. Politicians of both main parties tend to accept this as welcome diversity. It is certainly encouraging to see what can be achieved in schools like those of Boxes Q and U. But in Schools S and T, although they differ in accommodation and equipment, mainly due to the latter being successful in a TSI bid, the limited amount available for running costs means that the materials and components are not always there to deliver the curriculum as the schools would like. School R shows what diversity can mean in practice - technology so poorly provided for that it has been absorbed into art.

62. Although the schools do vary, the clear message of our survey is that schools generally do not have enough money to teach technology as the national curriculum lays down.

Resourcing the New Order

63. Technology is a resource intensive subject which our survey suggests is not being funded adequately. The allocation for running costs in nearly 90 per cent of our ten per cent representative sample of secondary schools in England and Wales was below the level considered by the Design and Technology Association to be reasonable. Over 70 per cent of schools reported accommodation problems and nearly two-thirds that they were inadequately equipped to deliver Key Stage 4 of the new technology curriculum. This is not the case of 'they would say that wouldn't they'; by any standards, these are serious problems.

64. The average technology capitation allowance in 1994-95 was £5.86 per pupil. The range was staggering - 40p to £21.10 - compared with the £9.30 recommended by DATA. In 1995-96, 39.2 per cent of technology departments were anticipating less than in 1994-95 (due in part to the difficulties of funding the teachers' pay settlement), while DATA's estimate of the amount required rose to £9.60. Technology teachers were often reduced to using scrap materials.

65. The average technology group size at Key Stage 3 was 21.1 and at Key Stage 4, 20.2, both above the maximum recommended by the National Association of Advisers and Inspectors in Design and Technology. In some schools average group sizes were touching 30. Many of the workshops were not large enough to cope with such numbers, nor were there enough specialist rooms. Technology in over a fifth of schools was spilling into ordinary classrooms. Accommodation was unsatisfactory in other ways: 71.2 per cent of the technology departments reported little or no space to store pupils' projects, and 62.9 could not provide office space for teachers. Inadequate workshops and support rooms not only put the quality of technology education at risk; they are also a health and safety hazard.

66. Nearly half the schools said they did not have the equipment to teach Key Stage 3 of the national curriculum properly and this rose to nearly two-thirds for Key Stage 4. Three-quarters identified the main priority as 'systems and control', but there were also needs in 'materials and components', 'health and safety', 'products and applications', 'structures' and other areas. Conversely, nearly half the schools had equipment they could not use either because it was out of date, or because they could not maintain it, or because the staff were not trained to use it. Funding for depreciation is a massive problem and increasingly schools are entering into leasing agreements to protect themselves from the unforeseen consequences of breakdown.

67. Staff time also emerged as a major issue. Some schools put it even above money as limiting the success of the new curriculum. *"We never seem to have the time to plan and think about the work while maintaining current courses. Time is our scarcest resource." "The most essential element is time. Every member (full-time) works the whole day plus many hours after school."* The present survey also underlined the concerns of Technology Teachers about finding and training the teachers. Three-quarters of the technology departments wanted more

opportunities for in-service training. *"INSET is used for school needs not staff needs."*

68. There is also a dearth of technician support. Nearly half the schools, 45.1 per cent, did not have the equivalent of a full-time technician, including 10.2 per cent with no technician at all. Whereas it is generally accepted that science departments must have technicians, technology, even more a practical subject, often seems to miss out. Without adequate back-up the teachers themselves become diverted to technician tasks, or even worse the practical work is reduced.

69. There were important differences between schools. The grammar schools, often in older premises and without a tradition of applied education, had particular difficulties with accommodation and staffing. This was especially true of the single-sex schools where the girls' lacked workshops and the boys' kitchens. The facilities in the secondary moderns were also often out of date. The comprehensives varied according to their background and local authority, and included some of the worst and best resourced.

70. Not all schools were under-provided. Our survey, supported by the case studies, shows what can be achieved in some cases. Where there is good or adequate funding it is usually because schools have benefited under government schemes of one kind or another. In part, these are intended to show what can be done and point the way to others. But selective funding does not square with the stated aim of good technology for all. Instead of being able to learn by example, the great majority of schools not receiving special support are more likely, as we saw from their comments, to feel left out and cheated. Even some of the departments whose accommodation and equipment had been upgraded were not receiving sufficient capitation.

71. Many technology departments do not have enough money to run properly. No matter how good the curriculum - and there have been difficulties enough with that – if teachers have to spend their time picking over skips for materials, if they have to use ordinary classrooms instead of workshops, if there are too many pupils to work safely, if necessary equipment is not there, it will not result in good technology.

72. Moreover, the full pressure is only just being felt. The first Technology Order was planned to be phased in from 1990, applying to Key Stage 4 from 1993. However in the light of Sir Ron Dearing's review that Order was suspended and some schools have continued to leave technology at Key Stage 4 optional. The new Order which makes it compulsory did not take effect till September 1996 in preparation for exams in 1998.

73. The extent of the difficulties facing school technology when it becomes a requirement at Key Stage 4 has prompted headteachers to go public through their National Association[15]. The heads warn of *"the lack of qualified teachers, of suitable rooms and of equipment"*. They suggest that for 1996/97 at least many schools will not be able to comply.

74. If that is not to become the regular state of affairs, we urgently need a national strategy, and individual school management strategies, to provide the resources to enable technology to be taught as part of the national curriculum for all pupils.

75. It would take perhaps a £1 billion[16] of public money to bring all schools up to the standard of accommodation and equipment in Technology Colleges. It is recognised that there is no pot of gold and all schools cannot be refurbished for technology overnight. But it could be accomplished by a rolling programme over perhaps a ten-year period. Already ten per cent of schools have been upgraded.

- ***The government should be asked to fund a rolling programme over, say, a ten-year period to make good the shortcomings in capital investment in accommodation and equipment identified in this report.***

76. Capitation allocations are very variable. But to raise the average from where it is now to the level recommended by the Design and Technology Association would require only about £10 million per year[17] compared with the £50 million per year the 15 City Technology Colleges are receiving for recurrent costs[18]. While, however, the government can vote the money, it is eventually a matter for governors and headteachers how much reaches technology departments.

- ***The government should find the relatively modest extra £10 million per year to meet the day-to-day running costs of school technology.***
- ***Governors and headteachers should address the variability of technology capitation allowances and compare their school with others and the national average, and the level recommended by the Design and Technology Association.***

77. The quality of technology in schools depends ultimately on the quality of the teaching. This was discussed fully in *Technology Teachers* and the new evidence underlines the concerns expressed there.

- ***The government should earmark funds for the recruitment of technology teachers and their training, both initial and inservice.***

78. But teachers to be effective must have back-up. Current technician provision is very variable and often inadequate.

- ***Governors and headteachers should act to ensure that the good technician support which is essential for the successful implementation of school technology is provided.***

79. The funding of technology should not, however, be a matter just for the public purse. It is the application of knowledge, skills and understanding to designing and making products. A test of its relevance and importance as a subject is the willingness of business and industry to provide support. We have already seen a healthy growth of school-business co-operation in establishing Technology Colleges, and in help with equipment, materials, visiting speakers and curriculum development.

- ***The senior management of schools should actively seek support from their community, including business and industry, Education-Business Partnerships, Training and Enterprise Councils, and from national programmes such as the Technology Enhancement Programme, Nuffield and the Royal College of Arts.***

80. Nevertheless, it is for the government to take the lead. If it is serious about technology for all then it must find ways of funding it adequately. As one of the schools in our sample said, *"The lack of funding defeats the actual purpose of the subject."* We need a national campaign.

- ***The Engineering Profession, together with organisations like DATA, TEP Nuffield and RCA, should lobby for the proper resourcing of school technology.***

Technology in schools, learning how to put to use the discoveries we have made about the world, is too important to the future of the country, educational opportunity, and the quality of all our lives to be left to founder through lack of funding.

Appendix: Sample and Methods

A.1 A one in ten quota sample was arrived at by sending a questionnaire to heads of technology departments in a random one in five sample of maintained secondary schools listed in the *Education Year Book, 1995*. In constructing the quota the organising variables were school type, regional distribution and sex of school. Within these parameters inclusion of schools in the final sample was random. The success in achieving the quotas can be seen in Tables A1, A2 and A3.

TABLE A1: School Type

School Type	Sample		England and Wales[2]	
	N	%	N	%
Comprehensive to 16	140	40.7	1,388	40.3
Comprehensive to 18	169	49.1	1,707	49.6
Grammar	18	5.2	153	4.4
Secondary Modern	14	4.1	142	4.1
Other[1]	3	0.9	50	1.5
Total	**344**	**100.0**	**3,440**	**100.0**

1. Technical and bilateral schools.
2. From *Statistics of Education, Schools in England 1994*, HMSO and *Statistics of Education in Wales: Schools, No 3 1995*, Welsh Office.

TABLE A2: Regional Distribution

Region	Sample		England and Wales[1]	
	N	%	N	%
East Anglia	17	4.9	133	3.9
East Midland	32	9.3	308	9.0
Greater London	41	11.9	403	11.7
North	18	5.2	211	6.1
North West	46	13.4	451	13.1
South East	71	20.6	694	20.2
South West	34	9.9	304	8.8
West Midlands	39	11.3	383	11.1
Wales	20	5.8	227	6.6
Yorkshire & Humberside	26	7.6	326	9.5
Total	**344**	**100.0**	**3,440**	**100.0**

1. From *Statistics of Education, Schools in England 1994*, HMSO and *Statistics of Education and Training in Wales: Schools, No 2 1995*. Welsh Office.

TABLE A3: Single Sex or Co-educational

School Type	Sample		England and Wales[1]	
	N	%	N	%
Boys' only	21	6.1	204	5.9
Girls' only	23	6.7	236	6.9
Co-educational	300	87.2	3,000	87.2
Total	**344**	**100.0**	**3,440**	**100.0**

1. From *Statistics of Education, Schools in England 1994*, HMSO and *Statistics of Education and Training in Wales: Schools, No 3 1995*, Welsh Office.

A.2 The representativeness of the sample in terms of the size of the intake can be seen in Table A4. There is a slight over-emphasis on large schools. One hundred and ninety of the schools in the sample had sixth forms, 55.2 per cent, compared with 56.9 per cent for England and Wales as a whole (1,959 out of 3,440).

TABLE A4: Size of Intake

Number of Pupils	Sample		England and Wales[1]	
	N	%	N	%
500 or less	28	8.1	337	9.8
501 – 800	113	32.8	1,219	35.4
801 – 1000	76	22.1	822	23.9
1001 – 1200	70	20.3	617	17.9
1201 – 2000	57	16.6	441	12.8
2000 or more	0	0.0	4	0.1
Total	**344**	**100.0**	**3,440**	**100.0**

1. From *Statistics of Education, Schools in England 1994*, HMSO and *Statistics of Education and Training in Wales: Schools, No 3 1995*, Welsh Office.

TABLE A5: LEA and Grant Maintained *number*

School Type	Technology College	Technology Schools Initiative	Compre -hensive	Grammar	Secondary Modern	Total
LEA	2	23	235	8	11	279
Grant Maintained	7	6	40	9	3	65
Total	**9**	**29**	**275**	**17**	**14**	**344**

A.3 Twenty-nine of the schools (8.4%) had participated in the Technology Schools Initiative and nine (2.6%) had achieved Technology College status compared with 249 (7.2%) and 67 (1.9%) respectively of schools overall. Similarly 65 (18.9%) were grant maintained compared with the national figure of 18.4 per cent at the time. The composition of the sample in terms of TSI schools, Technology Colleges and the others cross-tabulated with grant maintained status is shown in Table A5. Unfortunately the statistics to test the representativeness of the sample in these terms are not available in the public domain.

A.4 The head-of-department questionnaire (copy available on request from the authors) was kept as brief as possible. It covered basic school details such as school type, age range, sex of school and number of pupils; and departmental details like income, staffing, technician support, accommodation, furniture, equipment, consumables, curriculum materials and examination courses offered. Heads of department were also asked what constituted technology in the school and which Order they were currently working to.

A.5 At the end of the questionnaire there was space for further comment led into by the invitation, "*We would welcome any comments you might like to add about the adequacy of the resources you have available to deliver the national curriculum"*. Over two-thirds of respondents, 235, an unusually high proportion, took the opportunity, spread evenly across the school types. The comments, nearly all highlighting problems, provide the detail behind the numerical patterns and have been used extensively to illustrate the chapters.

A.6 The questionnaire was assembled through interviews with heads of technology departments in ten schools during May 1995, five of whom were selected later as case studies. With minor modifications the questionnaires went out to schools in June 1995 and were completed and returned within two to three weeks by mid-July 1995.

Notes

1. Smithers, A. and Robinson, P. *Technology in the National Curriculum* (1992), *Technology at A-Level* (1992), and *Technology Teachers* (1994), London: The Engineering Council.
2. Her Majesty's Inspectorate (1992). *Technology – Key Stages 1, 2 and 3: A Report by HMI on the First Year 1990-91*; Smithers, A. and Robinson, P. (1992). *Technology in the National Curriculum*. London: The Engineering Council; National Curriculum Council (1992). *National Curriculum Technology: The Case for Revising the Order*. Advice to the Secretary of State for Education, May 1992, York: NCC.
3. Ofsted (1992). *Technology for Ages 5 to 16*. Proposals to the Secretaries of State for Education and Wales, December 1992. London: DFE.
4. National Curriculum Council (1993). *Technology Programmes of Study and Attainment Targets: Recommendations of the National Curriculum Council*. September 1993. York: NCC.
5. *The National Curriculum, England*. January 1995. London: HMSO.
6. See also Chart 2, page 8, *Technology Teachers* (ref. l).
7. *The City Technology Colleges Trust: Who We Are, What We Do, Where We Are* (1995). London: CTCT.
8. Ofsted (1994). *The Technology Schools Initiative 1992-93*. London: HMSO.
9. *Technology College Applications: A Guide for Schools* (1995). London: DFE. Also *DFE News* 289/93, 50/94, 186/94, 246/94, 15/95, 130/95, 163/95.
10. Design and Technology Association (1996). *A Survey of Capitation Allowances, Resources and Inset Needs for Design and Technology in Primary and Secondary Schools in 1994/95*. Wellesbourne, Warwickshire: DATA.
11. See also DATA (1995), para. 3.3.3 (ref. 10).
12. Capitation for Years 7 to 11 was divided by pupils on roll up to age 16.
13. DATA (1995), Para. 3.2.2 (ref. 10).
14. Ofsted (1995). *Design and Technology. A Review of Inspection Findings 1993/94*. London: HMSO.
15. National Association of Headteachers (1996). *Key Stage 4 Technology Requirements Cannot be Met NAHT Tells Secretary of State*. Haywards Heath: NAHT.
16. Estimated from the 3,050 non-technology schools receiving, on average, a capital injection of £330,000.
17. Calculated from difference between recommended and actual capitation multiplied by 11-16 pupils on roll grossed up from sample, ie £ (9.30 - 5.86) X 284,282 x 10 = £9.8 million. On DATA's estimate of £9.60 for 1995-96 this rises to £106 million.
18. DFEE/Ofsted (1995). *Departmental Report. The Governments Expenditure Plans 1995-96 to 1997-98*. Cm 2810. London: HMSO.

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