A Survey of CDT in Secondary Schools in a County Borough

Her Majesty's Inspectorate*

* *We reprint, with permission this recent detailed study of CDT in a northern county borough. It is a striking example of the sensitive, detailed and frank style of HMI reporting now being published. Normally reports are specific to a school, here exceptionally a subject area is the focus of attention. We believe all CDT teachers will find the document of exceptional interest.*

Scope and Purpose

1.1 This report on craft, design and technology (CDT) in 13 schools and two sixth form colleges in a county borough is based on a survey undertaken in the summer and autumn terms of 1984. It is one of a number of survey reports, arising from the inspection of educational provision in a county borough, designed to contribute towards an overall report on that authority. This particular report should be read and considered in that context, although it is intended that it should make a contribution in its own right. The 15 establishments visited, details of which are given in Annex 1, were chosen for a variety of reasons: age range of institutions, their size (numbers on roll varied from 320 to 1170 pupils), their geographical location, their social and economic backgrounds and their accommodation. Of the institutions visited, four are 10-13 middle schools, seven are 11-16 secondary schools, one is a 13-18 upper school, one an 11-18 school and two are 16-19 sixth form colleges.

1.2 Two schools and one sixth form college were subject to full inspections, others received shorter visits of varying duration. All the schools provided helpful information on matters of accommodation, finance, resources, organisation, planning, staffing and staff development. It was therefore possible to spend most of the inspection period observing pupils from the full range of ability at work in workshops/classrooms and focusing on the key issues of provision and response.

2 Accommodation

2.1 The majority of the workshop provision in schools and in both sixth form colleges was built or remodelled in the 1970s and in most instances it is well designed and spacious, reflecting the craft/technical bias of that decade; however, a minority of schools do have small and cramped facilities. In three schools, improvements and remodelling programmes are either underway or planned in order to provide more appropriate CDT workshop environments. In a small number, the fabric is in a poor state of repair and redecoration is overdue. A number of display areas have been created and are well used. In the majority of cases, however, pupils' work is not displayed and much of the accommodation, although well cared for, is visually uninspiring.

2.2 In half the schools the facilities have been designed and constructed to provide for CDT, art and home economics in a faculty form of organisation. With the exception of the much smaller 10-13 middle schools, however, only a few faculties have developed a common philosophy which allows CDT to benefit from being part of a federation of subjects. In the 10-13 middle schools, and four of the secondary schools, multi-purpose rooms have been developed for handling more than one material. In the remaining schools the rooms are equipped for either woodwork or metalwork or technical drawing. In some schools the scattered nature of the workshop and drawing office accommodation, causes difficulties for both staff and pupils. Where this is coupled with an absence of facilities for teaching technology, as in three quarters of the schools, the successful operation of a design approach is inhibited.

2.3 Health and safety issues, with two exceptions, are given high priority At one school the timber racking arrangement is unstable and this prevents the operation of a circular saw. At another school, heat treatment has been curtailed because there is no provision for the efficient extraction of fumes. The storerooms in three schools are adequate but unsatisfactory in two others. In another school, the store is used as an alternative access to workshops and this is less than satisfactory.

3 Equipment and Resources

3.1 In almost all the establishments the workshops are well equipped with machines and handtools. Furniture is usually appropriate to the range of work undertaken.

3.2 Two schools have benefitted from funding provided through the Technical and Vocational Education Initiative (TVEI). One school has been equipped with custom-built technology equipment, and the other has purchased electronics and pneumatics equipment. The general provision for technology in the other establishments is, however, insufficient. Wide variations exist in capitation allowances, even in schools of a similar size. The subject in a middle school of 500 pupils receives the same allowance as that in a 16-19 college of 820 students. Across the schools, the sums allocated to CDT range from £300 to £2,300 and percentage of the total capitation show variations from 3.7% to 9.4%, the latter comparing favourably with the national average of approximately 8%.

3.3 Significant variations in material stocks exist. In one school there is no noticeable lack of consumable materials even though the capitation allowance is not over generous; at two other schools stocks of materials are inadequate and there is little evidence of the necessary provision of components to support the needs of a technological syllabus. While the acquisition of usable scrap materials provides some amelioration of the shortages, in some instances, these are not appropriate to the work undertaken and valuable teaching or preparation time is spent in negotiation for and collection of such material. In a majority of schools, there is a shortage of modern textbooks of appropriate quality. The provision of reference books, stimulus material, magazines and journals in CDT departments is very limited. Such deficiencies, however, are not evident in a number of schools which have been provided with or have created effective CDT resource areas of their own.

3.4 Most schools indicate that the regular maintenance of machines and equipment by the local education authoriity (LEA) is a vital asset. Not all schools have a CDT technician. In those which have, it is apparent that teaching staff are able to devote more time to planning and preparation.

4 Curricular Planning

4.1 Significant variations in curriculum design and/or philosophy are to be seen in the four middle schools. At one school there are no schemes of work indicating the objectives and methodologies of CDT and the workshop experience which pupils receive in this school is haphazard. Of the other three schools one has full and recently updated schemes of work and two have written descriptions of the CDT curriculum with a clear commitment to new ideas. There was, however, little real co-ordination or progression in CDT through the four years in each of the four middle schools visited. In general the work of the pupils consisted of individual practical projects and these had little connection with preceding or succeeding experiences.

4.2 In the majority of the 11-16, 11-18 and 13-18 schools, the schemes of work reflect an emphasis on tool and machine skills with limited opportunities for pupils to become involved in product design. In some schools there is no evidence of a CDT curriculum policy for 11-13 year old pupils, and examination objectives are interpreted narrowly in Years 4 and 5. There is often an emphasis on technical drawing and this diverts both curriculum policy and the use of facilities away from practical problem solving. One school has a clear commitment to CDT throughout all five years culminating in the use of an appropriate examination at the end of the course. Another school has successfully introduced examinations with a technological bias.

4.3 Schemes of work in the 16-19 establishments and the two other schools with a sixth form lack detail. In one school, the work has a design dimension and is enhanced by the introduction of some simple electronics and control systems. In another sixth form, the scheme of work makes no reference to teaching method or course assessment. In order to enrich and support the sixth form CDT curriculum the schools and sixth form colleges might profitably plan a programme of shared teaching activities which would extend and broaden the courses which are currently provided.

5 Academic Organisation

5.1 In each of the four middle schools different forms of organisation operate but all are based on a rotational principle. Typically, pupils experience art, CDT and home economics in turn. In every case CDT is taught in mixed ability groups.

5.2 In the majority of secondary schools visited, rotational courses of art, home economics, and CDT in varying time modules are in operation during the first three years. In one 11-18 school, pupils make a choice between CDT and home economics on arrival. This results in few boys choosing home economics and even fewer girls choosing CDT. One school which had previously segregated boys crafts from girls crafts introduced mixed classes for the first time in 1984. There is no common pattern of ability grouping for CDT in the secondary schools visited.

5.3 No school has CDT as a compulsory activity for all pupils beyond Year 3. Instead the subject takes its place in the option system in Years 4 and 5. In one school the option pattern prevents the top two ability groups from taking CDT. All schools provide option booklets for pupils and parents but they frequently consist of an examination syllabus with little additional descriptive information to help in the making of choices. Examination targets usually consist of Certificate of Secondary Education (CSE) or General Certificate of Education (GCE) O level courses in woodwork, engineering drawing and engineering workshop theory and practice. A few schools are starting to introduce the new GCE O level and 16+ design and technology syllabuses and one school provides a CSE motor vehicle maintenance course. In a number of cases, mixed ability groups, on lower and upper school courses, are given work which is insufficiently differentiated to cater for individual needs and abilities.

5.4 Both sixth form colleges offer students GCE A levels in design and in geometrical and engineering drawing. The latter examination course is gradually being phased out. At one of the sixth form colleges, students are seeking to obtain GCE O level Design in one year. This appears to be an unrealistic aim since candidates have had little previous experience of practical design activities.

6 Staffing, Staff Development and Support

6.1 All the institutions visited were staffed with adequate numbers of teachers to run the courses offered. All the middle schools have been able to recruit teachers with techical qualifications and in consequence no non specialist teaching was seen. With a few exceptions the teachers in all the establishments were specifically trained for teaching woodwork, metalwork and technical drawing. Many are now attempting to teach CDT without the necessary philosphical understanding, essential training in new skills and professional strategies and, in some cases, confidence in their own ability to teach the newer syllabuses. Head teachers and senior staff in the majority of schools are keen to introduce the newer design and technology courses and hope that staff will acquire the essential skills. It is, however, difficult to stimulate interest or expertise in technologically focused work. Many teachers are unsure of the demands that might be made on them to teach either control or modular technology and a number of one year trained teachers consider that they are ill-prepared for the tasks before them.

6.2 In the majority of schools frequent departmental meetings are held, usually to discuss organisational issues and to ensure that courses are evaluated effectively and regularly. Few departments have considered the changing nature of the CDT curriculum over the last few years, the need to change from handicraft to CDT courses or the in-service training required. While the majority of CDT departments regard staff development activities as important, only a small group of teachers have been involved as lecturers or students in the in-service programme of the local subject teachers' organisation. An even smaller number have attended Department of Education and Science regional and national courses. Without exception, all the schools visited, pointed to the lack of LEA specialist CDT advisory support and the consequent low incidence of CDT in-service courses.

7 The Learning Experience

7.1 Some schools were visited for short periods and it was not always possible to see the work of all age groups in equal range or depth. For this reason what follows, deals with general trends and standards across three age bands and uses examples of actual work seen as illustration.

Pupils aged 11-13 years

7.2 The response of pupils aged 11-13 was considered to be acceptable or better in half the lessons observed, the other half being judged to be less than satisfactory. A quarter of all the lessons observed were design-based but frequently pupils' design skills were limited and hindered by an inability to present and communicate ideas. Good work at one middle school included a class designing a simple hand game incorporating a ball-bearing: pupils had chosen one solution from three well thought out design alternatives they had produced; the design brief which had been given to them was sensitively prepared; the pupils were well motivated by it and the standard of practical work was good. At another middle school pupils were solving a problem associated with the building of a tower in folded paper and there was much excitement as different forms of folding gave variations in strength. The response was good. In contrast in an 11-16 school, pupils of the same age were involved in designing and making an egg rack but the simple need to investigate the size and shape of an egg had been overlooked. The best design work was seen at an 11-16 school where pupils were designing, making and testing a child's animated pull-along toy. Most solutions were in wood and demonstrated sound analytical and preparatory work. The class was committed and enthusiastic, the standard of constructional work was high and several pupils were designing for a known child — a most encouraging feature.

7.3 One third of all the lessons observed were in woodwork. In one middle school pupils were engaged in practical activities within an extremely exciting environment which was enhanced by a display of pupils' work featuring different examples of creative and stimulating projects: brightly coloured cleverly designed toys, simple jewellery and well devised kitchen tools. In contrast, a first year group in a 13-18 school were making a pencil box and no opportunities had been provided for designing or decision-making because the drawing on the blackboard gave all the necessary information. A number of less academically gifted pupils were side-stepping measurement skills by placing their work alongside the work of a successful pupil and marking out from it. Standards of craftsmanship were capable of improvement and the room was devoid of examples of good workmanship that might excite or inform pupils.

7.4 Just over a quarter of all the lessons centred on metalwork activities and at best these were impressive. A class of boys in a 13-18 school were designing and making a bookshelf support. The project had been carefully and successfully devised to compensate for the different level of skills which pupils exhibited on entry from five middle schools. Standards of craftsmanship were generally good and demonstrations were brief and lucid. Every opportunity was taken to ensure that each pupil understood what to do and how to achieve a good result. In contrast a group of boys in an 11-16 school were making a small mild steel hammer with a mild steel shaft or a screw driver with an aluminium handle using photocopied drawings. Most of the pupils seemed bored with the task and were unaware that the hammer and the screw driver would be of little use because of the construction and the materials which were used.

7.5 A fifth of the lessons seen were technical drawing and most provided a narrow experience with content lacking application to practical problems. One lesson was typical of many seen: pupils aged 13 in an 11-18 school were asked to draw orthographic views of a simple block with a hole in it. This was followed with another task which provided a similar experience. One able pupil demonstrated how to sketch the correct answer before any teaching began. In a 13-18 upper school, however, where the tasks were design-related some of the free-hand sketching related to the nature and purpose of a book support, set as a design communication homework exercise, was excellent. In under a third of the lessons seen, however, pupils were engaged in copying activities particularly in technical drawing lessons.

7.6 Pupils responded enthusiastically to their work in a quarter of the lessons seen within this age group.

Pupils aged 14-16 years

7.7 Lessons were seen in design, woodwork, technical drawing, technology, metalwork, motor vehicle studies and plastics. The response of pupils aged 14-16 was described as satisfactory or better in two thirds of the lessons seen but unsatisfactory in the remainder. Over a quarter of the lessons were theoretical. Typical of a number of lessons observed was that involving a group of 13 boys and girls in an 11-16 school who were gathered around a woodwork bench for 35 minutes and shown how to cut mortice and tenon, housing and dovetail joints. Few questions were asked, pupils were not actively involved although they remained polite throughout, despite the lack of interest. Few pupils understood when the joints should be used and few considered themselves capable of replicating the work which had been demonstrated. In contrast a group of 13 boys in an 11-16 school were considering the action of a double pole switch as part of their control technology course. The pupils were totally involved, demonstrated good analytical and deductive skills and with the help of sensitive questioning were able to establish a high degree of understanding. Over half the lessons had some form of sketching or drawing as a component. One CDT group was engaged in designing and making storage units and racks for a variety of purposes and their useful range of solutions to problems encountered were well drawn and prepared. At another 11-16 school pupils were making a cutting jig for working on small pieces of timber and good developmental drawings were very much in evidence. Generally, however, there was little evidence of any extension to drawing techniques, particularly in respect of rendering methods, use of templates and guides, introduction of colour and the application of modelling techniques which would have been of benefit to pupils in the process of designing.

7.8 Problem-solving was seen in two fifths of the lessons and at best the work was very good. In one 11-16 school, pupils were completing a GCE O level set project which required the production of a vacuum pump to strict specifications. All the individual solutions were well designed and the quality of construction was high. The pupils were well motivated, competent in the application of design and technoloigcal skills after having benefited from a five year course in designing, making, testing and evaluating. In contrast, a group in another 11-16 school was working on the theme of play. A visit to the local primary school did not appear to have affected the pupils thinking. All had chosen to make a wooden toy but the design discussion which followed the visit failed to focus on the critical questions of purpose, construction, materials and cost. The decisions made were limited and inappropriate. Sketches and methods of presentation were less than satisfactory in quality and not helped by the pupils inability to describe what they hoped to achieve.

7.9 Pupils were engaged individually in one third of the lessons seen but were copying from the blackboard, books or worksheets for a substantial portion of time in almost half of all the lessons. In a third of the lessons the learning objectives achieved were judged to be limited. An example of this was provided by a group of fourth year lower ability pupils producing a paint scraper shaped to fit three types of window frames. All were working to the same restricted basic design, with few modifications. On many other occasions, step-by-step instructional techniques in technical drawing were also seen to inhibit opportunities for solving problems. In a number of technical drawing lessons the content of the course was inappropriate and the pupils, particularly those of lower ability, failed to understand the significance or the relevance of the use of constructions used to produce shapes such as the cycloid. In distinct contrast, a group of 17 fifth form pupils in an 11-16 school were designing and making a door restraint for security purposes. Each had achieved an individual solution which was interesting, practical and novel. Pupils were highly articulate and described their solution with clarity and insight. Such high levels of pupil motivation, with pupils totally engrossed in the learning activity, were only recorded in a fifth of the lessons seen: most frequently in activities which had a design and technological bias.

Students aged 16-19 years

7.10 Students aged 16-19, of whom 80% were boys, were observed in various GCE A level, O level and non examination courses. Although few students' responses were judged very good, three quarters were deemed satisfactory or better. In over half the lessons, students were engaged in problem-solving activities with varying degrees of success. In one 11-18 school an upper sixth form student was making an elementary storage cupboard as his major project. The design was based on a very simple concept and was poorly executed, the quality of work being well below the standard normally expected from a GCE A level candidate. No thought had been given to basic

requirements such as how the back would be fixed, what type of handles would be appropriate and where the hinges might best be placed. The studio in which the work took place lacked stimulus material and there was only limited guidance to indicate the standard required. In contrast, students in a sixth form college following the same examination course were engaged in much more advanced activities. One was involved in a modelling exercise for a micro-computer carrying case, another was making mockups for a loud speaker system, a third was working on a treadle mechanism for use in conjunction with a typewriter and yet another was compiling a demonstration chart illustrating the properties of different plastics. All were working diligently and had given a great deal of thought to their design work. Another GCE A level group in a sixth form college carried out work on cam design and discussed perceptively simple harmonic motion, uniform acceleration and velocity as part of their geometrical and engineering drawing course. No textbooks were used but handouts had been prepared and some wooden models had been used. Work would, however, have benefited considerably had the students been able to see for themselves how various types of cams operated in particular machines. An upper sixth form group in the same college were being taught the difference between stress and strain but some of them were unable to grasp and understand the work through lack of practical examples.

7.11 Only half the lessons were considered to be preparing students appropriately for their examination targets and almost half of the students were engaged in tasks that were deemed to be inappropriate for their age and ability. Lack of systematic teaching of many of the methods which students might use in solving problems meant that course work was not as challenging as it might have been. At one school the student's design proposal necessitated complex dovetail joints to be produced on an 18 inch wide board; the student was, however, still practising simple joints on a piece of timber only 3 inches wide. Students frequently lacked appropriate previous experience and as a result, limited learning objectives were set in a third of the lessons. On a number of occasions, students had been allowed to embark upon A level courses on the basis of inappropriate previous experience. A recreational course at one school failed to provide clear guidance to the activities that might be undertaken and a number of students remained undecided what to make.

7.12 Teaching styles varied substantially within the sample of work seen. One GCE A level group received a lecture for a whole period and were then given a worksheet which summarised the content. This was a follow-up to a previous lesson which had been illustrated with slides. Students sat at desks, in rows, when a less formal atmosphere would have been more appropriate. The students made notes based on oral guidelines, but their contribution to discussion was limited. The teaching styles in only three lessons were illustrative of good CDT practice. In one GCE O level sixth form engineering drawing lesson on loci a helpful demonstration model, made in the school, was used to illustrate various linkages. Drawings completed for homework had been systematically marked, the quality of work was satisfactory and students' folios indicated that previous work had also been competently executed.

7.13 In general, the sixth form work was unstimulating and opportunities for enriching the examination syllabuses were often missed.

8 Some Conclusions

8.1 The accommodation which was built or remodelled in the last decade, consists of workshops traditionally equipped for woodwork or metalwork and this often restricts the realisation of designs to one material. Although such departments are generally well resourced this single subject provision is inhibiting the successful introduction of new CDT courses and approaches. Furniture is relatively new and well maintained. In a number of instances there appears to be a shortage of materials and where useable waste obtained from industry is in common use it is not always appropriate for the tasks which pupils undertake.

8.2 The quality of pupils' work across the LEA showed marked differences. At best it was stimulating, challenging, and relevant, but in too many cases work was dull, inappropriate, and based on a philosophy more suited to technical skills of an earlier age. Where classes were taught in mixed ability groups, there was too often insufficient differentiation in lesson content to meet the needs of individual pupils.

8.3 Behaviour was generally good and pupils applied themselves with enthusiasm when opportunities arose. A number of schools were fortunate in having pupils who reacted positively to unchallenging situations.

8.4 The dedicated but traditionally trained CDT teachers have not had the opportunity to focus their talents with sufficient precision on the changing goals. Initial training for a different perception of craft teaching and a lack of LEA CDT in-service courses or school visiting to see the work of others, has left departments bereft of ideas but conscious of the need to make changes. On occasions, staff are jettisoning traditional courses before adequate replacements have been thought through and tested. There is a need for a team approach both within individual schools and across the LEA to define the nature of CDT, to agree on appropriate aims and objectives, to list priorities and to ensure that effective strategies are devised.

8.5 When resources allow, the leadership of an LEA adviser with special responsibility for this area of the curriculum would help to stimulate, develop and co-ordinate CDT work in the schools.