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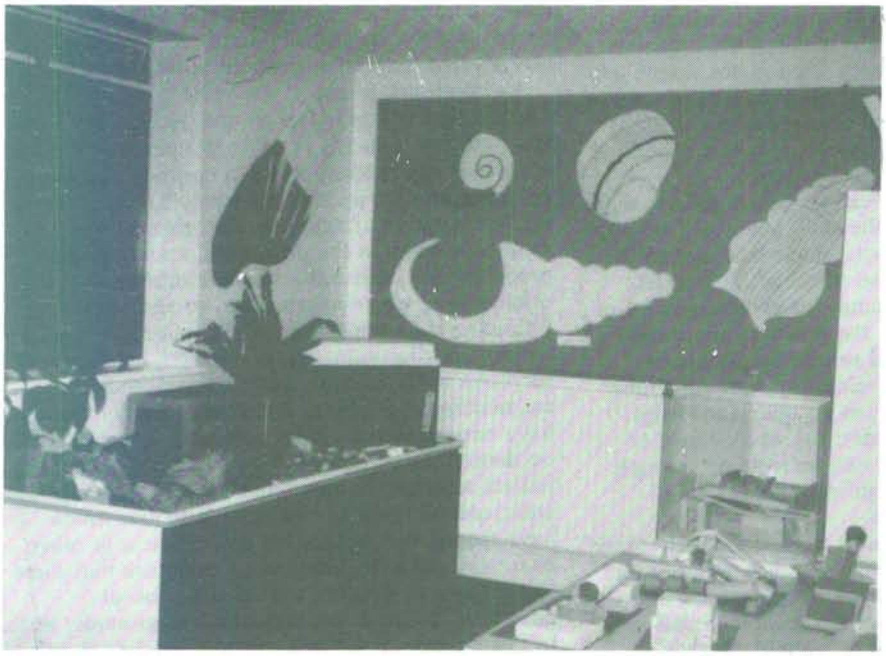
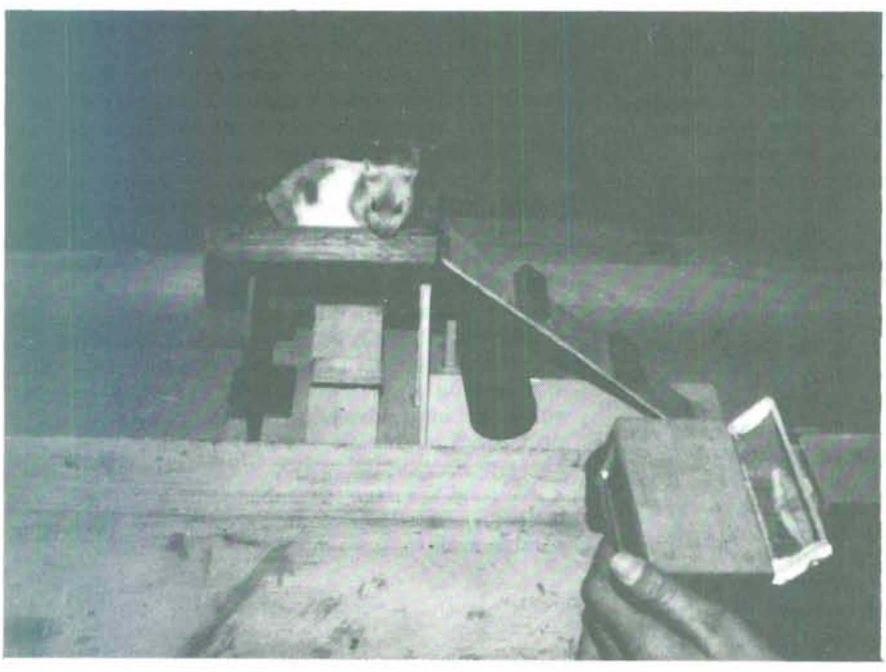
CDT in the Lower Years: A National Debate?

The foundation years, prior to choosing options for examinations, are critical in the development of children. Fundamental to this development is an education which gives sound practice in Craft, Design and Technology (CDT). Practice varies considerably, and so I would like to illustrate the thinking of one middle school to show how design work can be extended at the upper primary and lower secondary age range. I will then go on to suggest that purposeful activity needs structured guidelines if it is to develop further as a meaningful educational experience.

Below: A Display in one corner of the Design Studio.
Bottom: Eric the hamster on an adventure playground construction, (modelled in sugar paper, firstly).





As Head of a design department, I motivated a team to work in a broad design orientated way an in particular I developed a core CDT course for 9-13 year olds focusing on basic concepts, skills and values.

Longfield C of E Middle School opened in 1981 and after only 2½ years has now established itself as one of Kent's prominent middle schools. At present the school is 5 form entry, co-educational and covers the age range from 9 to 13. It is staffed by a mixture of specialist and general class teachers. As far as the design elements are concerned the children are timetabled in half classes numbering 14 to 17 children per group to study in the purpose-built Design Studio. Physically, the Design Studio has four teaching bays, a central area and a resources room. The Design Studio has 4 specialist teachers responsible for the main areas of work, i.e., CDT, Ceramics and Painting, Food and Textiles and Graphics and Printing.

The children rotate from one teacher to the next every 10 weeks, having 4 'turns' overall per year. Each child comes to the Design Studio for one morning or afternoon per week, with the exception of the first years (i.e. 9 year olds) who come for just over an hour per week and who have 'Art and Craft' with the specialist teachers as well as their own class teacher. Rotation systems and block timetabling are nothing new nor necessarily always successful; however, the advantages to be found in this approach at Longfield are several. Firstly, the mixture of teaching bays and an open area enables children from similar classes to see each other's work, secondly, the rotation system helps the teachers to recognise and reinforce the common links in their design approach, choice of level of work and the development of a common philosophy. As for block time allocation, this enables the teaching staff to command a strong influence on design studies throughout the school and ensures a reasonable block of time for all children, on a yearly basis. 'Blocking' also solves one of the main practical problems associated with the teaching of Arts and Crafts, i.e., the storage of children's on-going work; this is especially helpful to the CDT and Ceramics areas. Blocking, also eases curriculum development and experimentation as children have the opportunity to explore ideas more fully and the teaching staff equally feel free to experiment with different techniques. It also helps in the time allotted for assessment of the varying activities, especially in the subject area Food.

The development of a common philosophy was demonstrated through a common teaching strategy

Below: "Design in Action" – Some re-designed school swimming pool floats to enable the learners to gain more confidence in the water.

and can simply be summarised as a 'design and making' philosophy. It was achieved by working very closely together, constantly reviewing and restating our aims, objectively analyzing curriculum practice, discussing and reasoning through every new development or idea before putting it into practice, but above all being sympathetic towards each other and towards new ideas. What developed was an exciting and rewarding set of curriculum activities which motivated staff as much as children.

What all the staff in the Design Studio found important, rewarding and worthwhile was the quest for a solution to the problem of getting the children to think and participate in their own activities in a far from superficial way. Foremost in the decision making process for the planning of content and method were the words: 'justification', 'communication' and 'design-link'. As professionals we were concerned with promoting a curriculum which developed in sequential and incremental steps, whilst recognising and respecting that each particular discipline has its own particular needs and peculiarities.

Each team member structured a course so that basic concepts, skills and values were built up and reinforced. Much of that reinforcement was achieved by each member of the team knowing what the next was doing, and why, and also by presenting a common design approach; this all helped with justifying and communicating our ideas to the children and other members of the school staff.

It was decided not to work on a common theme or topic such as 'Bicycles' or 'Animals' which might tend to lead to what has been coined the 'Marzipan Bicycle Syndrome' with some crafts extending topics to ridiculous extremes and only stimulating and increasing the creativity of the teachers rather than that of children. Thematic work can be exciting and worthwhile, but it is no substitute for analytical curriculum planning, indeed, it can often be carried out in design based subjects with little or no regard for the knowledge, skills and values being presented as a whole over the period of a foundation course. However, having said that, thematic links at Longfield were often made, discovered and sometimes planned but never forced. It was appreciated that each subject has its own distinctive qualities, none more so than CDT, and so it was decided that more valuable than linking topics was the link in the level of design procedures. This meant approaching problems in a similar way from group to group so reinforcing earlier work and common aspects of preliminary design stages.

An example of the way design links were made and found to be advantageous can be seen in the use of card or sugar paper modelling as a means of analysis and synthesis. Quite often designing, i.e. drawing, is not enough; a model of the final prototype can be of enormous help to pupils and teachers. Before children start work in the final media (be it clay, wood, metal or plastic), decisions about scale, size, form, ergonomics, visual and functional aspects were made, using card or sugar paper as the constructional media. This not only enabled fast, sound, concrete appraisal of the object

Left: Marble projecting machines which use various energy/power sources including those associated with elastic band power, electricity, torsion, bending, stretching, gravity, air and pressure.

Below: Some children from the same class who have just completed the vehicles they have designed and constructed. All vehicles are made using scap materials.

by the pupils but it also enabled the teacher to identify very early the able and less able pupils, this facilitated the teacher to give the appropriate help and stimulation before frustration on the part of the pupil set in.

As well as modelling, preliminary design work varied and covered first hand observations, discussion drawing, examining structures, talks, enquiry, experimentation and writing. For example, children were set the problem to build an adventure playground for the resident Design Studio hamster, but before the actual playground was constructed the children were asked to construct a scaled paper model having previously discussed and assessed the needs of the hamster. Another example illustrates the point further: be ore children started to construct 'The old woman that lived in a shoe' as a ceramic sculpture they would make a card model, having previously drawn shoes and discussed the nature of houses. Initial preliminary concrete experiences help children develop a high quality of 3-dimensional ideas; however, work does not always start from the 2-dimensional and develops towards the 3-dimensional, this can be reversed. With this age range it is more appropriate at times to do a 'technical drawing' after the prototype has been made. It is a mistake to ask children to do too much preparation on every project. It is more worthwhile to involve children with a variety of design procedures and preliminary types of enquiry spread over a variety of projects, which are structured and introduced gradually to keep pupil motivation high.

Below are some examples of design problems used in the CDT area to enable the reader to understand more fully the type of course under discussion. For example:– A 4th year project (i.e. 12 year olds) to design and construct a system/object for helping handicapped children reach a greater distance from a wheel chair. The variety of objects produced ranged from scoops, electrically operated rotating brushes, hydraulic grabs, lever systems, large pincers, lasoos, cranes, and possibly all of these alternatives came from one group. A 3rd year project (i.e. 11 year olds) is to design and make a vehicle which uses hydraulics and/or pneumatics to operate some of the moving parts. The highly motivated child at 11 years of age, with good 3-dimensional design ability (but not necessarily the best reader or mathematician) might produce a hydraulic bulldozer with moving buckets, arms and stabilizers. A 2nd year project (i.e. 10 year olds) is to design and make a land yacht model and test it for efficiency – examining concepts of friction, wind resistance, steering, position and shape of wind catching area. Variations can be made in bearings, sails, masts, counter-weights, wheels and steering mechanisms etc. A 1st year project (i.e. 9 year olds) is to design a boat hull and make it catch wind to sail up the school swimming pool as far and as fast as possible. Each CDT project involved some type of considered movement; for example the hamster moving up, over or through his child-made environment or people using the object or the object reacting to a variety of forces such as electrical, wind, heat, air, gravity, elastic power etc. The technological challenge was increased with the addition of movement in the design problem. Structure was achieved by restricting certain tool

Left: A pneumatic set of drawers designed with a secret compartment by an eleven year old girl.

processes to particular projects and limiting basic raw materials.

One of the department's major strengths laid in its conceptual approach to problem solving; viz, analysis, synthesis and evaluation along with the variety of overlapping departmental procedures. In genral, I would argue that 9-13 middle schools need supportive and structured design experiences which allow freedom but are also carefully graded to make increasing demands on the children; it is also necessary to cater for changing interests and the variety of children's abilities. Design problem solving is just as valid for girls as for boys, the able, ane the less able.

Right: The testing of pneumatic vehicles before final details are added. Below: Testing of land yatchts before final adjustments and evaluation procedures are complete.

The problem of finding a balance between the amount and type of specialist and class-based teaching is a problem which faces all types of middle schools; perhaps the solution is more clear cut in standard junior schools and 11 to 18 comprehensives. There are very few specialist CDT teachers in junior schools, some in 8-12 middle schools, more in 9-13 middle schools and not, as you might expect, always a full allocation in pre-14 years courses in comprehensives. However, due to the practical and intellectual demands covered in this subject area it is important to have scaled specialist posts for CDT development. At Longfield we were very fortunate to have a specialist team and this was undoubtedly one of the factors that contributed to the strength of the department.

It seems to me that for my experience at Longfield to be of value I should offer some guidance – but in what form? Schools vary so much and so does the position of CDT on the curriculum; for what is valued at Longfield may not necessarily be greeted in the same fashion in other schools. However, I have always thought that primary CDT should be regarded with higher status than it is at present. Practical problem solving should and could permeate all areas of the curriculum. Of course, trying to improve the status and increase the amount, type and practice of CDT in the primary foundation age range is no simple task. I am sure many people have been led down blind and frustrating avenues, but no matter how daunting the problem, incremental steps must be taken to move in the right direction towards the right solutions.

Two thoughts spring to mind in my search for guiding principles; the first: 'what ever you do, do it well' and the second 'its not what you do, its the way that you do it'. The first must be accepted with qualifications in relation to the external limitations made upon the situation. Needless to say, stimulus for making improvements must be taken at ground level with the teachers arguing the case with Headteachers for reasonable allocations of resources, time, money, space and staffing. The education of Headteachers in appreciating the value of design-based subjects is paramount; the prime place to start is in the schools.

The second observation 'its now what you do, its the way that you do it' holds as much truth as it does falsehood. Design activities need to be approached in a certain structured manner, encouraging questioning, analysis, synthesis, development and evaluation in cycles, but all too often these can be considered without looking at the selection of knowledge, skills and values. It is not enough to choose a project because of convenience or because the finished product

Knowledge	Skills	Values
Knowledge of materials	Investigative or search and assessment skills	Technical
Knowledge of design procedures	Invention or putting together skills	Moral
Knowledge of structures	Implementation or carrying out skills	Aesthetic
Knowledge of control	Evaluation or summing up skills	Economic
Knowledge of systems		Craftsmanship
Knowledge of visual elements of design including communication and computation		Design
		Production
Knowledge of energy		
Knowledge of manipulation		

looks impressive. We have to combine the development of skills, knowledge and values with the very real necessities of pupil motivation and the restraints of the real world.

Having worked in a middle school has made me very aware of the effects the option system has upon children and made me realise the importance of the foundation years. We must re-assess the foundation years and get them right because for many children, especially girls, it may be the only CDT design based activity they receive in their formal education. A patchy or mismatched experience in first, junior, secondary or middle schools may be their only formal experience. Few comprehensive schools have a core CDT course running for children beyond 13 years of age. The early primary/foundation experience for some will be a foundation for option systems with its large variety of CDT exams (although this may change soon), but for the majority it will be, perhaps the only foundation of life, home, leisure, survival, management, government. Can we therefore risk anything short of professionally formulated, balanced, good quality curriculum practice?

The problem is obvious: how do we prepare to assess what should be good curriculum practice and, perhaps more importantly, balanced curriculum practice. Any proposals must be applicable in assessing existing practice and give positive guidance as to what is needed to redress the balance in differing school environments.

In my search, I was grateful for the DES 'APU Document' and the follow-up document entitled 'CDT a curriculum statement for 11-16+ age group'. These two documents have laid down foundations which invite building upon and refining for younger children. The three area skills, knowledge and values – tabulated separately in these documents, give a distinct framework from which to assess CDT practice and make projections for future developments.

I, too, felt the need for formulating my own analysis of the type of knowledge, skills and values which are worthwhile to any foundation CDT course, and prior to the second document being published set about this task. My break-down, although similar to the DES analysis, is set out above.

More debate is clearly needed on a national level about what should constitute the finer aspects of such a curriculum. If we take knowledge of materials for example, this should involve the knowledge of various aspects and relative qualities such as feel, texture, warmth, pattern etc., as well as an awareness of quantitative factors such as size, weight, shape, area, form etc. Physical characteristics of materials which need not be quantified mathematically, at this stage, can be divided up, for example, into tensile strength or 'resistance to pull', compressive strength or 'resistance to push', toughness or 'ability to resist impacts', and an obvious problem to begin with is to devise an appropriate vocabulary which 'matches' the way young children think.

Another example of what could be part of a 5-13 curriculum for CDT is the development of investigative skills by questioning, discussing, reasoning about the 3 dimensional world. The children will need to plan, write, sketch, record, and observe to enable them to develop the ability to assess relative values of physical and social aspects of design.

In Humanities, historical topics such as 'Castles' could be developed to include the design and construction of working portcullises or series of working seige machines; the teacher should actively extend the children's CDT knowledge, skills and values. He could begin to introduce such vocabulary as trajectory, strain, construction, bonding, accuracy, durability, safety and so on. Using simple and cheap materials such as cotton reels, coat hangers, elastic bands, garden canes and card or kits such as Lego and other technical functions kits, projects could be extended and made more exciting and more worthwhile.

I have argued the need for a balanced and planned approach in primary CDT; it is not enough to say that the junior child should enjoy CDT with 'suck it and see' approaches. It is, of course, essential that the child should learn by experimentation but this should be within a coherent, sequential pattern. It is my contention that a statement is needed for a national set of guidelines to be formulated for this age range, rather similar to the 11-16 document.

We are certainly anxious in Kent, under the auspices of the Teacher's Centre, to begin a public debate on these matters and we warmly invite specialist colleagues to contact:

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