Paul D. Burton
Heathland School

Off to a Good Start– Or How to put the 'T' in C.D.T.

A thematic approach in Design Work and its application towards providing a method of integrating the areas of Craft, Design and Technology as a basis for teaching Third Year pupils in Secondary Education (age ranges 12-14).

Introduction

The pungent smell of machine oil mingled with disinfectant prevails the workshop air. Lathes stand gleaming, a little worse for wear but devoid of swarf and bits of metal. Floors and benches swept clean, tool cupboards, racks full, vacant places replenished with sharpened dividers and scribers. Files, try squares, calipers, all recolour coded with a fresh coat of paint.

Another school year and the beginning of a new term. The noise of Third Years lining-up in the corridor cracks the atmosphere, eager, expectant, demanding bodies rush and jostle. Mixed ability, mixed emotions, mixed sexes, all mixed up in groups of twenty-ones.

Finding a project, topic, problem, need, situation, design brief, whatever we call it that involves a total Craft, Design and Technology concept and experience is difficult. No, you may say, it's easy – just set a design problem such as design and make a small hammer, box, egg-holder, toothbrush rack and so on. Good old standbys, never fails, grabs their interest, teaches skills, functional end product – 'Something to show Mum and Dad'. But ask yourself is it CDT?

Producing a design problem that is stimulating, demanding and relevant to that age group and combines the following:
(a) that encourages the development of each pupils' potential both in cognitive and manipulative skills.
(b) encompasses the whole essence of what CDT is about.

I would suggest that points (a) and (b) are a challenge for many new and even established teachers.

Probably one of the main reasons for this situation occurring is what I call 'The Great Technological Syndrome'.

The 'T' in CDT

Recent developments in CDT have centred around the growing awareness of technological approaches to design work. The DES publication 'Technology in Schools' provides some indication of this along with the perennial reports and working papers of the NCST.

But how many departments in schools are structured, geared up, or pneumatically controlled for this modulated, electrically stimulated, micro-ogasmic computerised experience?

Perhaps we are in danger of polarising the subject and alienating the various interested bodies, so that in fact at one end of the spectrum we have Craft Design based curriculum and at the other Design Technology. A more prestigious emphasis placed on D. and T. as highlighted in 'Technology in Schools', where Headmasters that were questioned saw new Technology Courses being more desirable academically, socially and financially than the traditional workshop activities.

This area which I wish to consider is one about which I am becoming concerned: that is a dissension which seems to exist between certain groups representing what might be described 'main-stream' Design Education and certain elements of the Technology 'lobby'. In some respects what I had intended to describe has been pre-empted by an article in The Times Educational Supplement 'CDT Extra' of 23 October 1981 by Paul Griffiths, a lecturer at Avery Hill College. In this article Mr. Griffiths referred to 'type of Partisanship' which has resulted in a 'tunnel-vision' mentality in which the individuals concerned are unable to see the total spectrum of creative activity, and are blinkered by their own particular specialisms and prejudices. Certainly, I recognise that polarities exist and it seems that they have been vocalised with increasing determination in some quarters. This is to be regretted as it is contrary to the whole direction and spirit of the recent developments in CDT. The formation of Design Departments and faculties has produce co-operative attitudes between the various interested parties associated with Design activities, ie DS, Art, some Sciences and Maths Departments.

In a recent address of NADE, Chairman Phil Mason said that in the county of Bedfordshire where he teaches almost all of the curriculum developments eggs have been firmly placed in the Technology-basket. I am very sympathetic with his thinking when he then goes on to say that his experience in this area have shown that the enthusiasm and inventiveness brought to this aspect of the design continuum is no less than in any other facet. Certainly, as he put it, many able pupils, in schools where there is no common core, have remained in Design activity through Technology who would previously have been lost in the option lottery. But, how do schools who are Design Craft orientated begin to introduce Technology, and what kind?

Over four years ago I found myself in a similar situation. What follows is an outline of a stage-by-stage approach and a teaching strategy that is employed by members of my department and has been developed over four years. It is a thematic approach based upon 'Transport' and has been devised to integrate the subject areas of CDT in a total experience for Third Year pupils, providing a 'vehicle' (unintentional pun) in which to involve technology to a reasonable level.

My intention is not to provide just a 'Reader's Digest' type guide, but to offer an approach that can be analysed, evaluated and possibly adopted and refined by other schools.

MAIN THEME
Transport – Methods of Travel
Secondary Theme –
Materials in Action

STAGE 1 (CDT) INPUT Visual Stimulus for generating ideas

(a) Display area - large cardboard replica of articulated lorry with theme titles as logos.
Posters, magazine cuttings, manufacturers handouts and brochures. Visual stimulus on past/present modes of transport, e.g. traction engines to space shuttle, Concorde to Leonardo de Vinci's drawings of helicopters. Methods of power. Steam engines, electricity, wind, nuclear, solar and so on.

(b) 3D - Display on materials and different methods of forming, e.g. plastics, metals, wood (types of) forming methods drape moulding, injection moulding, blow moulding, appropriate shapes of manufactured objects, e.g. old vacuum cleaner, record player deck, lamp fittings, parts of vehicles, bits and pieces of engines, electrical components, household objects.

(c) This display is set up to provide a stimulating and interesting area whereby pupils can examine and relate to the various information media. Communicating ideas, needs INPUT both visually and in a tactile way in order to germinate the seed of an idea in a child's imagination.

STAGE 2 (DESIGN) - DESIGN BRIEF - A Logical Approach to Designing

(a) Introductory talk/lecture to 2 - 3 groups of mixed ability boys and girls, 21 maximum in each group. Slides on methods and modes of transport - cars, lorries, boats, hovercraft, swamp buggies. Means of motivation - energy/power requirements.

(b) Problem - Design and make a model vehicle that can move over either land or water. It should be powered by electric motor that is a minimum of 1.5 volts and does not exceed 6 volts. Alternative power sources may be considered in consultation with staff.

(c) Design Process - recapitulation on first and second year Design Approaches, see handout on Design sheet.

(d) A more sophisticated approach is introduced, overheads plus handout on the Design Process and a simple analysis of the brief is part of the talk.

STAGE 2 (continued)

(e) Individual group work/Brainstorming

	Land	Water
	cars	boats
	lorries	submarines
e.g.	tanks	hovercraft
	trains	swamp buggies
	etc.	etc.

(f) Home Works - Underline what you consider to be the main words of the design brief and write one or two sentences about each one. Also, research is needed for your ideas. Collect, find and draw any pictures about the type of vehicle you may want to design - see Photo No. 1 of one third year boy's initial design sheets.

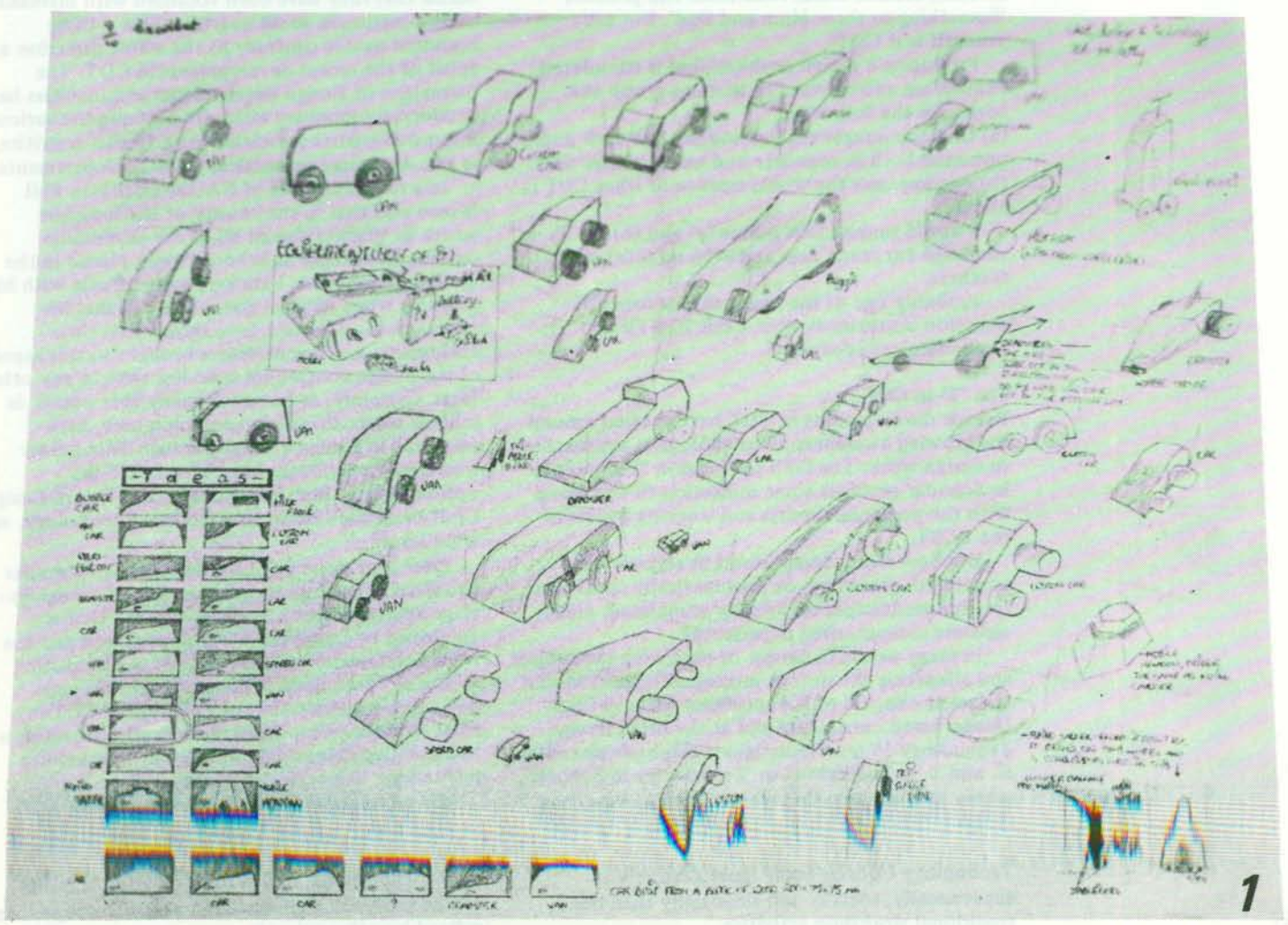
STAGE 3 (DESIGN)

Methods of Communicating your Ideas

(a) Groups are brought together in a Technical Drawing room and given a talk/lecture by the member of staff in charge of Graphics, who explains and demonstrates the various ways of illustrating and communicating ideas. These include models and mock-ups in various materials, free hand sketches, cardboard cut outs, T.D., paintings and illustrations. He goes on to talk about style, form, shape and basic aesthetics.

(b) Pupils are returned to individual groups and allowed a period of exploring different methods of communicating ideas and the handling of medium associated with these methods.

(c) Home Works - Design your vehicle shape and present your ideas in any of the ways you have been shown in lessons but, you must include at least one page of Graphics.



1

FIRST YEAR

NAME	GROUP This is my DESIGN.
PROBLEM.	*What are we going to make?*
THINK ABOUT IT.	*Find pictures and other 'information' from books and magazines.*
IDEAS.	*Put ALL your thoughts and ideas on paper using sketches and notes.*
SOLUTION.	*Choose your BEST idea Why is one you have chosen the best?*
MAKE IT.	*What tools do you need?* *How long will it take?* *What kind of materials do you need?* *What size of materials?*
TEST IT.	*Does it work?* *Will it last?* *Is it the same as your design.* *Could it be better?* NPG'

THIRD YEAR

A SIMPLE ANALYSIS OF THE BRIEF

ANALYSIS.
Examine, check. Word check list.

PROPORTION.
Size, scale.

APPEARANCE.
How it looks.
Colour, shape, texture, material.
Aesthetics (is it pleasing to the eye?)

ADAPTABILITY.
How suitable is it?
Will it do the job?

RELIABILITY.
Will it last?
Is it consistent?

THIRD YEAR

THE DESIGN PROCESS AND DESIGN CONSIDERATIONS

Definitions: 'A goal directed, problem solving activity'. L.B. Archer
'The conscious effort to impose meaningful oder'. V. Papenk

Design covers almost every aspect of our lives, from Christmas cards to Cars. It is essential that you realise from a very early stage that Designers do not simply dream up ideas; their designs are arrived at as a result of a great deal of work. It is essential that you realise that a designer can not work without data and this is derived from a basic knowledge of materials, processes and techniques. To build up your own data you should make a point throughout the course of collecting any information which may be useful, this information should be stored in either your DESIGN FOLDER or TECHNOLOGY FOLDER.

Most design work is carried out in a systematic and logical manner with each phase of the work being dependent on previous decisions/assumptions the designer has made. The designer must also look at a variety of solutions to the problem before finalising his design.

Below is a logical approach for the designer to work through:

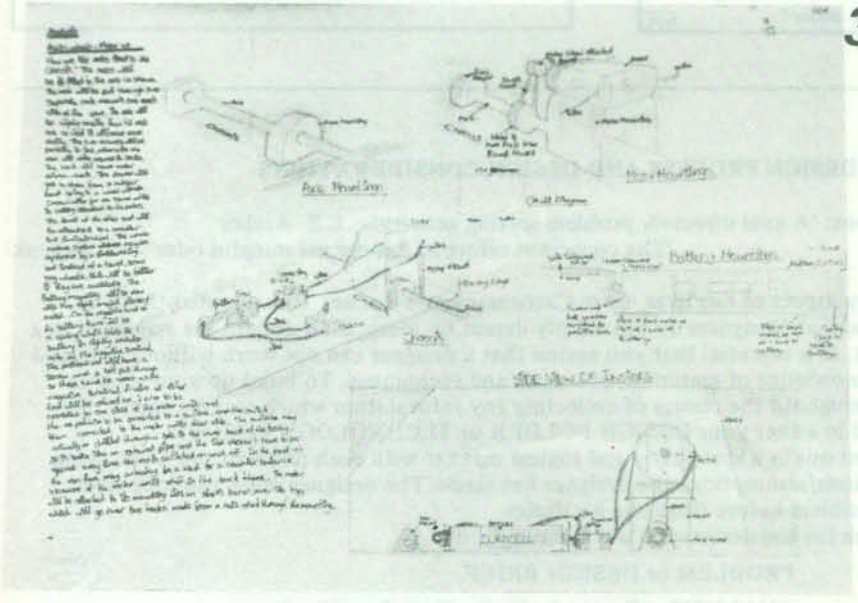
PROBLEM or DESIGN BRIEF
ANALYSIS. (Research: Evaluation of problem)
IDEAS. (Creative Thinking)
SELECTION AND REJECTION (Decision Making)
DEVELOPMENT and SYNTHESIS ('Mock-up' Models)
REALISATION (Production)
ASSESSMENT (Does it satisfy the brief?)

When designing the designer must take a great number of factors into consideration. The following considerations are not always applicable, but most have relevance to the majority of design problems. This is not an exhaustive list, please add other points as you discover them.

Proportion. Size. Market. Function. Form. Shape. Ergonomics.
Appearance. Aesthetics. Finish. Quality. Quantity. Storage.
Adaptability. Style. Production. Manufacture. Materials.
Reliability. Safety. Environment. Cost.

Techniques useful to the designer: Sketching – Perspective – Isometric
Orthographic – Use of scrap views – section views – exploded views.
Colouring through Crayons – Felt pens – Paint

You must keep all work relating to a design solution, as even rough sketches form an important part of the design.



STAGE 4 (CRAFT) Producing the vehicle bodies

(a) Material 80 x 80 x 250 mm. Pine or Hornbeam block (old fence posts) is distributed to each pupil. They then refine their chosen design to accomodate within the size of material (a constraint).

(b) Demonstration on planing, use of surforms, marking out procedure. Also a brief explanation is given about desired shapes, height ratios, problems of air pockets in moulding and encountering difficult grain structure.

(c) A rough outline of their idea is drawn on their wooden block and cut out either by the member of staff using a bandsaw or by the pupils using a jig saw, coping saw or tenon saw.

(d) The shape is developed by using Surforms and other hand tools and finally finished off with glass paper

(e) Home Works - Using annotated diagrams write up a Design Log on what you did in lessons and find out information on the tools and equipment you used.

STAGE 5 (CRAFT) Producing the mould and forming the Acrylic body shape

(a) The finished wooden former is used to mark out the profile for the yoke and then mounted on a base board (see Photograph No. 2 showing example of finished mould). Instructions on the sequence of screwing, clearance and pilot holes countersinking, clearance for Acrylic sheet is given by individual membetrs of staff.

(b) Forming shape in Acrylic, calculations on the size of materials and methods of production is given in a demonstration.

(c) The pupils individually having heated their material in a special oven then procede to produce their own moulded forms.

(d) Home Works - Design Log, handouts on processes used, annotated diagrams required plus written information.

STAGE 6 (CRAFT, TECHNOLOGY) Forming the vehicles body and Research Techniques

(a) After the moulded shape has been formed it is cut out by pupils using a jig saw, coping saw, abra files.

(b) Talk/lecture using slides and models is given on methods of converting energy into mechanical/electrical motivation. Handouts "Basic Mechanical Movement" such as gears, pulleys, cams, levers.

(c) Talk/lecture on developing and producing wheels, chassis, super structures, slides plus models to be shown as examples.

(d) Home Works - Research on wheels, super structures and mechanical movement for your own particular vehicle, e.g. propellers for boats, fans for hovercraft (See Photograph No. 3).

STAGE 7 (CRAFT TECHNOLOGY) Forming wheels/ superstructures

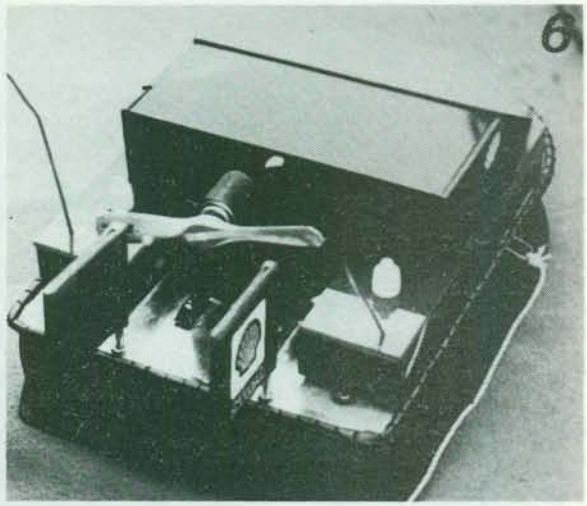
(a) Video on basic turning on a lathe.

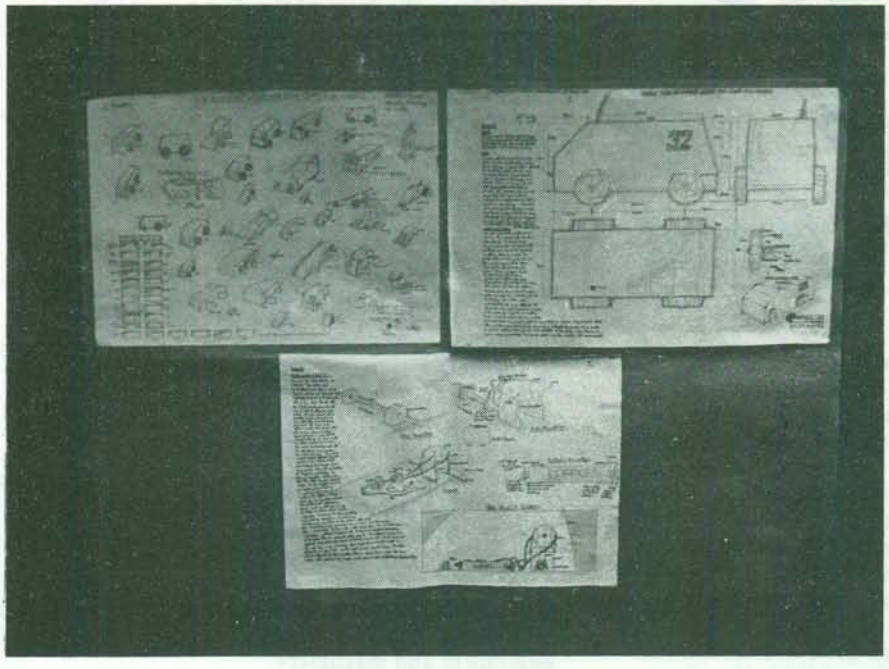
(b) Alternatively - demonstration by staff on turning on a lathe, notes to be taken by pupils, facing off, parallel turning, centre drilling, counter boring using 18, 20 and 25 mm. drills (See Photo No. 4 showing different formats of wheels. Materials used - off cuts of nylon and aluminium bar, tyres can be bought by pupils or they can use slices of old bicycle innertube.

(c) Examples are shown of methods of mounting axles, super structures.

(d) Home Works - Annotated diagrams plus notes required on lathe work for production of wheels in following lessons.


5


6



STAGE 8 (TECHNOLOGY) Chassis Design - Power/ Mechanical Movement, Control Techniques, Circuit Diagrams

(a) Chassis design - use of cardboard mockups, development of ideas.

(b) Illustration and examples of possible means of motivation and methods of powering (Photo. No. 5).

(c) Introduction to simple circuitry and use of circuit diagram, basic electronic theory.

(d) By this stage a more individualistic approach is occurring whereby each pupil is beginning to formulate their own way of answering his/her own requirements to the design problem. Subtle refinements to the basic model become apparent, such as adding accessories, painting and spraying the bodies of their vehicle, transfers, and so on.

(e) See Photos. Nos. 6 and 7.

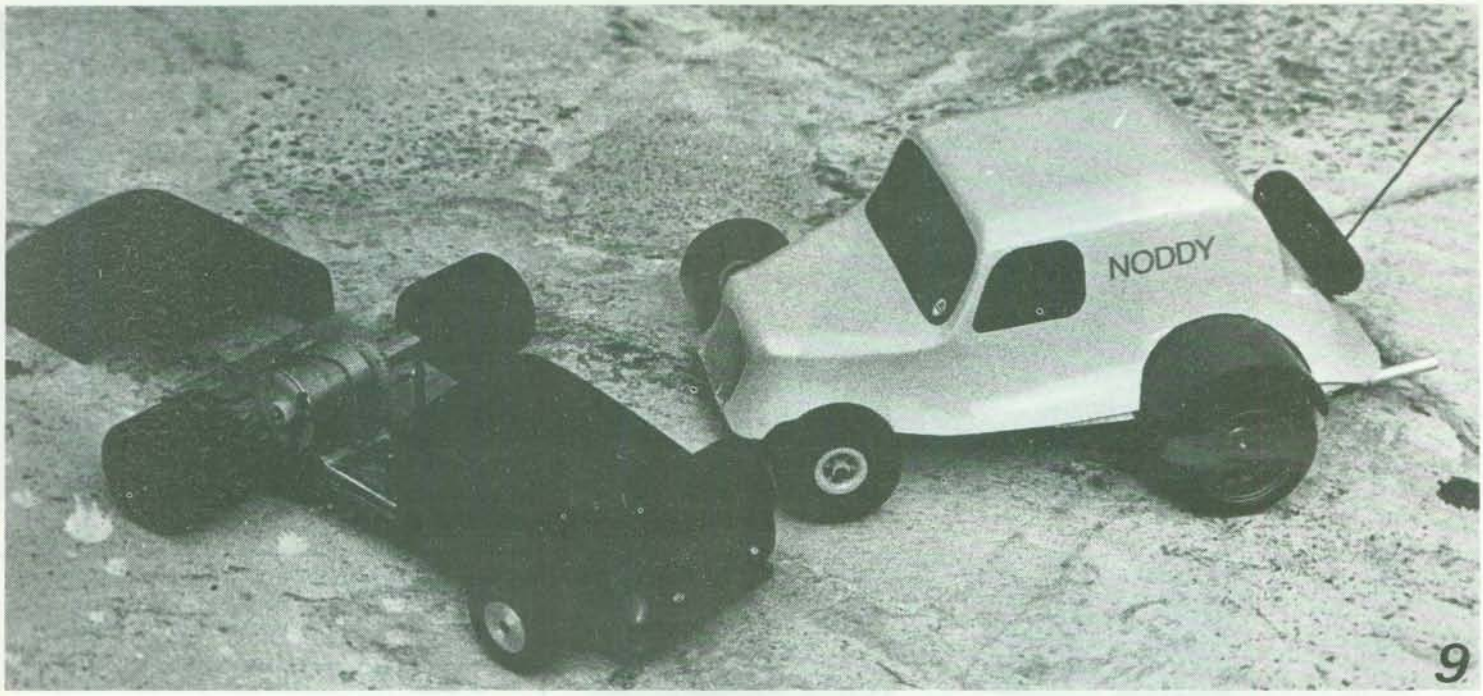
(f) Home Works - Design Logs, circuit diagrams, use of simple electric motors and other methods of motivation. (See Photo. No. 8 "A Completed Design Brief".

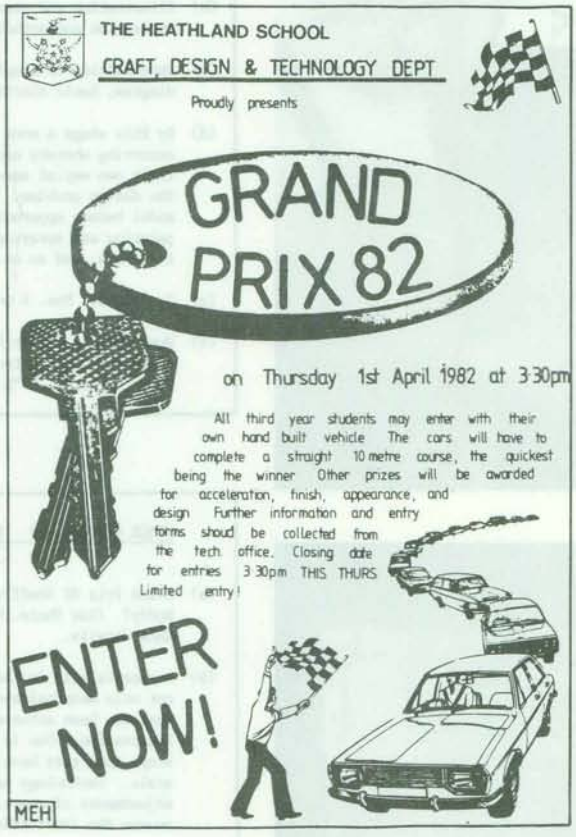
STAGE 9 (C.D.T.) Evaluation - Testing, 'Does it Work'

(a) Grand Prix 82 Staff versus Pupils or Who can beat Noddy? (See Photo. No. 9). Also see advertisement on Race details.

(b) A race is held in the Girls' Side Hall which provides not only entertainment but a practical demonstration on what has been achieved by pupils, fun, frolics, frustration. One is surprised at the number of pit stops some cars have to make even at this reduced scale. Technology in action!! But not always, minor adjustments of gears, pulleys even elastic bands and of course the inevitable flat batteries!

(c) Prizes for originality, body design for boats, cars and any other vehicles, design logs and briefs. However, the record still stands to a member of staff 6.7 seconds for a 10 metre course with a winning entry Noddy.





Integration of subject areas in a department

The 'spin-offs' from this approach have been extremely valuable, it has strengthened team work and integration of subjects within the Department. For example, one of my colleagues, in charge of Technical Graphics, has developed and implemented a Third Year course based on workshop activities. Pupils begin to see Graphics work both as exciting and relevant to what they are producing. Underlying this approach is the result that pupils are mastering complex draughting and geometrical skills, such as developments and laying a good foundation for future work in the Fourth and Fifth Year (see Model Car sheet).

Another consequence of this approach is that drawing interpretation is a complex activity in itself which some pupils find extremely difficult but who can now see it related to their own models. Standards of presentation of graphics work has increased both in quantity and quality in the classroom and for homework.

In a Woodwork context, the problem of designing a model vehicle based on the principles of land yachts, has provided a stimulating and exciting dimension to a traditional craft area. Technology involved here consists of work on control methods for sails, steering, wind power and gearing systems.

Extra curricular clubs in CDT in the department have flourished, providing another outlet for ideas and a chance for pupils to progress at their own speed and level. The main advantage is that these clubs supplement valuable practical lessons which have been used for talks and demonstrations.

Conclusion

Criticism that could be raised on this thematic approach is that it is not CDT, but a glorified 'hobby' based upon design methods. My defence would be in the form of the diagram which illustrates the concepts, skills and technology involved in this project (see diagram of 'model' vehicle).

I personally believe that any approach which has the honest intention of imparting the aims and objectives concerned in the CDT subject areas, and transmitting these to pupils, has validity.

We are in a period of contraction in Education with falling roles, cuts in expenditure, facilities, capitation and in teaching staff; consequently 'initiative' and 'innovations' become a necessity. Much of the technical hardware required for design technological based subjects is expensive and money is not always readily available.

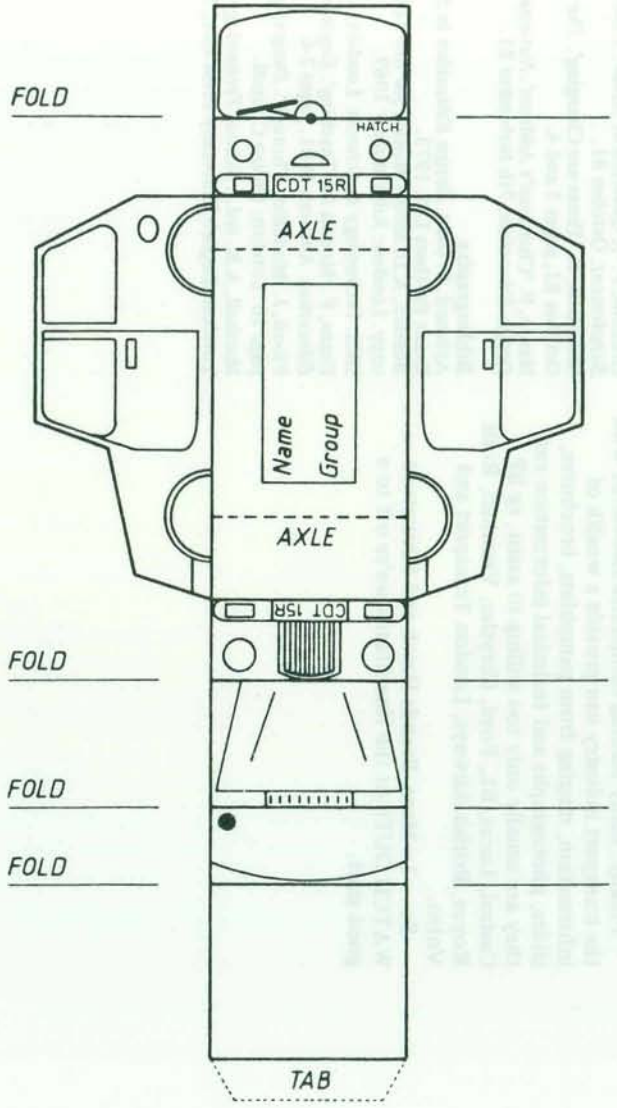
Resources

I suppose like a great many departments in this country I have the best set of 'scroungers' (meant in the nicest possible way). In a time of recession opportunities abound, many small uncompetitive firms are closing down and these are worth approaching. Salvaging pieces of acrylic signs, off-cuts of card, paper, metal, wood, nylon rod and it is well worthwhile ferretting out old electrical equipment and machinery.

Another source of material which can supplement a department's capitation are the firms who actually pay for the removal of waste material, these firms are usually only too glad for a school to do the job for nothing! The school minibus finds

THIRD YEAR TECHNICAL GRAPHICS	UNIT N°	NPG!

DEVELOPMENTS :- MODEL CAR.

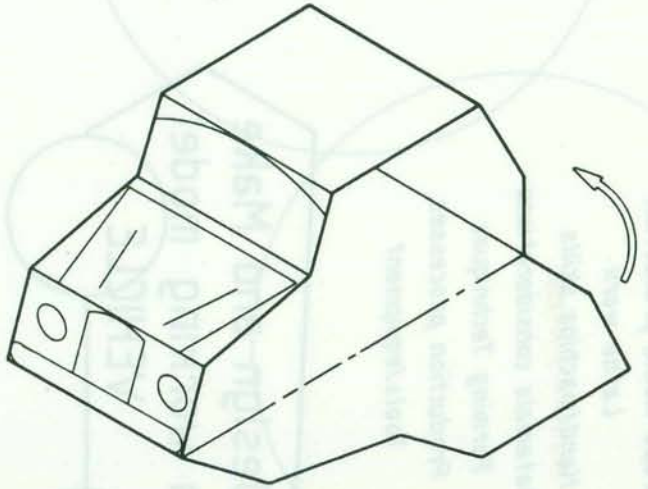


WORKSHEET. TO BE PRINTED ONTO A4 CARD. VARIOUS COLOURS IF POSSIBLE.

THIRD YEAR TECHNICAL GRAPHICS	UNIT N°	NPG!

DEVELOPMENTS :- MODEL CAR.

When you have cut out the development from your worksheet and have coloured it and added any missing features you can begin to fold and glue it.

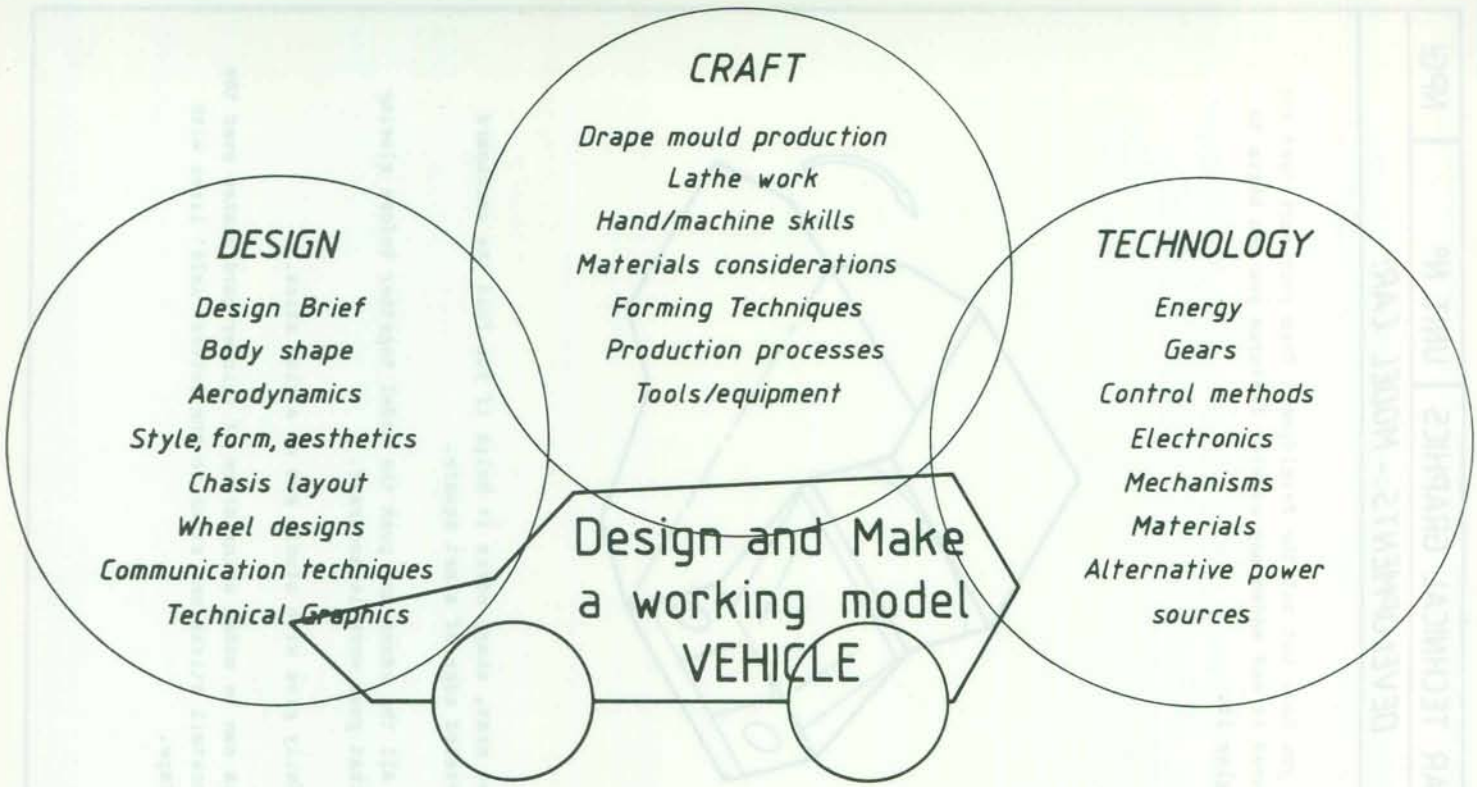


To get neat, sharp edges it helps if you fold the cardboard along a beveled edge of a set square.

Fold all the edges and push the model together before glueing to check that your work is accurate.

Carefully glue with studio gum or a glue stick.

Wheels can be added using discs of thicker card pushed over the ends of cocktail sticks and stuck to the dotted 'Axle' lines with sticking tape.



A THEMATIC APPROACH TO C.D.T.

Methods of Transport — Materials in Action

another use rather than just transporting sports teams.

Perhaps we are lucky in being situated in a comparatively industrial area, but anywhere and anyone is a potential source. As my old Yorkshire Grandad used to say 'Tha's no harm in asking, thee can only say "No"!'

Finally, many leading companies associated with the transport industry can provide a wealth of information, ranging from pamphlets, brochures, slides, photographs and technical information and they are usually only too willing to assist, eg BP, Castrol, Lucas, BL, Ford, Chrysler, Vauxhall, Rolls Royce, British Airways, London Transport and Volvo.

So — Le Mans, Brands Hatch and Silverstone — WATCH OUT! At the Heathlands we're off to a good start.

References

Barnes, B. 'CDT in the Secondary School – What They to Offer? *Design Education Supplement Engineering*, May 1970, page 25.

DES. 'General Conclusions and Suggestions'. *Technology in Schools*, DES, London 1982.

Elliot, C. Where Technology Stands. *CDT News*. Extra Edition for A CDT, 82.

Griffiths, P. 'A Question of Aims'. *Times Educational Supplement*, October 81.

Nicholson, B. 'Times are Changing'. *The Stanley Link No. 8*, October 82, pages 3 and 4.

Mason, P. 'Chairman's Address'. *National Association of Design Education*. 7th November 81.

Bibliography

Aylward, B. (ed.). *Design Education in Schools*. London: Evans Brothers Ltd. 1973.

Bulman, A.D. *Model Making for the Young Physicist*. Proof copy. London: John Murray 1969.

DES. *Technology in Schools*. London: 1982.

Evans, F. 'Models for Teaching'. *Engineering Design Education*. Autumn 1981, pages 2-6.

Flood, J. 'Modelling Through'. *Designing*. Autumn 1982, page 10. London: Design Council.

Marshall, A.R. (ed.). *School Technology in Action*. London: English University Press Ltd., 1974.