Designing and Making for ages 9-13 years

Thames Television

We print here, with permission, teacher's notes on two of 16 programmes for primary and middle schools currently being broadcast by Independent Television. The full teacher's notes with information on all programmes is available from Thames Education 149 Tottenham Court Road, LONDON W1P 9LL.

Speed on Water

Summary

The programme looks at the problems associated with moving through water and how these may be tackled with increasing sophistication. Starting with wading and moving through water using craft powered by paddles, oars and propellers, it deals in detail with the achievement of speed in a rowing 'eight'. It looks at materials, design and how the crew use the boat and the oars. This manually-powered boat is contrasted with a diesel-powered catamaran propelled by water jets. In each case, the method of construction and means of propulsion are explained.

Use

Many primary and secondary schools include designing and making model boats or water toys as part of their design and technology curriculum. Apart from the intrinsic satisfaction of producing something that behaves in water and moves, pupils gain considerable insight into quite difficult maths and science concepts — surface area, volume, displacement, buoyancy and stability. It is easy to extend this work to consider animals that live in water and see how their control and propulsion methods relate to those used in boats and ships.

Activities for children

1 Visit ycur local swimming pool and try out the following:

a) Lying flat on your back in the water with your arms and legs by your sides.
b) Lying flat on your back in the water with your arms and legs spread out.

Which position a) or b) is the most stable?

c) Pushing off from the side with your head up and your arms stretched out side ways.
d) Pushing off from the side with your head down and your arms stretched out in front with your hands together.

In which position do you go the furthest?

Find a book with pictures of different sorts of small boats designs and work out how the designers have managed to get both stability and streamlining.

2 Visit your local aquairium shop or pond and try to observe some of the following animals in action: frog, newt, goldfish, eel.

For each animal you observe, make careful notes and sketches and answer the following questions:

How does the animal move through the water?
How does the animal keep upright in the water?

Present your observation and answers as a small display.

3 Visit a local boating lake and make sketches of any boats you see there. Observe the boats carefully and for each one answer the following questions:

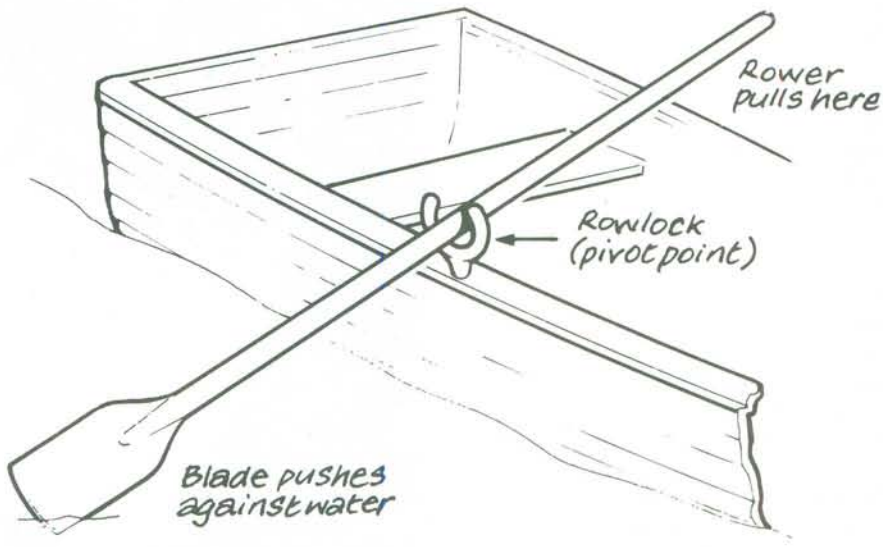
a) What causes the boat to move through the water?
b) How does this propulsion system work?
c) How is the speed of the boat controlled?
d) How is the direction of movement controlled?
e) How does the direction 'controller' work?

Present your obsrvations and answers as a small display.

4 Design and make a raft out of squeezy bottles or tin cans, tied together with wood and elastic bands. Float your raft in a paddling pool. Try to control the movement of the raft with a sail, propellor or a rudder. You will probably have to make changes to make them work better.

5 Some materials float while others sink. Make a collection of materials and sort them into 'floaters' and 'sinkers'. Present your findings as a wall chart. Try to turn your floaters into sinkers and your sinkers into floaters. If you are successful try to explain exactly why your idea works. Use your answer to explain why boats that float can be make from concrete and steel.

6 The oar is one of the oldest ways of proulsion. It is really just a lever and the diagram shows the important parts labelled. Making a simple model and investigating its performance is a good way to understand how an oar work. Use a wooden stick for the oar and a wire loop for the rowlock. Use your model to answer the following questions:

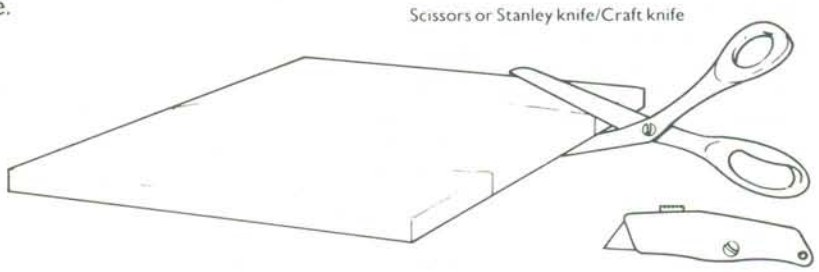


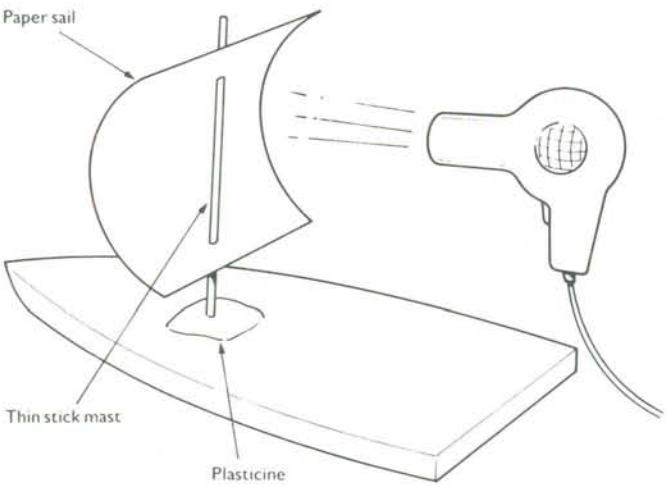
ACTIVITY SHEET

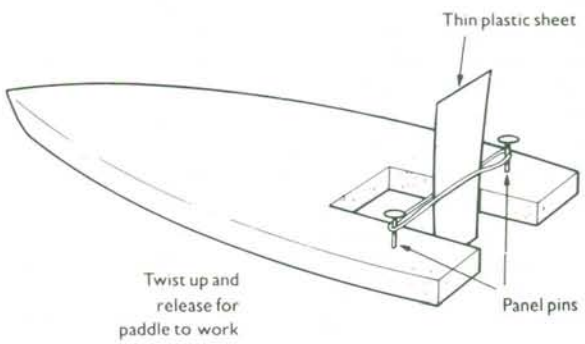
SPEED ON WATER

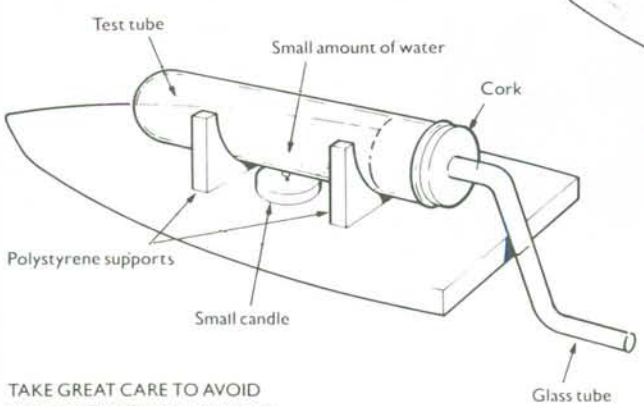
The following diagrams show you how to make a boat shape from a polystyrene ceiling tile and a number of different ways to cause the boat to move through the water. It is possible to make boat shapes from wood, but this will take you longer. For each boat you make, carry out tests and modifications so that:

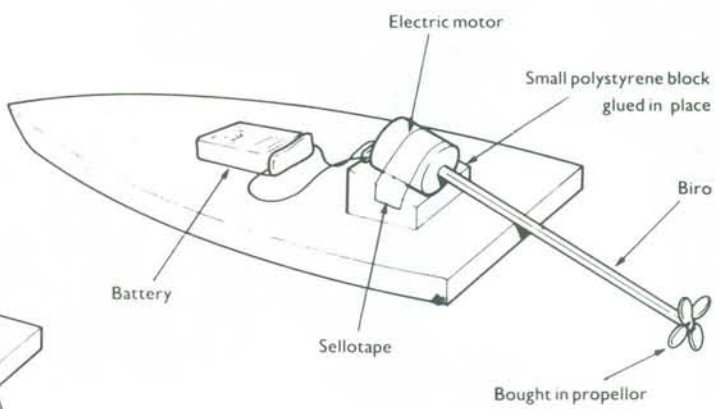
a) The boat travels as far as possible.
b) The boat travels as fast as possible.
c) The boat travels in a straight line.











TAKE GREAT CARE TO AVOID CONTACT BETWEEN CANDLE FLAME AND POLYSTYRENE

a) What happens to the force applied to the water if the distance between the pivot and the rower's grip gets longer? What happens to the force if this distance gets shorter?

b) What happens to the force applied to the water if the blade area is made larger? What happens to the force if it is made smaller? Use your findings to explain the design of oars used in the programme.

Wheel-Ability

Summary

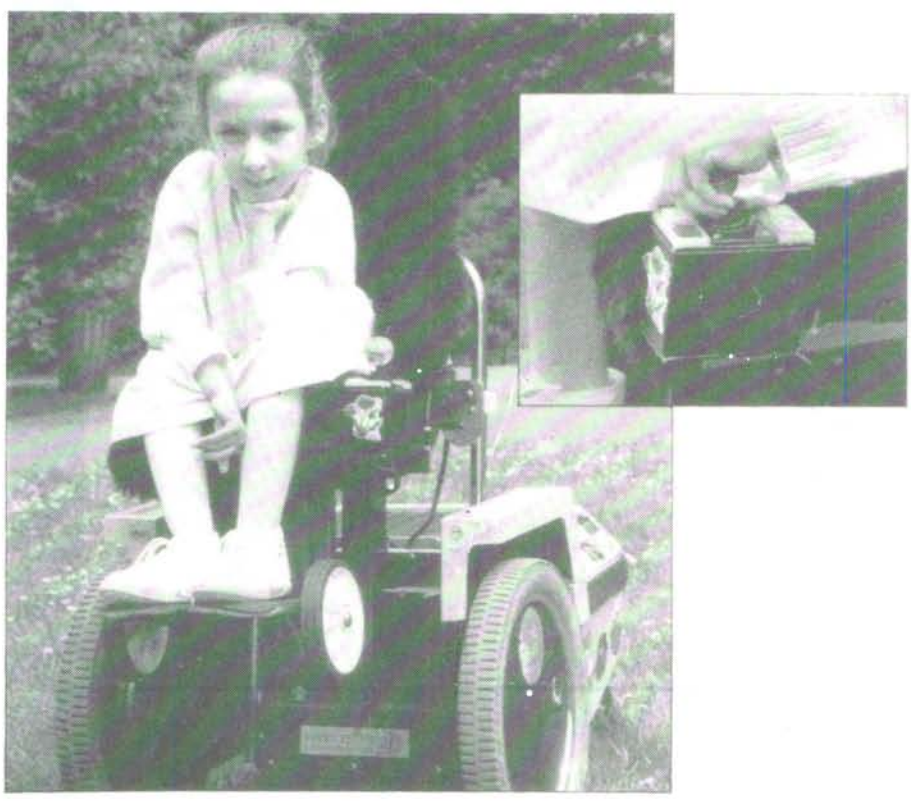
The programme looks at how the designer can identify the needs of disabled children and develop artefacts that allow them to make maximum use of their limited physical abilities, in order to achieve the independence and freedom of action the rest of us take for granted. The programme concentrates on the design and development of the 'Turbo' — a powered wheelchair that is adjustable to the user's body shape and handicap needs and can be controlled by means of an easy-to-use joy stick.

Use

An understanding of the variation that there is between individuals and how this can be taken into account by means of ergonomics and anthropometrics is fundamental to any education in design. A consideration of the needs of the handicapped provides easy access to this complex area in the primary school. The designing and making of devices to help a wide range of handicapped people is a common feature of secondry school CDT courses.

Activities for children

1 We are all different and this can be revealed by looking at the variety in a single class of children in the following features: Height, weight, arm length (reach), head size (circumference at widest point). It is an interesting exercise to measure each of these features for every person in the class and to present this information visually — block graph is the easiest way to do this. From the information colelcted the average size of each feature can be worked out and by how much this differs from the largest and smallest sizes. This information can be used to make a very attractive wall display.



2 It is difficult for us to realise the effect a handicap has on the life of the handicapped person. One way to gain insight into the problems and frustrations of being handicapped is to make a list of all the things you do in an ordinary day. Then think about how well you could tackle these if you had a particular handicap — unable to walk, unable to stand for more than five minutes, unable to grip things tightly, unable to stop your hands shaking, unable to sit up straight, only able to move your head. These thoughts can easily be turned into interesting and imaginative graphics.

3 Some products are poorly designed and difficult for everyone to use. One way to find out about this is to use an artefact and make notes on those features which are easy to use and those which are not. This is called 'going on a user trip'. The following items give interesting user trips:

— hair drier
— vacuum cleaner (emptying and changing the bag as well as just using)
— kettle (filling and emptying)
— manual tin opener (what happens to the sharp tin lid?)
— walkman
— cooker
— cutlery
— 'grindr' salt and pepper pots.

Present your user trips as a series of diagrams and notes for a wall display. Consider how some of the items might be redesigned for easier use.

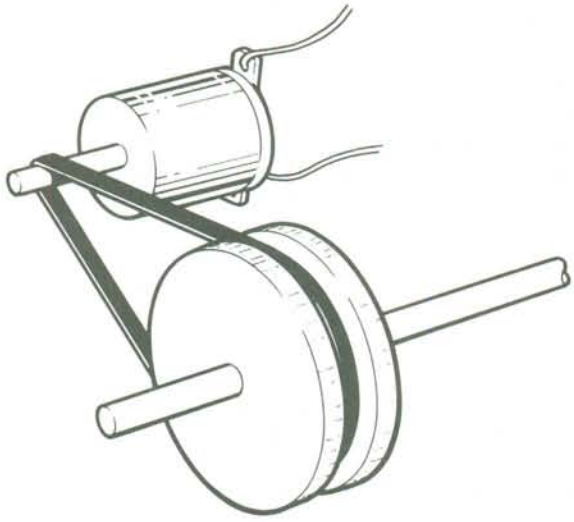
4 As people get oldr they often lose the ability to grip tightly. This makkes opening and closing jars difficult. Here is a design problem that you might be able to solve. Talk to your grandparents or elderly neighbours to see if they have this problem and, if they do, work with them in developing a solution.

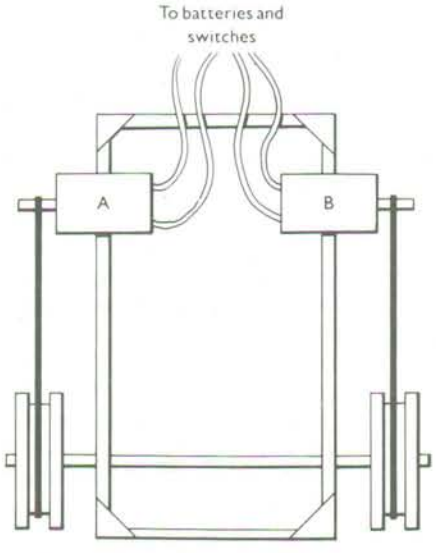
5 Handicapped people need special switches to be able to do many things. Can you design a selection of special switches using some of these: tin foil, drawing pins, balloons and tubing (rubber, PVC, empty biro tubing), pegs and buttons. Describe the type of disability your switches would be appropriate for.

WHEEL-ABILITY

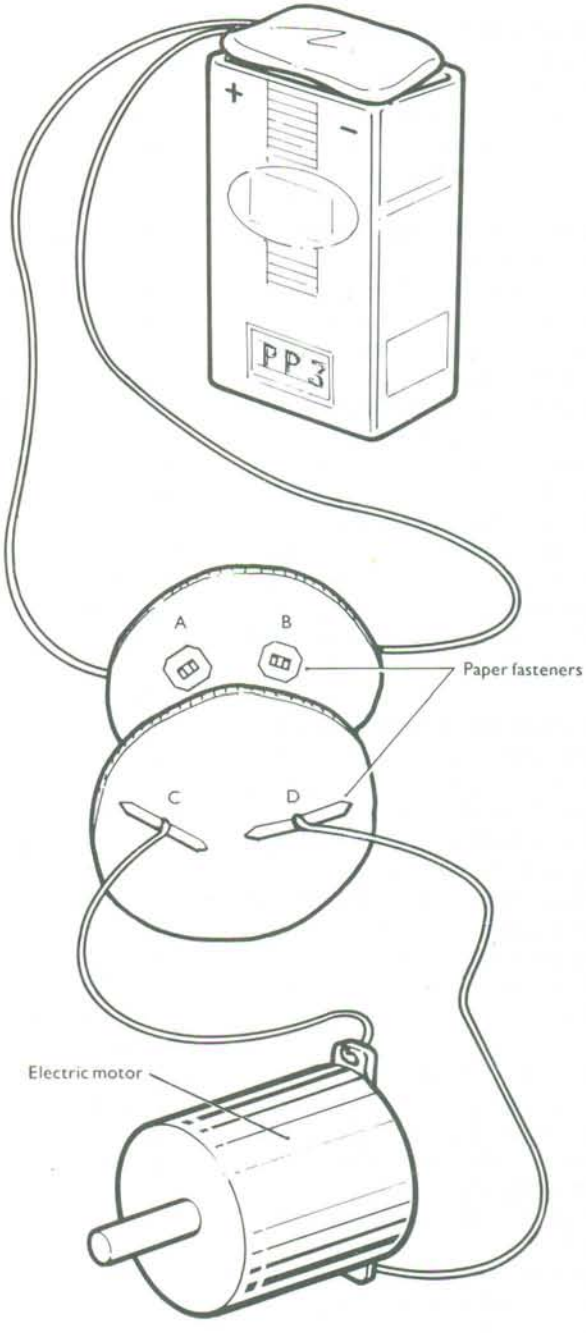
Using the information given, design and make a model powered wheelchair that can move backwards, forwards, left and right and is controlled by means of a hand-held control unit.

Although the finished product will be a model, the hand-held control unit can be developed as though it was going to be used with a real wheelchair. It is a great challenge to your design skills to develop a unit that uses either a joystick or a few pushbuttons and is easy to use.





Motors A + B forward – buggy goes forward
Motors A forward, B off – buggy turns left
Motors A off, B forward – Buggy turns right



What will be the effect of running motors backwards?