

Piaget has shown us that before the age of 12 or 13 most children have trouble grasping abstract ideas.

Reckoning with this problem, researchers have now found a way to let a child control and program a computer without needing to handle such abstract ideas (see the box on LOGO). The usual way teachers introduce children to computers is by a mixture of the two methods.

Turning Turtle

Even very young children can use computers to help them to learn. The picture on the facing page shows a young child playing with a 'turtle', a mechanical robot that is attached to a micro-computer. The turtles are expensive and are intended for school use, but the principle is simple: the turtle has two wheels and a pen. The child tells the turtle to move forward on a piece of paper and tells it whether or not to draw a line — a 'turtle trail' — as it goes. In this way the child draws, instructing the robot how to turn corners and join lines up. Because children are encouraged to work out exactly what moves the turtle has to make to draw a specific shape, they discover for themselves the elements that make up basic geometry. This 'self-help' approach is at the heart of the LOGO method. The belief is that lessons learned 'heuristically' (by trial and error) are better learned than when examples are shown.

These two schools of thought lie at the division in how we use computers with young children. In LOGO, older children, nine or ten perhaps, start using a version of the turtle on the computer screen, drawing intricate shapes and teaching the turtle how to remember various procedures. When a child is 'teaching' the turtle to do things, either on the floor or on the screen, he or she is, in fact, programming the computer. LOGO is a language that allows children to program before they have developed the abstract understanding necessary for most computer languages. Thus 'playing with turtle' allows young children to become used to the idea of controlling the computer and helps them explore their environment.

The other approach uses the apparent 'patience' of the computer to teach children by example.

Children who are having difficulty in understanding a subject or an idea are often helped by 'drill and practice' programs that ask the child questions and then provide a score to show how well he or she has done. Many of these programs are extremely attractive to look at, with good colour graphics and interesting tunes or sound effects. Children are encouraged to learn with these programs and the computer never gets tired or gives up if the child persistently provides the wrong answer. This patience has proved valuable in teaching slow learners, and drill and practice programs that, for example, ask a child to pick a noun out of a group of words, or make up a word out of a set of letters, are very useful educational tools. But to use a computer in this way is to substitute it for the human teacher, and this leads us to an important statement: no computer can replace the human teacher. Human contact is the most important element in teaching and, although a computer is the most powerful educational aid there is, it is no substitute for caring instruction.

If you are thinking of buying a computer for your children to use, it is worth finding out which type of computer is in use at your child's school. Buying a similar model will allow your children to use the same programs at home and will forge a link between computer activity at school and in the home.

Computers are fun, and it is quite all right to allow children to play games with them. A lot of parents are worried about the possible addictive effects of games such as Space Invaders or Pac-Man, but although these games are particularly enjoyable, there is no evidence whatsoever to suggest that their appeal goes beyond fascination.

Under seven, children need help and supervision in turning on a computer and television set and loading a program. If the program is good

LOGO Logic

Here we show how shapes are built up on the screen using the Logo language.

Logo is a computer language developed specifically to allow young children — as young as four or five — to program a computer. It was developed at the Massachusetts Institute of Technology in the late 1960s by a team led by Seymour Paper, a mathematician who had worked with the world-famous educationalist Jean Piaget at his Geneva Centre.

For the youngest children, Logo takes the form of a 'turtle', that is either a mechanical robot on the floor or a triangle of light on a computer screen. The command FORWARD 10 causes the turtle to move forward 10 units, drawing a line behind it. The command RIGHT 90 causes the turtle to make a right angle.

Chains of commands can be built up that cause the turtle to draw squares, triangles, circles and unorthodox shapes as well. The turtle can be also taught to 'remember' the commands. Without realising it, children teaching a turtle are, in fact, programming a computer

One way to draw a square box:

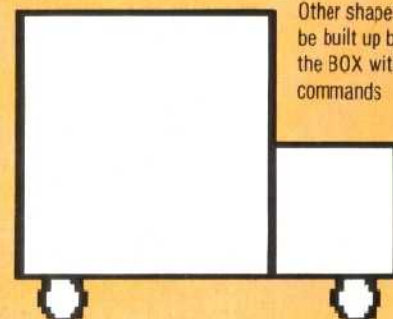
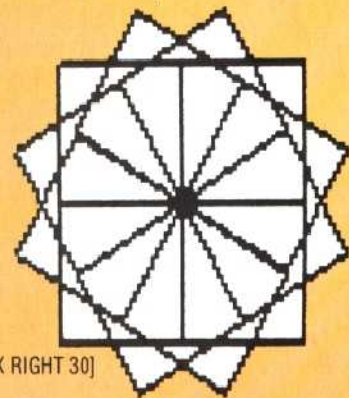
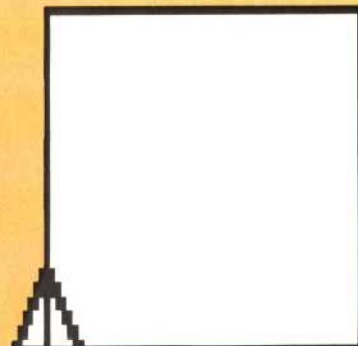
```
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
```

Constructing a 'BOX' command:

```
TO BOX
REPEAT 4 [FORWARD 50 RIGHT 90]
END
```

The STAR command:

```
TO STAR
REPEAT 12 [BOX RIGHT 30]
END
```



Other shapes can easily be built up by combining the BOX with similar commands