Primary Mathematics with IT

A pupil's entitlement at Key Stages 1 and 2.

This is an on-line version of the booklet *Primary Mathematics with IT.* It provides five major opportunities for children learning mathematics: learning from feedback, observing patterns, exploring data, teaching the computer, and developing visual imagery.

Primary Mathematics with IT – learning from feedback

Lengths and angles

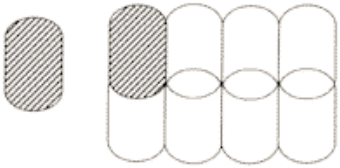
Some children from Year 1 were learning to use measures (lengths and angles) as they attempted to knock down piles of bricks with a floor robot. The children tried sending the robot forward 20.

The activity provided continual feedback. Each movement of the robot helped them decide what to try next.

Roamer from Valiant (020 8673 2233) or *Pip or Pixie* from Swallow Systems (01494 813471) could be used with this activity.

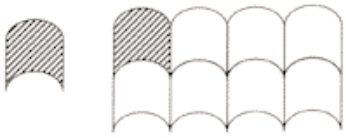
Tiling patterns

Various software packages can be used to create a motif and then position it on the screen to design a tiling pattern.



Some children in a Year 4 class were using tiling software. In their first attempt the tiles overlapped.

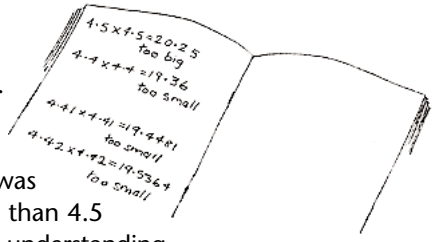
They decided to alter the shape of their tile so that there were no gaps or overlaps.



Versatile from Longman Logotron (01223 425558 x795) or *Reptile* from Kudlian Soft (01926 842544) could be used with this activity.

Square roots

A Year 5 class was working on decimals and developing skills of mathematical reasoning. Two children wanted to know which number could be multiplied by itself to give 20. They knew that 4 was too small and 5 was too big, so 4.5 was their first approximation.



The process was not as simple as the child's exercise book suggests. The teacher needed to help the children to find a number that was more than 4.4 and less than 4.5 and this improved their understanding of place value.

Trial and improvement methods often depend on IT and feedback from the machine is an essential ingredient.

Calculators or spreadsheets could be used with this activity.

A calculator or a computer can provide fast and reliable feedback which is non-judgmental and impartial. The facility to change things easily and try again encourages children to make their own conjectures and to test out and modify their ideas.

Primary Mathematics with IT – observing patterns

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

Number grids

Software is available which allows children to draw grids of numbers and shade multiples quickly and easily. Two Year 5 children were using the software to help their understanding of relationships between numbers.

Teacher: *Which times tables make columns on the 8-grid?*

Children: *The 4 times table gives 2 columns.*

Teacher: *Why's that?*

Children: *It's because 8 is the end number and 4 is half of 8.*

From this starting point the teacher went on to ask about other multiples. Then she asked about different grids. Later still, the emphasis was on diagonal patterns.

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36

Children: *7 works on the 6-grid.*

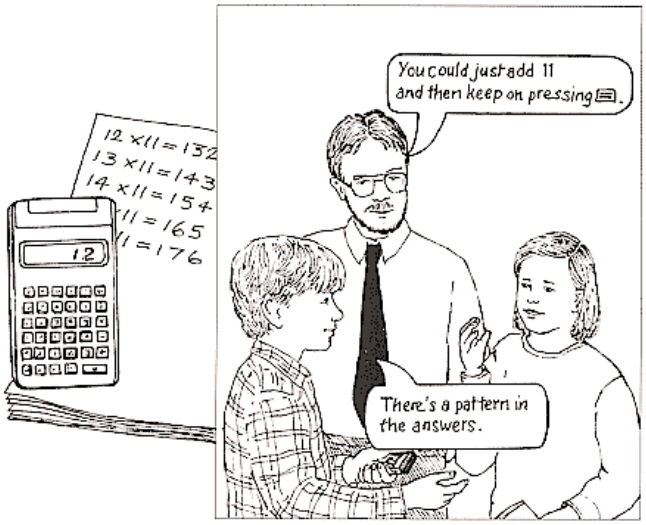
Teacher: *Why's that?*

Children: *It's always 1 more than the number of columns.*

Being able to draw many grids of different sizes and shade the multiples quickly helped the children to see the patterns and understand why they worked.

Numbers from Smile (020 7221 8966) or *LogoGrid* from Becta (024 7641 6669) could be used with this activity.

Eleven times table

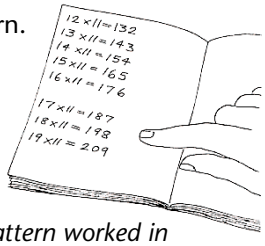


Two children (Year 5) were using their calculators to explore the patterns in the 11 times table.

Children: *The hundreds and the units always add up to the tens.*

Teacher: *Oh, I see. Does this always work?*

The children continued the pattern.



Children: *It goes wrong*

The teacher wanted the children to understand the pattern and why it breaks down.

Teacher: *Why do you think the pattern worked in the first place? Can you make up any other numbers which are divisible by 11? When does the pattern break down? Can you find any other places where it breaks down?*

Calculators or spreadsheets could be used with this activity.

When children can see many examples quickly, they are likely to observe patterns and where they break down. This may enable them to explain what is happening. The children learn to make generalisations and justify them.

Primary Mathematics with IT – exploring data

The giant's hand

A Year 5 teacher wanted to introduce scattergraphs while working on collecting, representing and interpreting data. She started by talking to the whole class.

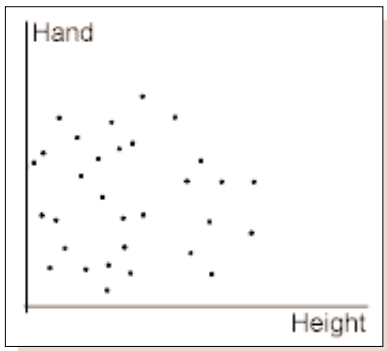
"I met a giant yesterday. She was so tall that my tape measure was not long enough to measure her. But I did manage to get a photograph of her hand."

The teacher held up an enlarged photocopy of her own hand and asked the children how tall they thought the giant was.

The class measured the heights of all the children and some teachers too. They also measured their hands and recorded the data in a spreadsheet.

	A	B	C
		Height (cm)	*Hand (cm)*
1	Siva	120	8
2	Helen	114	9
3	Peter	129	11
32	Roberta	156	10

The children examined the spreadsheet's scattergraph but no trends were obvious.



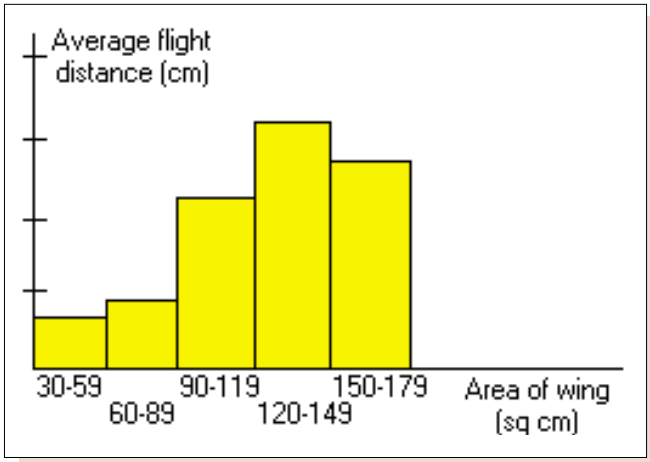
Teacher: *Sometimes things become clearer when there's more data. Why don't we ask the other Year 6 class to take part in our survey?*

The teacher explained what was meant by the line of best fit and the children drew it by eye onto a print-out. Then they used the line to estimate the giant's height.

Paper planes

A Year 6 class experimented with paper planes. Each child made one and then they were all flown three times to see which travelled furthest. The children's task was to determine how to make a model that would fly as far as possible and so they decided to measure the length of each plane, the height of the tail, the wing-span and the area of the wing.

The children recorded all the results in a database and they attempted to identify the important variables. Some were easy to spot; others were more complicated. Sorting and finding averages helped and various graphs were also useful.



The children also discussed whether their test was fair and some were able to see the need for changing one variable at a time.

Children can use computers to work with real data and represent it in a variety of ways. They can take their first steps in mathematical modelling by deciding what experiments to do, which data to record and how to interpret the data.

Primary Mathematics with IT – teaching the computer

An algorithm is a set of instructions. People often use mathematical algorithms, such as a pencil and paper method for adding large numbers, but devising algorithms is less common.

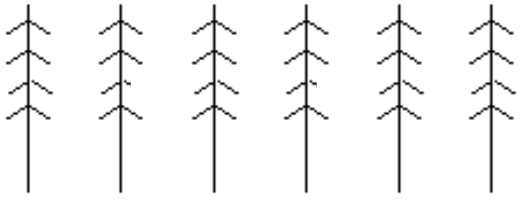
Logo trees

Children can develop mathematical reasoning by teaching algorithms to the computer.
Two girls (Year 5) used *Logo* to draw a tree.

Then they wanted to teach the turtle to draw their tree. They found they could save time by writing a procedure to draw a pair of branches and using it several times.

```
to tree
fd 70 bk 40
branches fd 10
branches fd 10
branches fd 10
branches fd 10
end
```

Later the girls used this procedure to draw an avenue of trees. At first they found it hard to work out how to move the turtle to the right place to draw each of the trees.



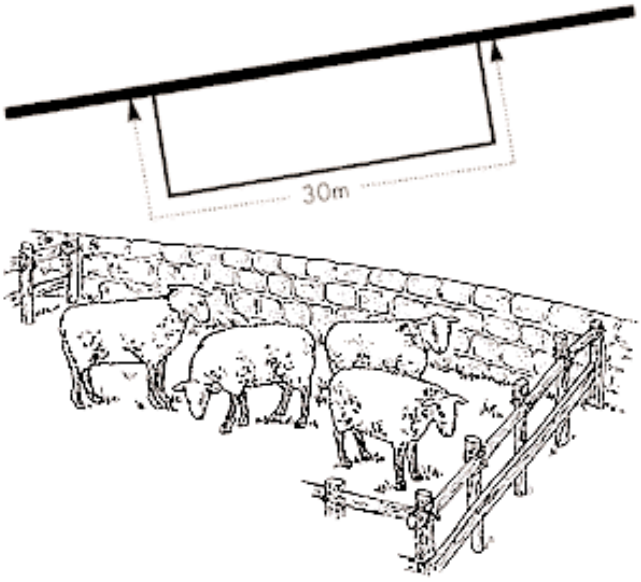
When they had finished, the children had taught the computer several new words and, whenever they typed 'avenue', the turtle followed their instructions and the complete picture was drawn on the screen.

A machine always obeys the precise instructions it has been given. It waits patiently, it has no expectations of its teacher and it is uncritical of failure

The children need to express their commands unambiguously and in the correct order.

Biggest sheep pen

Nick and Pinder were in a Year 6 class which was very familiar with spreadsheets and their graphs. The teacher wanted to introduce algebra and so the boys worked at finding the biggest rectangular sheep pen they could make with 30 metres of fencing against a wall.



They entered some results in their spreadsheet manually. They calculated the lengths by doubling the widths (column B) and subtracting from 30 (column C). Then they multiplied the lengths by the widths to find the areas (column D).

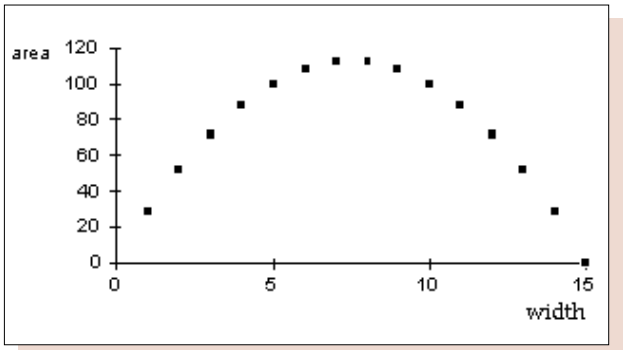
double → take from 30 → multiply by width

	A	B	C	D
1	width		length	area
2	1	2	28	28
3	2	4	26	52
4	3	6	24	72

They realised that they needed many more rows in their spreadsheet and so they taught the spreadsheet some formulas in order to generate the numbers they required.

Nick was not sure how to double but Pinder suggested trying =A2*2 in cell B2. Finding a formula for column C was harder. It took a while before the boys hit upon =30-B2 for cell C2. The last column was easier (=A2*C2).

Later they graphed the width against the area to help their exploration.



Teaching the spreadsheet provided an important reason for the boys to struggle with formal algebraic language and find the formulas. The spreadsheet also enabled them to break the problem into more manageable stages.

Primary Mathematics with IT – developing visual imagery

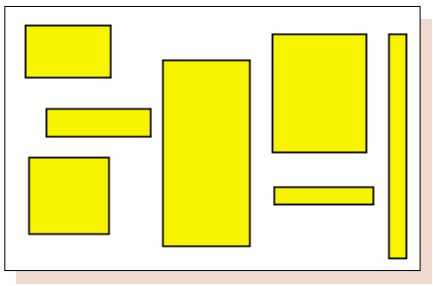
Stretching and enlarging

Some Year 2 children were using a graphics package to draw simple two-dimensional shapes and then distort them in various mathematical ways. The children stretched their drawings horizontally or vertically by using the computer's mouse.

Then the teacher discussed the various shapes with them.

"Which of these rectangles looks most like a door, or a window, or a book, or a TV screen?"

"How could you make a square?"



Later, the children wanted to draw a family of giants.

"They're too fat."

"They're not getting taller."

The children were shown where to click the mouse and the teacher talked about enlargement:

"The giant grows properly now."

"All the parts get bigger and the shape doesn't change."

Children can use computers to explore shapes by moving them. This encourages them to form their own mental images and visualise the geometry.

Primary Mathematics with IT – acknowledgements.

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- *Micromath* (Association of Teachers of Mathematics)
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- *Primary Mathematics* (Mathematical Association)
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