It's what's ON THE INSIDE that counts

Mike Askew is down on the farm to guide children through the relationship between perimeter and area...

Most arithmetical relationships that primary children encounter obey simple direct rules: for example, the larger the number you add, the larger the total. The relationship between perimeter and area is probably the first connection that children meet where the 'rules' are not simple and direct. While it's often the case that as the area of a shape increases, so too does the perimeter, this is not universally true. Similarly, increasing the perimeter does not always lead to a greater area. Children's 'common sense' will lead them to expect that the rule 'make one bigger and the other will always be bigger' will hold with respect to area and perimeter. They need time, experience and lots of talk about measuring shapes to work through what can be a confusing concept.

1 Preparing for the lesson

Alongside pencils and rulers (including some metre rules), cm squared paper is the only thing needed, although some children may benefit from having square tiles to move around. As my work is usually in urban schools, I set the context of the lesson within a city farm. Obviously children in rural schools will be more familiar with farms proper.

2 Introducing the first problem

I begin by talking about farms and how some have an area where children can go to see animals close up. I talk about a farmer, Jenny, who was setting up such an area. Some of the pens to put animals in are going to have a total area of 12 sq. metres. We use metre rules to mark out a square metre on the floor and talk about what a total of 12 of these might look like.

'Jenny thinks it would be interesting to have the animals' pens different shapes. She wants each one to be a rectangle but was wondering if 12 sq. metres can be arranged to create different rectangles. Turn to your partner. How could 12 squares be arranged to create a rectangle?'

I take different suggestions from the children and note these on the board. A quick sketch of each suggestion is made so that we can check that there are 12 squares inside the rectangle. We discuss whether, say, a rectangle 4 squares long and 3 squares wide is different from one that is 3 long by 4 wide and agree that these should count as the same rectangle. When we are happy that there are no more possibilities we list these on the board in an organised way.

1 x 12
2 x 6
3 x 4

3 Paired work

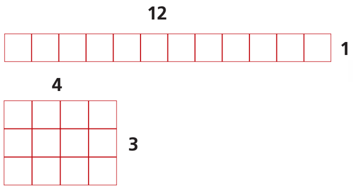
I explain that as well as wanting to build some pens with an area of 12 sq. metres, Jenny also wants to have some with areas of 24 sq. metres. Working in pairs, can the children find all the different arrangements of 24 squares to make rectangular shaped pens?

4 Back as a class

As the children begin to generate a number of examples, I direct their attention back to the board. I explain that Jenny is going to put a chicken wire fence around the outside of the pens and wants to know how many metres of fencing will be needed for each pen.

'Look again at these three pens that all have an area of 12 sq. metres. Talk to your partner. Will Jenny use the same length of chicken wire for putting a fence up around each one?'

We discuss whether the children think the 12 sq. metre pens will all need the same length of fencing or whether different pens require different lengths. We work on finding the perimeter of the 1 x 12 and 3 x 4 pens, recording the lengths of all four sides to make the overall calculation clear.



Back in their pairs the children continue to look at the possible rectangles with an area of 24 sq. metres and also the perimeters of these.

5 Review and reflect

At the end of the lesson we gather together all the information and order it into a table:

RECTANGLE	AREA IN SQ METRES	PERIMETER IN METRES
1 x 24	24	50
2 x 12	24	28
3 x 8	24	22
4 x 6	24	20

'What do you notice about the areas of all the rectangles? What about the perimeters? Why does the 4 x 6 rectangle need so much less fencing than the 1 by 24? Talk to your partner.'

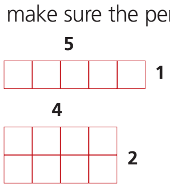
We discuss the fact that the 1 x 24 needs more fencing, as it is a long, drawn out rectangle, whereas the 4 x 6 is closer to being a square. Finally, we discuss the fact that it is possible for shapes to have the same area but to have different perimeters.

6 Introducing the second problem

We work on problem two a day or so later. I begin this by recapping the first problem – *'Who can remember what we noticed about the area and the perimeter?'* – and the fact that we were exploring keeping the area the same size and changing the shape of the rectangle.

'Today I have a different problem from Jenny. She has been given some rolls of chicken wire. Each roll is 12 metres long, so she has decided to make some rectangular pens that need exactly 12 metres of chicken wire to fence them in. Talk to your partner and see if you can suggest a rectangle that Jenny can make.'

We record a couple of suggestions on the board, marking the lengths of all four sides to make sure the perimeter is indeed 12 metres.



'What is the area of each of these rectangles?'

We quickly sketch the squares in to show the areas (I don't expect the children to move to length x breadth at this stage).

Find out more

Mike Askew is professor of mathematics education at King's College London and a freelance primary maths consultant. For further information on his work see: www.mikeaskew.net

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7 Paired work

'Jenny also has some rolls of chicken wire that are 36 metres long. She wants to use exactly a roll to fence off each pen. What are some of the different rectangular shaped pens that she can make?'

After the children have begun to record the dimensions of the pens, I briefly stop them and ask them to record the areas of the pens as well.

8 Review and reflect

As before we gather together all the information and order it into a table:

'What patterns do you notice in this table?

RECTANGLE	AREA IN SQ METRES	PERIMETER IN METRES
1 x 11	11	24
2 x 10	20	24
3 x 9	27	24
4 x 8	32	24
5 x 7	35	24
6 x 6	36	24

Talk to your partner.'

This time we focus on the fact that the perimeter never changes but the area can be different.

Extension activities

- **Children explore non-rectangular shapes on squared paper with an area of, say, 20 sq. cm**
- **Children explore non rectangular shapes on squared paper with a perimeter of, say, 16 cm**