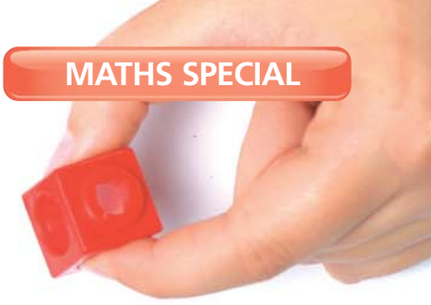


top 10s

How Chris Ingram's kangaroo puppet inspires children to explore number facts and develop their problem solving skills...

I have built up quite a large collection of puppets that I use in my teaching, and when it comes to maths lessons I have a firm favourite – the kangaroo. Her distinct movements and ability to hide and reveal objects come in very handy, as you'll discover with this problem solving lesson plan.

Introducing the problem

Before the lesson, I prepare a string of beads and hide this in the puppet's pouch. I then use the kangaroo to introduce the following problem:

"Today the kangaroo has hidden a string of beads in her pouch. There are 10 beads on the string. Some are red and some are yellow. I wonder if there are more red beads or more yellow beads? Can you draw a picture or make a number sentence to show how many of the beads could be red and how many could be yellow?"

At this point, I show children the large box of the beads being used and clarify: Can I use blue beads? Why not? Can I have 14 beads on my string? Can all 10 be yellow?

Make sure children are clear they're going to create a string of 10 beads, and that they must use both red and yellow beads.

Solving the problem

Differentiation is quite straightforward and is determined by whether it is more appropriate for the child to explore and record the problem practically, pictorially or symbolically. In addition, you will probably have some children from whom a single solution is required, whereas other children will be trying to find several or even all possible solutions.

Group 1

Using the same resources as the teacher, children come up with a solution that meets the criteria - i.e. the child produces a string of 10 beads, some of which are red, some of which are yellow. This may sound easy, but watching the children in action reveals this is more than a simple counting activity.

Most young children don't know the number pairs that make 10, so they randomly place red and yellow beads on the string[1]. Some children keep count of the total as they add each bead, but most seem to put beads on until it looks as thought they've assembled 10 - at which point they will count them to find out. If they find there are 8 or 11 beads, we hope that they will recognise they have not enough/too many and adjust accordingly. However, there will be many children whose response to this situation is to take all the beads off and start again, and again, and again. This is a useful assessment point and some careful questioning here can lead children in the right direction.

[1]

Reorganising the beads to represent two distinct groups will make it easier to subitise or count and will help later in the session with pattern spotting.

Group 2

Other children might also solve the problem using different manipulatives. You might explain that there aren't enough beads to go round, and invite pupils to use something else instead. Recognising it's possible to represent the beads with a different item (cubes, counters, coloured bears etc) and that this won't affect their ability to understand and solve the problem is a big step forward.

Group 3

Similarly, other groups may represent a solution pictorially using paint, crayon or coloured paper. This requires a more sophisticated process since children are less likely to use the trial and error approach described on the previous page (possibly because there will be 'evidence' of each attempt) and much more likely to use 'counting on' as a way of keeping track of the total as they work.

Group 4

You may have a group of higher attaining children who are able to present their solutions as number sentences. If this is the case, they could be challenged to find all possible solutions. It will be interesting to notice whether the children work systematically in compiling an ordered list – and if they are confident they've discovered all the possibilities with no repeats!

Back to the problem

Once children have created their solution (whether this be with beads, paint etc), it is important to encourage them to relate this back to the original problem, 'so how many yellow beads do you think the kangaroo has, and how many red beads, and how many beads altogether? If it is appropriate, you might ask 'could we use numbers to help us remember your idea?' Children might suggest writing the digits in yellow and red crayon or possibly creating a number sentence.

Review and reflect

Gathering the children back together after they have explored the problem is a crucial part of the process. This is the opportunity for the kangaroo to remind the children of the original problem and for pupils to present the various solutions they have come up with.

At this point, pupils may think there are as many solutions as there are children in the class. It is our role to help the pupils to make sense of this information. I usually do this by choosing a child to share their solution:

'Jake has made a string of beads with 3 yellow and 7 red. Does anyone have a painting or a number sentence that goes with 3 yellow and 7 red?'

We put all the presentations featuring this combination together and then move on to look at another solution. At this stage, you will have to deal with the commutativity issue; whilst 3 + 7 is clearly equivalent to 7 + 3, we need to pay attention to the context and be careful with our use of language:

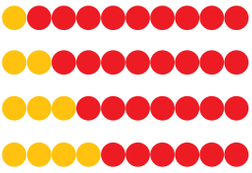
is equal to and the same as

or, whichever way round you look at it, there is a group of 10 made up of 3 yellow and 7 red.

is equal to but not the same as

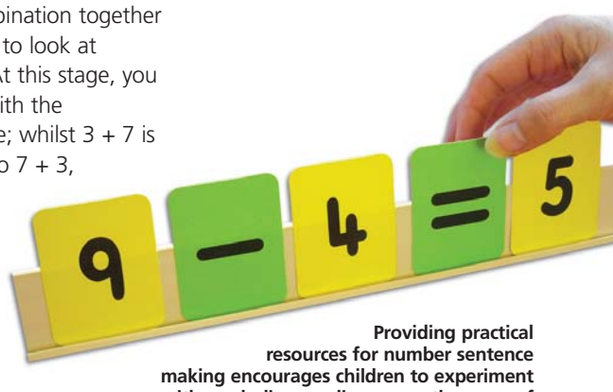
or, having 3 cats and 7 dogs is not the same as having 3 dogs and 7 cats, although either way you clearly have 10 pets.

As I collect the various solutions, I begin to list them in order to encourage children to realise that, by organising the solutions in this way, we may be able to see a pattern emerging.



The pattern gives us confidence to know whether we have found all possible solutions and to identify any missing solutions or repeats.

Some children are more likely to see the pattern in the coloured spots, others will find the pattern clearer to see when presented using number. Saying the pattern aloud in a chanting fashion will also help children to pick up on it.



Providing practical resources for number sentence making encourages children to experiment with symbolic recording as another way of communicating their ideas.

What's in the pouch?

The finale is the kangaroo revealing the beads she has in her pouch and the children identifying whether they have a solution that matches. At this point it is important to emphasise there were nine correct solutions to the problem, not one.

Tomorrow, and maybe for the rest of the week, kangaroo will hide another 10 beads in her pouch - some red, some yellow – and the children will use their other solutions to guess what they might be.

If you display the solutions and revisit the activity regularly as a mental/oral starter, children will soon be able to use their knowledge to solve missing number problems:

'The kangaroo has 10 beads in her pouch, some are red and the rest are yellow. She will give you a clue – she will show you all the red beads, can you work out how many yellow beads there are? How do you know?'

Later you might go on to show the children how this relates to equations such as:

3 + ■ = 10 or 10 – 3 = ■

Find out more

Chris Ingram is a freelance maths consultant who specialises in early calculation. For further information on the resources referred to in this article – including the kangaroo puppet! – see www.autopresseducation.co.uk