

## An introduction to number at

## Danegrove School



Created by Nick Davis


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It is important to keep number work a very concrete and visual experience for children using lots of different objects to represent number. We need to make sure that it is not too abstract because this can lead to a lack of confidence in being able to think mathematically and lead to the less productive route of just trying to learn rules rather than understand them.

Children need to be able to visualise numbers and turn them into pictures in their heads. We need to make numbers real: be able to see, touch, move and do arithmetic with them. This will make children more confident with numbers and develop a more persistent approach.

It is important that we create a positive attitude towards Numeracy and do not see it as a subject that it is acceptable to not be very good at.

We need to bring Mathematical language into everyday conversation. One of the most important supporting roles that adults can have in supporting children's understanding of number is to be able to regularly use Mathematical language in everyday situations and help children to begin to comprehend what they mean.



Where it all begins. $\qquad$ Counting

There are two meanings of counting in early childhood Maths:

1) Step 1: Saying the number names in order is one way, like counting to ten when you are playing hide and seek. $1,2,3,4,5,6,7,8,9$ etc. (Remember for many little children these are just abstract names that do not have a clear meaning.)
2) Step 2: Counting how many objects there are in a group. (The second kind of counting needs more understanding and more skill, and as adults we often forget what a complex task this kind of counting is.)

## How children learn about counting

Children learn to count things through practice, so the more often they meet occasions when they need to count, the easier they will find it. They need to count a wide variety of objects like: conkers, coins, shells, pencils, buttons, beans, apples, cakes etc and be able to identify where these numbers counted are on a number line. If you count out six objects it is then very helpful to point to the number 6 on a number line. This helps to make the link between the number of objects and the written number itself. The number line begins to show how each number relates to the ones around it. Is it bigger or smaller than...? Is it more or less than...?

## When learning to count out sets of objects the skills children will need to learn are:

- Co-ordinating saying one number with touching one object at a time.
- Separating the objects counted from those not counted.
- Knowing that, when counting objects, the last object counted is the final number of objects in the group.
- Recognising a small group of objects without counting.
- Counting a smaller number of objects from within a larger one. For example, can you count 10 objects from these 20 ? (This helps to learn when to stop at a fixed target.) This is a good stage to start discussing 2 different skills: how to count objects by moving them as you count
them and how you organise the objects as you are doing it- developing a clear and organised approach.
- Once counting in ones has been securely achieved you can then move on to counting in twos or tens and it is here that we begin to move into multiplication.


Estimating how many balloons could fit in a bag.
Estimating is a very useful skill and one we use all the time in life- How long will it take me to...? How far is it to....? With estimating it is worth getting a small group of objects and guessing how many there are before counting them out to see how close your guess was. Having made an estimate, it is worth asking - why a particular number was chosen and ask for an explanation. ("I think there are 10 buttons" "Why do you think there are 10?" "Well, I can see there are about 6 here and then there are about 4 here so that's about 10.")

Counting can be supported through the use of nursery rhymes, stories, songs and clapping games. Using illustrations in books is a great source for counting different objects or characters that you see.

Allow plenty of experience to explore if needed - to look, to touch, to experiment.


Children need plenty of time to explore different numbers and the picture above illustrates an example of the variety of experiences needed when investigating a number like 5.

Egg boxes and Ten Frames


Egg boxes and Ten Frames are very important in supporting children with exploring and learning about numbers. The egg boxes are especially adapted to only ever have ten spaces (just like the Ten Frames) and they underlie a very important concept of exploring different numbers and how they relate to a group of ten.


In the example above the number 4 is being investigated. Children are asked to place 4 cubes in an egg box and are then questioned about what they can see. The idea is to explore what children know or understand about number.

## How do you know that there are four cubes in the egg box?

Looking at the right-hand box (with the yellow cubes) a child might say- "Well, I know that 3 and 1 make 4 " or "I have three here in a row and one more makes 4 ". The layout is very important because a different layout may lead to a different line of thinking. With the box on the left (with the blue cubes) a child might answer, "I know there are four because 2 and 2 make 4 altogether." This is the beginning of what we call reasoning about number.

The example below explores the number 6. Again, children are asked to put 6 cubes in a Ten Frame. How they choose to put them in is up to them.


Similar questions are asked- "How do you know that there are 6 cubes altogether?' or "What can you tell me about the number 6? What do you know?"
"I know there are 6 because I can see 3 cubes here and another 3 cubes here and $3+3$ is $6 . "$
"There are 6 because there are 5 here and 5 add 1 more equal 6 ."
"I know that 4 add 2 are the same as $6 "$
'I know there are ten squares altogether and 4 are empty and I know that 10 take away 4 is 6 ."

In the last example a very important connection is made between the number 6 and 10 . A link which we want children to make with all numbers that they explore in the beginning of their Mathematical journey.

This reasoning about number and how numbers relate to each other is very important and closely connected to the idea of number bonds.

The key concept for an adult to understand, when supporting a child who is exploring number, is that we provide the language support necessary to help the child express through words what they are learning.


In the example above, it is easier to see this relationship between a number and ten.
It is more visual for children to comprehend when they are asked, "What number is this and how do you know?" to answer, "It is 9 because I know that 9 is one less than 10." Different answers are encouraged. "I know it is 9 because 4 and 4 make 8 and 1 more makes 9."

## Numicon

This is where Numicon (a very concrete and visual number resource used widely across the school) is very supportive in helping children to visualise a number through its shape rather than by counting.


This picture shows the Numicon numbers from one to ten.
Each number is clearly represented as a shape. There are holes in the shape so that if children are counting small objects they can put them in the holes to help them identify what the final number is.

Children quickly begin to recognise the shapes for each number using the Numicon. This helps them to begin to create a mental image to represent each number in their heads.


It also allows children to quickly see that each number is one more or one less than the numbers before or after it. This is a very important step because it is the beginning of calculation- to know that 6 is one more than 5 (This is the same as knowing that 5 add 1 is 6 ) rather than having to rely on counting from 1 each time.

Patterns begin to emerge with Numicon. For example, every other Numicon shape has a single, odd part sticking out at the top and so the idea of odd and even numbers begin to develop.
(Dice are an excellent resource to link written numbers to a visual representation. If the numbers from 1 to 6 are written down a dice can be thrown and the number it lands on can be matched to the numeral itself.)

In the following picture a dice is rolled and then a bean bag is thrown into the correct numbered bucket. This is matching and making the connection between what a number looks like as a picture and how it looks in its written form.

## Mathematical vocabulary in everyday conversations.

A trip to the park or a walk down the road are both excellent chances to introduce mathematical vocabulary. It is important to provide opportunities to use this vocabulary in real life situations. Children often get confused by mathematical words and this is where an adult using mathematical vocabulary in an understandable context is really important.

How many cars can you see parked on this side of the road? Are there fewer cars on the other side? Let's count how many lamp posts there are? How many steps do you think it will take you to reach that tree?

How many Smarties do you have? Has your sister got more or less than you? How many have you both got altogether? If I take away one how many will you have left? If I add two more how many will you now have?

Cooking is a great opportunity: We need 3 cups of flour; I have put in one how many more do we need? I need to put 4 cherries on the top of each cake. Can you count them out for me? How many cherries are there on three cakes?

The next step is for children to explore different number bonds (- that a number is made up of smaller numbers.)


Here is an example of Numicon being used to explore some of the number bonds that make up the number 10. Numicon is great to place in a stack because a 4 and a 6 is exactly the same size as a 10. A 3 and a 4 fit neatly over the top and match the shape of a 7 . Children can touch, move and then see that they are the same size. This leads to a deeper understanding of number.

When children are exploring this stage it is very important that any written calculations are supported by concrete visual aids.

In the case below children are working on finding different numbers that make ten and alongside each written sum there are Numicon resources to create a picture of each one.


Ten Frames and Number bonds


In the example above two different coloured counters are used to explore some of the different ways of making the number 6 .

As soon as children can see that 4 and 2 make 6 they are encouraged to swap the order around to see that 2 and 4 make 6 . This is a great opportunity to see that adding can be done in any order.

## A game to play: How many objects are there in the jar? (an estimation game)

Place a number of objects in a jar and ask your child to guess how many there are in there. (You could both guess and see who is closest). Mark each guess on a number line by circling the number. Then empty the jar and count up together how many there are and then record this on the number line too. You can now compare it to your estimate. How close were you? You can then try again by either adding more or less objects to the jar. In using language like "I am adding some more objects to the jar so will the new number get bigger or smaller?" you are helping your child to understand the language of Numeracy (bigger than, less than, greater than, fewer than etc). This game is fantastic especially if you use different objects each time in helping your child to develop a better visual understanding of what different numbers actually look like and how they compare to the numbers around them. It is very helpful when counting out objects to place them in an organised way-for example in twosbecause this helps the child to count them with greater accuracy and visualise the number itself.


Once children have a good understanding of recognising how many there are in any given number of objects then subtraction can be explored alongside addition. The two operations are closely linked together.

Children need as much practice counting backwards as they do forwards and this should be done aloud in exactly the same way as when they were counting forwards with a mixture of:

1) firstly, just naming the numbers in the right order.... $10,9,8,7,6$ etc
2) Secondly, being able to count objects starting with the total number and then counting backwards to zero moving the objects each time.

Numicon is helpful here because you can see exactly what is happening. If you have a 4 and a 3 resting on a 7 shape then it is easy to create a take away sum by removing one of the numbers and seeing what is left. What is important at this early stage is that any written sum is supported with visual aids. It helps children to comprehend that with subtraction numbers get smaller as they are literally taken away.

A great game to play: The bean game You need to play in a pair. To start you need to choose the same number of dried beans each ( 10 or less) and start by looking at them and agreeing that you have the right number. Partner 1 closes their eyes while partner 2 places some of the beans under their hand and leaves the remainder visible on the table. Partner 1 opens their eyes looks at the number of beans that are visible and then works out how many have been secretly placed under the hand. When a number has been said partner 2 lifts up their hand to show both piles to confirm how many there are in each pile and the total

## Taking bigger steps

Once counting in ones forwards and backwards has become a confidently learnt skill we can begin to think about multiplication. This starts with lots of practice at counting out loud in twos and tens. - both forwards and backwards.

It $s$ very important to create concrete pictures with multiplication and to make sure that children have a really good chance to experience what it actually looks like.


Here are 3 groups of 2
You can count each group of 2
This is $2+2+2$ which makes a total of 6


Here are 3 lots of 4
Each group can be easily seen
There is $4+4+4$ or three lots of 4


The next step is to begin to record



To create a language for numbers


We need to provide the language for the children to go with their pictures.
How many groups of 5 can you see? There are 4 lots of 5 or 4 groups of 5 . How many times did you place a 5 down? 4 times! 4 groups of 5 make 20 and this is the same as $5+5+5+5$.
$5+5+5+5$ is the same as $4 \times 5(x=$ groups of/lots of $) 4$ groups of 5
How many 4 are there? There are 3 lots of $4 \quad 4+4+4=12 \quad 3$ lots of 4 make 12 .
$4+4+4$ is the same as $3 \times 4$ ( 3 groups of 4 )


In creating strong, concrete visual images with Numicon it is possible to see the link between multiplication and division.

In the picture on the left it can be equally interpreted as being:
4 groups of 5 make $20(4 \times 5=20)$
or $(20 \div 5=4)$ There are 4 groups of 5 in 20
In the picture on the right it can be seen as 4 groups of 3 total $12(4 \times 3=12)$
or that there are 4 groups of 3 in $12(12 \div 3=4)$


Children can often naturally see and understand the numbers that are around them but it is the adult that needs to create the opportunity to provide the language to explain what is being explored together.

