

Withnell Fold Primary School



Progression in Bar Modelling

Bar Modelling in maths

What are bar models?

Bar models are pictorial representations of problems or concepts that can be used for any of the 4 main operations. They are also very helpful for fractions, percentages and ratio and proportion. In word problems bar models can help children to decide which operations to use or to visualise problems.

Bar models do not do the calculations for the children

The bar model needs to be taught using the principles of CPA (concrete, pictorial and abstract)

There is no rush to reach abstract

Although useful, bars don't need to be proportionally accurate although if a bar is representing 12 and another bar is representing 20, the 20 one should clearly be longer than the 12

How to teach addition word problems with bar models:

Pupils in EYFS and Year 1 will routinely come across calculations such as $4+3$. These types of questions are often presented as worded problems: Tommy has 4 apples and Lucy has 3. How many do they have altogether? It is vital that they use concrete apparatus in order to understand the process. They can use pre-printed bars.

? total	
	

Use counters in each section and move up to the total line. When children are ready to move from concrete, they can move to pictorial representations, then drawing numbered squares and finally just using numbers.

? total						
						

? s apple	
4 apples	3 apples

Although it is helpful if bar models are proportionally accurate, it is not something to get hung up on. Just try to ensure that the bigger number is represented by the bigger segment.

How to teach subtraction word problems with bar models:

The same concrete to pictorial to abstract stages need to be applied to subtraction in the same way as they were in addition. The method can be taught using the part-part-whole method or the find the difference model.

Toby has 18 bricks. He used 15 pieces to build a tower. How many pieces does he have left?

18	
15	?

Calculation: $18 - 15 =$

Toby has 18 bricks. Charlie has 3 bricks. How many more bricks does Toby have than Charlie?

18	
?	3

Calculation: $18 - 3 =$

How to teach multiplication word problems with bar models:

Bar models of multiplication start with the same 'real' and 'representative counters' stages as addition and subtraction. Then moves to its final stage, drawing rectangular bars to represent each group (it is necessary to understand multiplication as repeated addition).

Each box contains 5 cookies. Harry buys 4 boxes. How many cookies does Harry have?

?			
5	5	5	5

How to teach division word problems with bar models:

Children do need to be clear about the difference between grouping and sharing and need to be clear about bar modelling before they start. As always, use concrete apparatus to support the maths.

Grace has 27 lollies. She wants to share them into 9 party bags for her friends. How many lollies will go into each bag?

27								
3	3	3	3	3	3	3	3	3

Calculation: $27 \div 9$

Grace has 27 lollies. She wants each friend to have 3 lollies. How many friends can she invite?

Calculation: $27 \div 3$

Progression in bar modelling form KS1 to KS2:

Once children are clear about how to use bar models for the 4 operations needed at KS1 we can teach children how to use the bar model for a deeper understanding of more complex problems. The key question at any stage, at any age, is what do we know? By teaching children to ask this when presented with word problems themselves, they will be able to become quickly independent at drawing their own bar models – think of them like a jotting.

EG: Egg boxes can hold 6 eggs. We need to fill 7 boxes. How many eggs do we need? We know that there will be 7 boxes, so we know we can draw 7 rectangular bars under the one long bar which represents the missing information. We know that each box holds 6 eggs, so we can write 6 or 6 eggs in each of the 7 bars. From this they can see that they need to use multiplication or repeated addition to solve the problem.

?						
6	6	6	6	6	6	6

Bar models in KS2:

A bag of 5 lemons cost £1. A bag of 4 oranges costs £1.80. How much more does one orange cost than 1 lemon?

‘What do we know?’

£1.80 (oranges)			
45p	45p	45p	45p

£1.00 (lemons)				
20p	20p	20p	20p	20p

So, the difference is: $45p - 20p = 25p$

How to teach using the bar model for word problems with fractions:

Clearly children must understand the link between fractions and division before doing word problems.

Eg: On Saturday, Lara read two fifths of her book. On Sunday, she read the other 90 pages to finish the book. How many pages are there in Lara’s book? ‘What do we know?’

? pages				
30	30	30	30	30

← 90 pages on Sunday →

- I know 90 pages = $\frac{3}{5}$
- As fractions are about equal amounts, I know the other $\frac{1}{5}$ ’s are 30 pages each (Saturday)
- Pages in the book = 30×5

Use in exactly the same way for ratio and proportion.

How to teach equations with the bar model:

$2b + 15 = 27$ What is the value of b ?

27		
b	b	15

← 12 →

From this we can see that $27 - 15 = 2b$

So, we can see $b = 6$

$2a + 7 = a + 11$

So, what do we know?

← 4 →

a	a	7
a	11	

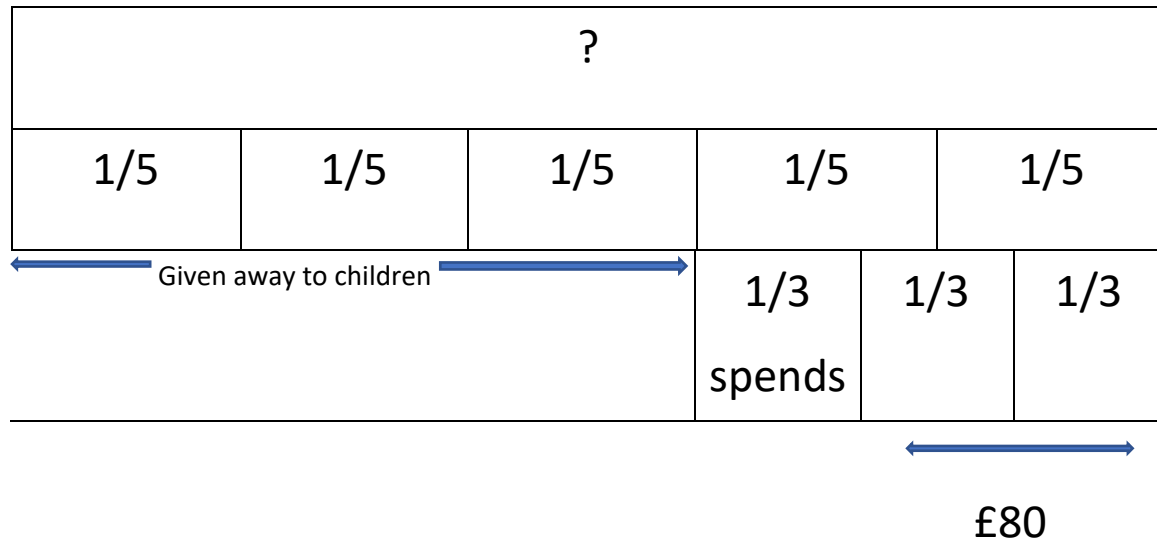
- From this we can easily see that $7 + a = 11$ so therefore $a = 4$. Once we know that we know the value of all of the a 's is 4. So, to prove this is true:

$$4 + 4 + 7 = 15 \text{ and } 4 + 11 = 15$$

Sometimes problems are even more complex and you may need more than 2 rows on your bar model.

EG: Toby wins first prize for his cake version of the Eiffel Tower. He gives $\frac{3}{5}$ of his winnings to his children and spends a $\frac{1}{3}$ of what he has left. He has £80 left. How much money did he win?

'What do we know?'



- I know that $\frac{2}{3} = £80$ so $\frac{1}{3} = £40$
- From that I can tell that $\frac{2}{5} = £120$ which means that $\frac{1}{5} = £60$
- He won $5 \times £60 = £300$