The power of Bar Modelling: Paul Rowlandson, White Rose Maths Hub Lead

People often ask me, *"Why do you like bar modelling so much?"* I've probably given quite a lot of different answers to this over the years, but I think my best answer to this is, *"When I want students to think about something new, bar models give them something to think with."* They empower students to not just consume mathematics through rote procedures, and provides them with the tools to think about mathematical ideas in depth.

Predictably, the next question I'm usually asked is, *"How can they do this?"* To help answer this, I've described my three main pieces of advice to teachers when using bar modelling.

1. **Bar models are not new ways of doing calculations.**

    The first thing to establish is that bar modelling is not the new grid method or a replacement for methods of division. In fact, its role is to strengthen students' understanding of these procedures; rather than replacing calculations, bar models should accompany them. More than anything, they help turn abstract ideas into something more tangible so that students can *see* what happens to the numbers when they perform calculations.

    Take for example the idea of division as sharing. A model for representing $12 \div 3 = ?$ as 'twelve shared between three' could look something like this:
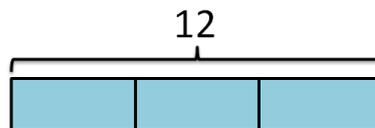

    This model won't necessarily help students get the answer; they may still have to draw upon other strategies such as placing dots in the boxes or thinking, *"Three lots of what give me twelve?"* But the diagram provides students with a way in to think about these things and once they have completed the calculation, they can see what the division has done to the twelve.
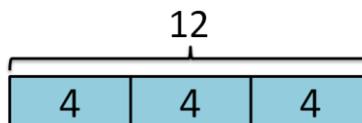
    I find their biggest strength is for questions that require more than one calculation. The diagram helps them determine, *"What could I do?"*, *"Why I'm doing that?"* and *"What happens when I do it?"* We could explore these questions with fractions of amounts.

    $$\frac{2}{3} \ of \ 12 = ?$$
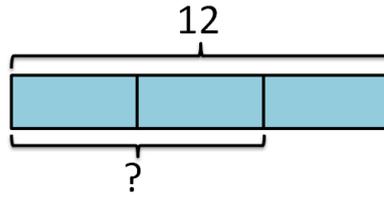
Q: What could I do?
A: I could start by dividing twelve by three.
Q: Why am I doing that?
A: Because there are three equal parts that make up the twelve.
Q: What happens when I do it?
A: The twelve gets split into three thirds and each part gets four.

Q: What could I next?
A: I could multiply my answer by two.
*Q: Why am I doing that?*
A: Because I need two parts.
Q: What happens when I do it?
*A: I go from having one third as four to having two thirds as eight.*

2. **Bar models can highlight links between topics.**

When the diagrams for addition and multiplication look different, it can be difficult to see how these two concepts are similar. That's not to say that students should only ever see bar models; having a variety of ways to think about a concept is important too. However, having a consistent structure that runs throughout the curriculum can make seeing the interconnectivity of mathematics that little bit easier.
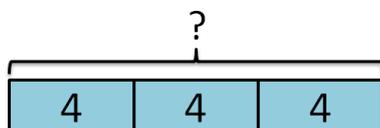
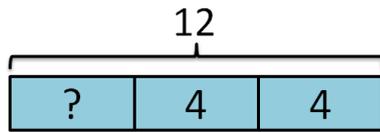To illustrate this, let's look at the following model:
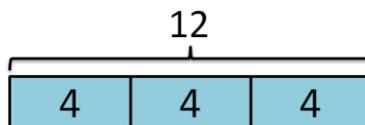
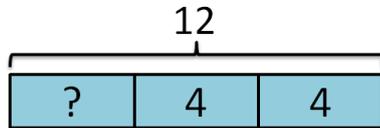By concealing different parts of the diagram, the same model can be used for a whole range of calculations.
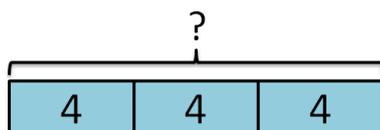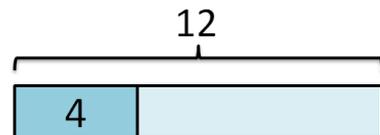

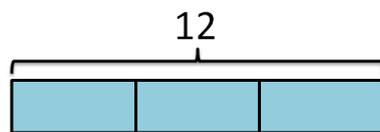$$4 + 4 + 4 = ?$$

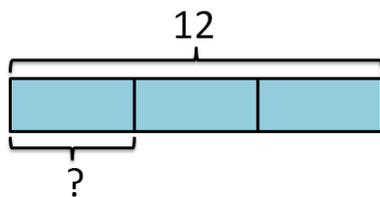$$4 \times 3 = ?$$

$$12 - 4 - 4 = ?$$

$$12 - (4 + 4) = ?$$

$$12 \div 4 = ?$$
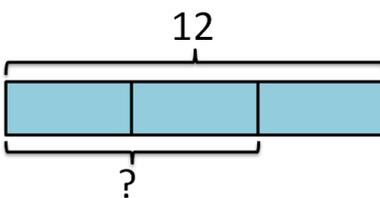*How many fours go into twelve?*
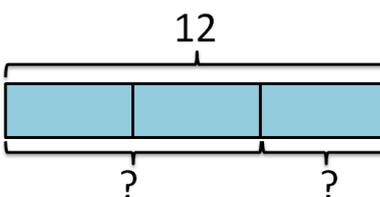
$$12 \div 3 = ?$$
What is twelve shared between three?

$$\frac{1}{3} \ of \ 12 = ?$$

$$\frac{2}{3} \ of \ 12 = ?$$

Divide 12 *in the ratio* $2 : 1$

3. Bar models provide a backdrop for questioning.

Providing a bar model alone to a student won't necessarily cause them to have an epiphany (although that's not to say that it won't). However, it gives students something to talk about and something to think with when they are trying to make sense of a new concept. To make the most of this, teachers can question the students about the reasons and meanings behind calculations while using a bar model a point of reference.

Some generic questions may be things like these…

- *"How could we represent this question with a diagram?"*
- *"What would our whole bar represent?"*
- *"Looking again at the question, how is each number represented in our diagram?"*
- *"Where on our diagram would we find the answer to this question?"*
- *"What calculation could we do first?"*
- *"Why might we want to do that?"*

Want to find out more about Bar Modelling?

Then book a place at our national Bar Modelling Conference in Manchester on 16 February 2017! We are joined all the way from the USA by expert and author of *'Step-By-Step Model Drawing: Solving Word Problems the Singapore Way'*, Char Forsten.
To find out more, go to whiterosemathshub.co.uk/bar-modelling-conference