Part-Whole Model

$$7 = 4 + 3$$
$$7 = 3 + 4$$

$$7 - 3 = 4$$
$$7 - 4 = 3$$

Benefits

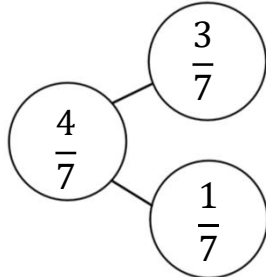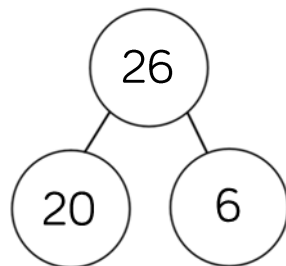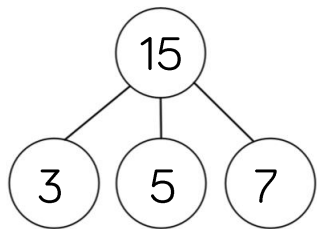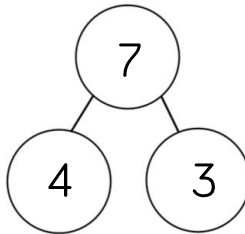This part-whole model supports children in their understanding of aggregation and partitioning. Due to its shape, it can be referred to as a cherry part-whole model.

When the parts are complete and the whole is empty, children use aggregation to add the parts together to find the total.

When the whole is complete and at least one of the parts is empty, children use partitioning (a form of subtraction) to find the missing part.

Part-whole models can be used to partition a number into two or more parts, or to help children to partition a number into tens and ones or other place value columns.
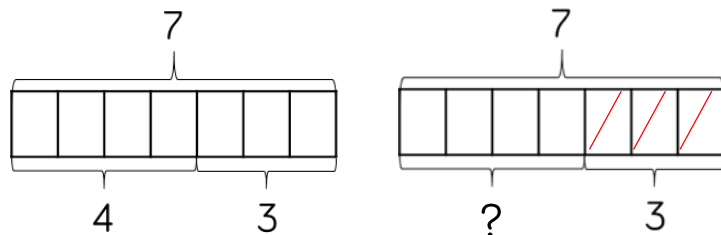
In KS2, children can apply their understanding of the part-whole model to add and subtract fractions, decimals and percentages.
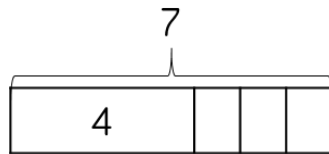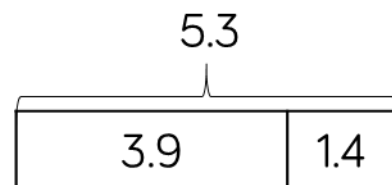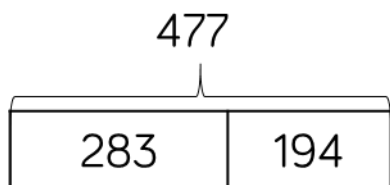
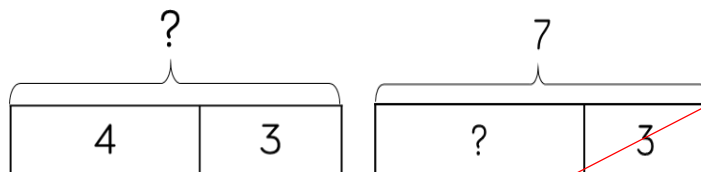# Bar Model (single)

Concrete

Discrete

7

| | | | | | | |

4   3

7

| | | | | / / / |

?   3

Combination

7

| 4 | | | |

Continuous

?

| 4 | 3 |

7

| ? | 3 |

477

| 283 | 194 |

5.3

| 3.9 | 1.4 |

Benefits

The single bar model is another type of a part-whole model that can support children in representing calculations to help them unpick the structure.

Cubes and counters can be used in a line as a concrete representation of the bar model.

Discrete bar models are a good starting point with smaller numbers. Each box represents one whole.

The combination bar model can support children to calculate by counting on from the larger number. It is a good stepping stone towards the continuous bar model.

Continuous bar models are useful for a range of values. Each rectangle represents a number. The question mark indicates the value to be found.
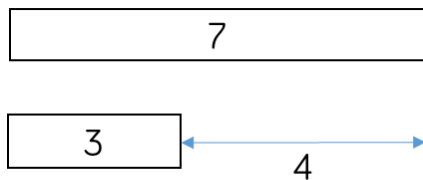
In KS2, children can use bar models to represent larger numbers, decimals and fractions.
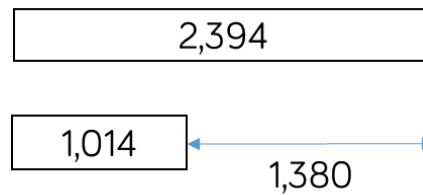
Bar Model (multiple)

Discrete

$$7 + 3 = 10$$

10

$$7 - 3 = 4$$

4

Continuous

7

3
4

$$7 - 3 = 4$$
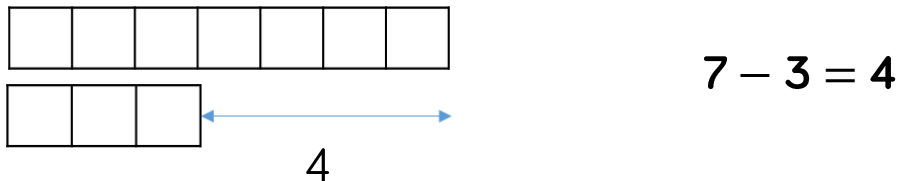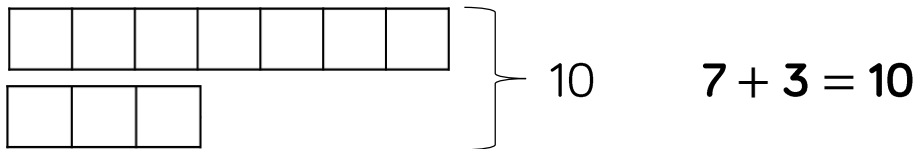
2,394

| 1,014 |
|---|
1,380

$$2{,}394 - 1{,}014 = 1{,}380$$

Benefits
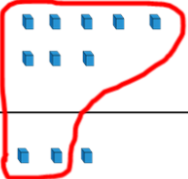
The multiple bar model is a good way to compare quantities whilst still unpicking the structure.

Two or more bars can be drawn, with a bracket labelling the whole positioned on the right hand side of the bars. Smaller numbers can be represented with a discrete bar model whilst continuous bar models are more effective for larger numbers.

Multiple bar models can also be used to represent the difference in subtraction. An arrow can be used to model the difference.

When working with smaller numbers, children can use cubes and a discrete model to find the difference. This supports children to see how counting on can help when finding the difference.

Base 10/Dienes (addition)

Tens	Ones

$$38$$
$$+\ 23$$
$$\overline{61}$$
$$1$$

Hundreds	Tens	Ones

$$265$$
$$+\ 164$$
$$\overline{429}$$
$$1$$

Benefits

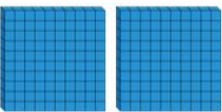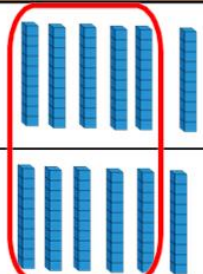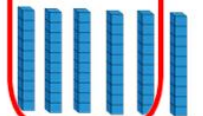Using Base 10 or Dienes is an effective way to support children's understanding of column addition. It is important that children write out their calculations alongside using or drawing Base 10 so they can see the clear links between the written method and the model.

Children should first add without an exchange before moving on to addition with exchange.. The representation becomes less efficient with larger numbers due to the size of Base 10. In this case, place value counters may be the better model to use.

When adding, always start with the smallest place value column. Here are some questions to support children.
How many ones are there altogether?
Can we make an exchange? (Yes or No)
How many do we exchange? (10 ones for 1 ten, show exchanged 10 in tens column by writing 1 in column)
How many ones do we have left? (Write in ones column)
Repeat for each column.

Base 10/Dienes (subtraction)

Tens	Ones

$$\begin{array}{r} \overset{5}{\cancel{6}}\overset{1}{5} \\ -\ 28 \\ \hline 37 \end{array}$$

Hundreds	Tens	Ones

$$\begin{array}{r} \overset{3}{\cancel{4}}\overset{1}{3}5 \\ -\ 273 \\ \hline 262 \end{array}$$
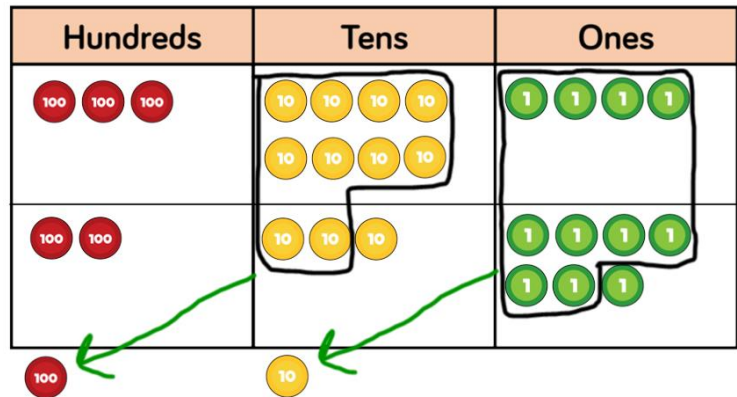
Benefits

Using Base 10 or Dienes is an effective way to support children's understanding of column subtraction. It is important that children write out their calculations alongside using or drawing Base 10 so they can see the clear links between the written method and the model.

Children should first subtract without an exchange before moving on to subtraction with exchange. When building the model, children should just make the minuend using Base 10, they then subtract the subtrahend. Highlight this difference to addition to avoid errors by making both numbers. Children start with the smallest place value column. When there are not enough ones/tens/hundreds to subtract in a column, children need to move to the column to the left and exchange e.g. exchange 1 ten for 10 ones. They can then subtract efficiently.

This model is efficient with up to 4-digit numbers. Place value counters are more efficient with larger numbers and decimals.

Place Value Counters (addition)

384
+ 237
621
  1 1

3.65
+ 2.41
6.06
   1

Benefits

Using place value counters is an effective way to support children's understanding of column addition. It is important that children write out their calculations alongside using or drawing counters so they can see the clear links between the written method and the model.
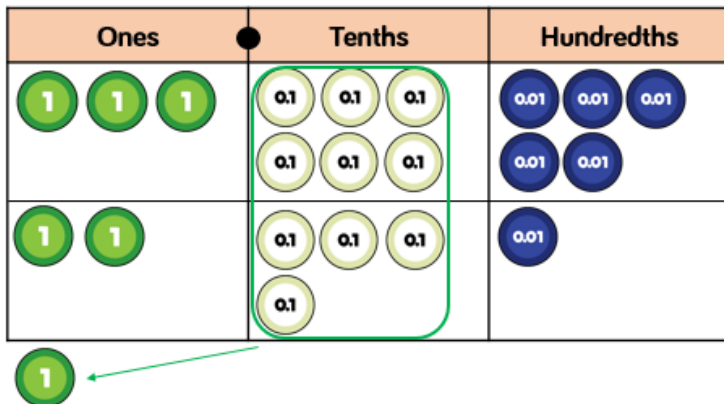
Children should first add without an exchange before moving on to addition with exchange. Different place value counters can be used to represent larger numbers or decimals. If you don't have place value counters, use normal counters on a place value grid to enable children to experience the exchange between columns.

When adding money, children can also use coins to support their understanding. It is important that children consider how the coins link to the written calculation especially when adding decimal amounts.

Place Value Counters (Subtraction)

$$
\begin{array}{r}
6\overset{4}{\cancel{5}}\overset{1}{2} \\
-\ 207 \\
\hline
445
\end{array}
$$

$$
\begin{array}{r}
\overset{3}{\cancel{4}}\overset{1}{3}57 \\
-\ 2735 \\
\hline
1622
\end{array}
$$

Benefits

Using place value counters is an effective way to support children's understanding of column subtraction. It is important that children write out their calculations alongside using or drawing counters so they can see the clear links between the written method and the model.

Children should first subtract without an exchange before moving on to subtraction with exchange. If you don't have place value counters, use normal counters on a place value grid to enable children to experience the exchange between columns.

When building the model, children should just make the minuend using counters, they then subtract the subtrahend. Children start with the smallest place value column. When there are not enough ones/tens/hundreds to subtract in a column, children need to move to the column to the left and exchange e.g. exchange 1 ten for 10 ones. They can then subtract efficiently.