

## Handout 1

### Structure of Wave 3 mathematics materials

In order to exemplify progression in calculation, Reception, Year 2, Year 4 and Year 6 have been chosen as representative milestones. Under each year group heading, associated knowledge and skills that contribute to understanding of the year group key objective are listed. (See first column of tracking chart.)

The whole primary age range is represented in the progression in the chart. The year group labels provide a convenient link to the National Numeracy Strategy *Framework for teaching mathematics* progression in number and calculation. As they use the chart, teachers will need to 'track back' to find the error or misconception appropriate for the child, **irrespective of the year group to which it is attributed in the progression.**

### Tracking charts

1 Tracking children's learning through the NNS Framework for teaching mathematics (addition and subtraction)

Year 6 key objective	Associated knowledge and skills	Errors and misconceptions	Questions to identify errors and misconceptions	Teaching to address the errors and misconceptions	Next steps in moving towards the key objective
Carry out column addition and subtraction of numbers involving decimals (NNS Framework for teaching mathematics, Supplement of Examples, Section 6, pages 48, 51)	Apply knowledge of the number system to enable efficient counting of a large number of objects. Add and subtract multiples of ten, a hundred and a thousand. <b>1 Y6</b>	Has inefficient counting strategies and/or insecure understanding of the number system. <b>1 Y6 +/-</b>	Imagine you have a money box containing 2p and 1p coins. What do you think would be a good way to count these quickly to find out how much money there is? What is $60 + 20?$ ... $80 + 30?$ ... $60 + 40?$ What changed when you found $60 + 40?$ What is $40 + 40?$ ... $400 + 40?$ Which answer is the larger? How is the calculation $40 + 400 + 4000$ different from the others? What is $60 - 20?$ ... $600 - 200?$ ... $6000 - 2000?$ Explain how you worked these out. What is $6000 - 200?$ ... $6000 - 20?$	Practical opportunities to develop efficient counting strategies for a range of objects, for example coins, cubes, counters, collectable cards, etc. Count forwards and backwards in tens, hundreds and thousands from different starting points, including starting numbers that are not multiples of ten or a hundred. Use an empty number line to support this development. Order multiples of a hundred and a thousand. Use number squares and/or number lines to consider the order and comparative value of numbers to support rounding.	Carry out simple calculations that involve crossing the boundary from hundreds to one thousand and vice versa, supported by an empty number line and extending this to a visualised image to develop mental calculation. Consider pairs of items from a catalogue and ask child to estimate whether a £10 (or £20, etc.) note would be enough to buy both the items?
	Give approximate by rounding to determine whether the answer to a calculation is sensible. <b>2 Y6</b>	Rounding inaccurately, particularly when decimals are involved, and having little sense of the size of the numbers involved. <b>2 Y6 +/-</b>	Is 26 nearer to 20 or 30? Is 271 nearer 270 or 280? Is 1.8 nearer to 1 or 2? Draw a sketch to illustrate your answer and explain how you know.		

2 3 4 5 6 7

- 1 Key objective.
- 2 This column lists associated knowledge and skills that contribute to understanding of the key objective.
- 3 Common errors and misconceptions linked to specific knowledge and skills are listed to support diagnosis of children's difficulties.
- 4 Questions in this column can be used to help the teacher decide where the child's difficulties lie.
- 5 Examples of the types of teaching activity in the A4 booklets (see below).
- 6 This column provides ideas to develop when the child has improved their understanding of the identified difficulty. The teacher can make use of these ideas to consolidate understanding and extend thinking.
- 7 Code referencing to an A4 teaching unit.

### A4 booklets – teaching units

The structure of each booklet is as follows:

- focus error/misconception;
- opening teaching activity addressing error/misconception;
- a number of Spotlights (short focused teaching activities from which to select);
- final Spotlight, which includes assessment opportunities, often encompassed in a game, key vocabulary checklist, and intended learning outcomes list;

## Opening teaching activity

## Spotlight

**Has insecure understanding of the structure of the number system, resulting in addition and subtraction errors and difficulty with estimating**

**Opportunity for developing mental images**

**Resources**

- Two sets of number cards 0-9 (Resource sheet 1)
- 100-square
- Place value blocks
- Long number line (or number line)
- Sticky notes
- Bundles of straws or other Base 10 equipment
- To count for counting

**Key vocabulary**

- digit
- larger/smaller
- more than
- less than
- units
- ones/hundreds/thousands
- column
- estimate
- guess
- more/less than
- subtle
- after
- rounding to the nearest
- thousand

**Teaching activity**

We are going to be working with numbers today, but some numbers are larger or smaller and we are going to count on a long number line. This work will help you with estimating and with doing more calculations.

Lay out the two sets of number cards 0-9 on the table.

**1 Can you make the numbers thirty-three and thirty-four?**

Support the child to make:

**2 Which is the larger number, forty-three or thirty-four?**

If the child knows which is larger, move on.

If the child doesn't know which is larger, you could count with the child from 100 on a 100-square, pointing out the thirties and the forties.

Then change the numbers to 40 and 30.

Count tens with the child on the 100-square, establishing that if you had forty sweets you would have more than thirty sweets because forty is more than thirty.

Then you will need to make some more two-digit numbers and repeat the activity before you move on.

**Note:** If the child seems to have problems crossing boundaries, see 112-113. If the child seems unsure of numbers, you might want to check that the child can count a large place value so that you can assess their counting skills (see also 115-116).

Display a long number line, say up to four hundred. (You could stick masking tape on the floor or wall and write the numbers along it. You will need to use the number line throughout this set of activities.) Ask the child to position the numbers on the line with sticky notes or paper.

**Time 10-15 minutes**

**Problem-solving emphasis**

**Suggested time**

**Activity title (for Spotlights)**

**Key vocabulary**

**Resources**

**Teaching activity**

**Error/misconception heading**

**Spotlight 2**

**Has insecure understanding of the structure of the number system, resulting in addition and subtraction errors and difficulty with estimating**

**Opportunity for developing mental images**

**Resources**

- Calculator each
- Large board or other screen
- Number line

**Key vocabulary**

- digit
- larger/smaller
- more than
- less than
- units
- ones/hundreds/thousands
- column
- estimate
- guess
- more/less than
- subtle
- after
- rounding to the nearest
- thousand

**Teaching activity**

Today we are going to do some more work on place value and where numbers go on the number line. We will be using the thinking about numbers that we saw. So if you see a zero, tell me and I will record the number for later.

**1 Can you see any numbers with zeros on the number line?**

Follow with the children, giving experience of reading numbers such as three hundred and six.

Prop up a large board so that you can enter numbers secretly.

**2 How many tens to key in three hundred and forty-two on your calculator and will do the same on mine. How many look the same as mine?**

Then you add a one-digit number, such as 3, and show the child your calculator.

**3 What do you think I did to three hundred and forty-two to get to that number?**

If the child isn't sure you will need to do some further adding and subtracting of one-digit numbers.

**4 Can you make your number the same as mine in one move? (Meaning an operation key, a number and the equals key)**

**5 What did you do to make your number the same as mine?**

Repeat until the child understands how to add and subtract single-digit numbers.

Record any numbers you see that have a zero in them.

Then subtract all the tens from the number secretly.

Show the child your screen.

**6 What subtraction will take away the four? (Signal to the child that you have a number with a zero in and record that for later use.)**

**Time 10-15 minutes**

Specific icons are used to improve access to the text:

### Icons

**?** Questions are incorporated for teachers to select from and add their own as appropriate.



Whole-class follow-on activity.



Symbol reminding of the necessity to estimate, calculate, then check.



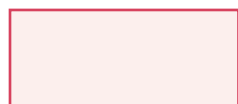
This variation of the game is harder.



This variation of the game is easier.

$$12 \times 2 = 24$$

Text within this symbol indicates an opportunity for recording.



Text within a shaded box indicates alternative approaches for a child who is having difficulty with the activity.



Additional game at the end of some teaching units.