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 (arrow) cards
- Long number line (or masking tape)
- Sticky notes
- Bundles of straws or other Base 10 equipment
- 1p coins for counting

Key vocabulary

digit	column order
larger/largest	estimate
smaller/smallest	guess
more than	nearer/nearest
less than	before
units	after
ones/tens/hundreds/ thousands	rounding to the nearest ten/hundred

Teaching activity

Time 15–20 minutes

'We are going to be working with numbers today, deciding which numbers are larger or smaller, and we are going to order them on a long number line. This work will help you with estimating and with getting more calculations correct.'

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

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

Support the child to make:

4	3

3	4

? **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 up to 100 on a 100-square, pointing out the thirties and the forties.
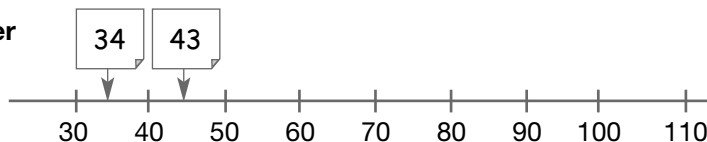>
> Then change the numbers to 40 and 30.
>
> Count in tens with the child on the 100-square, establishing that if you had forty sweets, you would have more than thirty sweets because forty is more than thirty.
>
> Then you will need to make some more two-digit numbers and repeat the activity before you move on.
>
> *Note*: If the child seems to have problems crossing boundaries, see *1 Y2 +/−*. If the child seems unsure of numbers, you might want to check that the child can count a large pile of coins so that you can assess their counting skills (see also *1 YR +/−*).

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.

? **Does thirty-four come before or after forty? So is thirty-four smaller or larger than forty?** *(And so on.)*

[34] [43]

30 40 50 60 70 80 90 100 110

> If the child is struggling with this, position quite a few numbers, checking that they know how to write numbers such as fifty-seven and can distinguish this from seventy-five.
>
> If the child seems not to understand, use the 100-square and/or place value cards to clarify tens and ones, positioning more numbers on the number line and making the link to a number line to thirty that the child is familiar with in class.

Make some of the numbers with Base 10 equipment such as bundles of straws, ten rods, or other familiar Base 10 equipment.

? **How could you make forty-three with these straws?**

If the child can do that confidently and name the number accurately, move on.

> If the child is having problems with models of the structure of the number system, you do need to move on to assess their understanding of three-digit numbers and return to this in Spotlight 3.

With number cards, make two three-digit numbers.

| **1** | **4** | **3** | | **1** | **3** | **4** |

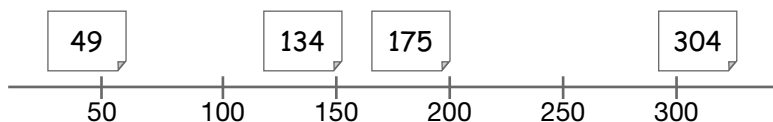**?** **What are these numbers?**

? **Which is larger?**

> If the child is unclear, again use two zero cards to make one hundred and forty and one hundred and thirty.
>
> Count in tens with the child from zero to one hundred and forty and back again, establishing that one hundred and thirty is smaller than one hundred and forty.

Position some three-digit numbers on the number line.

If the child is successful with this, move on to some early work on estimating, using a number line marked as an image to support the child's understanding.

[49]   [134] [175]   [304]

50   100   150   200   250   300

? **Is forty-nine closer to fifty or closer to one hundred?**

? **If you doubled forty-nine, would your answer be closer to fifty or closer to one hundred?**

? **Is one hundred and thirty-four closer to one hundred or closer to two hundred?**

? **What did you learn today that was new for you?**

Note: Estimating is a theme through the Year 4 and Year 6 activities.

Spotlight 1

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

Opportunity for: making decisions

∙ ∙

Your number, my number

Time 15–20 minutes

Resources

● Number line
● Three sets of digit cards (Resource sheet 1)
● Place value (arrow) cards

Key vocabulary

digit	ones/tens/hundreds/thousands	order
larger/largest	column	before
smaller/smallest	estimate	after
more than	guess	rounding to the nearest ten/hundred
less than	nearer/nearest	
units		

Teaching activity

'We're going to play a game today with these digit cards, but first I want you to tell me what we did last time with this long number line.'

Follow on from what the child says, going over naming numbers on the number line and their order, including naming numbers in the three hundreds.

Then move on to the game with three-digit numbers, making these two three-digit numbers.

Your number

3		7

My number

3	6	7

Give the child a set of digit cards 0–9 and explain the game. Their number has a turned over card in the middle; your number is complete.

[?] **What is my number?**

[?] **If you put the number nine on your turned-over card, what number will you make?** *(Three hundred and ninety-seven)*

[?] **Is that number larger or smaller than my number?** *(Larger.)*

> If the child needs more support, let them try different digit cards in the middle of their number, naming them and ordering them on the number line.
>
> It might also help to make the numbers with place value cards, emphasising how many hundreds, tens and ones.
>
> If you can, help them to see which of their numbers are smaller than yours and which are larger. Then mark your number on the number line and play the game.

To play the game, ask the child to follow each of these rules in order to make a new number:

[?] **Make your number bigger than my number.** *(For example, three hundred and eighty-seven.)*

[?] Make your number smaller than my number. *(For example, three hundred and twenty-seven.)*

[?] Make your number the biggest it can be. *(Three hundred and ninety-seven – not allowing the seven units to be changed.)*

[?] Make your number the smallest it can be. *(Three hundred and seven)*

[?] Make your number as close to mine as you can. *(It could be the same.)*

[?] Which other card could you have chosen to make your number close to mine? *(For example, three hundred and fifty-seven.)*

Record on a number line some of the numbers they make in response to the prompts and ask some estimating and rounding questions.

[?] Is three hundred and eleven closer to three hundred or closer to four hundred?

[?] Which hundred is three hundred and eighty-nine closer to, three hundred or four hundred?

[?] If you had to estimate what three hundred and eleven and three hundred and twelve made altogether, would your estimate be six hundred or seven hundred?

'You are getting good at ordering numbers on the number line and deciding which hundred the numbers are close to.'

Note: Developing children's estimation skills plays an important role in improving calculation skills.

Spotlight 2

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

Opportunity for: reasoning about numbers

• •

Place value on the calculator   **Time** 10–15 minutes

Resources

● Calculator each
● Large book or other screen
● Number line

Key vocabulary

digit	ones/tens/hundreds/thousands	order
larger/largest		before
smaller/smallest	column	after
more than	estimate	rounding to the nearest ten/hundred
less than	guess	
units	nearer/nearest	

Teaching activity

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

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

Follow what the child says, giving experience of reading numbers such as three hundred and six.

Prop up the large book so that you can enter numbers secretly.

? Now I want you to key in three hundred and forty-two into your calculator and I will do the same on mine. Does yours look the same as mine?

`342`

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

? 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.

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

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

`345`

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

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

Then subtract all the tens from the number secretly.

`305`

Show the child your screen.

? 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.)*

Many children at this point will subtract four, not realising they need to subtract forty.

> If the child consistently subtracts one-digit numbers instead of tens and hundreds, make the number with place value cards, showing how many tens and hundreds.
>
> Remember to name numbers with zeros in full.

Continue with subtracting the three hundred, then repeat with other numbers.

Make a collection of numbers with zeros in, recording them for next time.

> Calculators can help enormously when exploring place value. If the child has struggled with this task, give them more calculator time during class when you can set small tasks, such as adding three hundred and one and three hundred and one.

'Enter nineteen thousand, four hundred and eighty-five into your calculator.'

$$19\,485$$

? **In one move, change it to eleven thousand, four hundred and eighty-five.**

? **What did you need to subtract?**

Spotlight 3

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

Opportunity for: making connections

● ●

Hunt the zeros   **Time** 15–20 minutes

Resources

- Record of numbers with zeros from Spotlight 2
- Number line from earlier
- Large paper or whiteboard that you can keep for a while, prepared with some column names
- Place value (arrow) cards
- Money, including notes
- Bundles of straws and any other Base 10 equipment
- Number cards 0–9 (Resource sheet 1)

Key vocabulary

digit	estimate
larger/largest	guess
smaller/smallest	nearer/nearest
more than	order
less than	before
units	after
ones/tens/hundreds/ thousands	rounding to the nearest ten/hundred
column	

Teaching activity

'We're going to find out where to put these zero numbers on the number line and on a big chart.'

Start to position and name the numbers with zeros, for example one hundred and two.

?   **Where will we put this number on the number line?**

> If the child has had problems naming and ordering numbers, go over some of the numbers already on the number line and add some more, checking that they can name them and position them.

On the whiteboard or large paper start to draw Base 10 place value columns, naming them. Place the chart horizontally so that the child can put items onto it.

Now, or at a later time in the lesson, choose a digit card, such as 3, and show how the magnitude of the numbers changes depending on where you put the 3. So, if you put it in the tens column it means three tens, thirty. If you put it in the units column, it means three units. Where you put it changes the value of the digit.

Talk through some of the equipment you have and ask the child which column these items might go in.
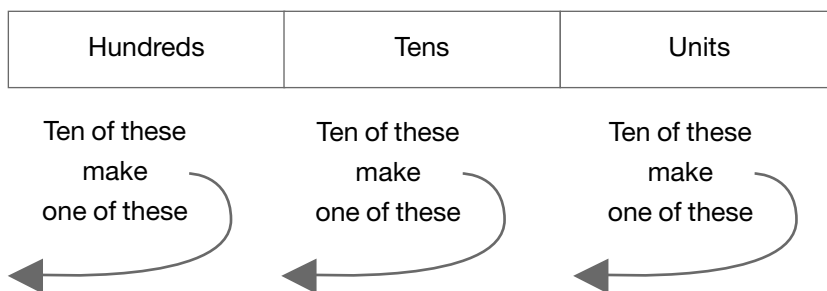

Hundreds of thousands	Tens of thousands	Thousands	Hundreds	Tens	Units (ones)
		1 0 0 0		10	1

?   **Where shall we put the 1p coin?** *(The column on the right that is ones or units.)*

?   **Where shall we put a 10p coin?**

? What is ten times bigger than 10p? *(One pound, one hundred pennies, and it goes in the hundreds column.)*

You need to explain that each column just to the left of another column holds numbers ten times larger, that is:

Hundreds	Tens	Units

Ten of these make one of these → Ten of these make one of these → Ten of these make one of these →

Now ask the child to place some items onto the chart. So, for example:

● a bundle of ten straws goes in the tens column;

● a £10 note is a thousand pennies so it goes in the thousands column;

● a Base 10 equipment 'block' goes in the thousands column.

Put place value cards in appropriate columns, focusing particularly on the zeros.

> You might find you need to repeat this session a few times with some children. You might find it helpful to put some number cards onto the columns to read numbers. For example, the digit nine in the tens column would mean ninety and we place a zero in the ones column as a place holder.

Explore some of the numbers on place value cards.

1	**0**	**0**

? Tell me what each of the digits in this number is worth?

? Why do you think there are zeros? *(To 'hold' the place in those two columns that are empty.)*

Clarify that if one hundred didn't have the zeros, we would write '1', but we would call that 'one'!

10 means one ten and no ones.

100 means one hundred, no tens, no ones.

Return to naming the numbers with zeros.

? What did you learn today?

Note: You might want to take the place value columns and equipment back to class because some higher achievers don't always make connections to the structure of the number system, despite being able to calculate reasonably well.

? My number has six zeros and one digit 3. What could my number be? *(This is likely to raise the issue of how appropriate a number such as 0000003 is.)*

Spotlight 4

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

Opportunity for: solving real-life problems

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Ordering money   **Time** 15–20 minutes

Resources

● Number cards 0–9
  (Resource sheet 1)
● Money
● Number line
● Place value (arrow) cards
● Sticky notes

Key vocabulary

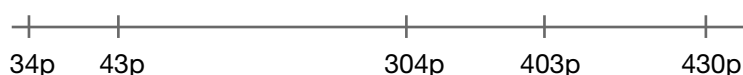|		
digit	ones/tens/hundreds	order
larger/largest	/thousands	before
smaller/smallest	column	after
more than	estimate	rounding to the nearest
less than	guess	ten/hundred
units	nearer/nearest	

Teaching activity

'This lesson is about money amounts and which amounts are more or less than other amounts. We will be doing some estimating as well.'

? Which is more, 46p or 64p?

> If the child is unsure about this you will need to make more two-digit amounts of money and order them on a number line.

With the sets of digit cards, select some 3s, 4s and zeros and work with the child to make some amounts of money, for example: 34p   43p   430p   403p   304p

You might find that place value cards help with this. You could write the amounts on sticky notes so that you can order them, or write the amounts straight onto the number line, for example:

```
  +----+------------+-----+------------+------------+-----+
  34p  43p          304p  403p         430p
```

? Now you mark in about where 100, 200, 300 and 400 go. Is 400 more or less than 403?

? What amount of money could I put between 304p and 403p? *(For example, 320p.)*

? What is that amount of money *(for example, 403p)* **to the nearest pound/nearest hundred pennies?**

? Would you round 403p to 400p, or is it nearer to 500p?

? What is 34p rounded to the nearest 10p?

Repeat with several rounding and ordering questions.

? If you added 43p and another 43p, would you have nearly £1 or nearly £2?

? What number would you add to 49p to make 100p?

? How much would you add to 347p to make 367p?

Ask more addition and subtraction questions.

? What do you think you did well today?

Spotlight 5: a learning check

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

Opportunity for: explaining and discussing

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Calculator zapping

Time 5–15 minutes

Resources

- Calculator each
- At least two children, or the whole class

Check: does the child use key vocabulary?

digit	ones/tens/hundreds /thousands	order
larger/largest		before
smaller/smallest	column	after
more than	estimate	rounding to the nearest
less than	guess	ten/hundred
units	nearer/nearest	

Teaching activity

'This game, **Calculator zapping**, will help you with understanding place value, and that will improve your estimating and your calculating.'

Each child needs a calculator.

How to play

1. Tell the children which number to key in, for example, 'four hundred and fifty-nine':

$$459$$

   (*Make sure everyone has it entered correctly.*)

2. Now give an instruction to 'zap' a digit in one move. (One move is one operations key, one number and the equals key. See Spotlight 2.)

   For example, if you wanted to zap the five in 459 you have to enter – 50 (not – 5).

   So ask the children:

   ? How could you get rid of the five in one move with one subtraction?

   Many children at this point will key in [–] [5] , so you need to clarify why that doesn't work.

3. Repeat with different numbers.

Variations

- Children can choose their own three-digit numbers and use the rule that they must zap the digits in descending order. So in the number 456, they must get rid of the 6 first.
- Zap digits in ascending order.
- Children play in pairs, one child challenging another. Let them explore large numbers!

Learning outcomes

By the end of this set of activities children should be able to:

● tackle related learning tasks with increased motivation and confidence;

● use and understand connected mathematical vocabulary;

● understand the structure of our Base 10 number system;

● understand how the magnitude of the digits changes depending on where the digit is placed;

● understand the role of zero as a place holder;

● understand and use columns, reading numbers appropriately;

● order and round amounts of money;

● add and subtract with money amounts;

● start to make estimates.