Discuss...

How do you promote mathematical talk in your classroom?

Mathematical Talk and Questioning

Course Lead

White Rose Maths

@WhiteRoseMaths

Content

- Why is talk important?
  - Developing flexibility
  - Assessment for learning

- Developing talk
  - Using CPA to support talk
  - Modelling and explanation
  - Thinking together

Why is talk important?

‘average word-count 10 : 1’

King’s-Medway-Oxfordshire-Formative-Assessment-Project (1999-2000)

Why is talk important?

In a study of mathematics lessons in 2013...

- Teachers asked an average of 87 questions per fifty minute lesson (one every 34 seconds)
- In one fifty minute lesson, the teacher asked 146 questions (one every 20 seconds)

'Teachers give students an average of 0.8 seconds to respond to a question before intervening.'

Renton. (2011)

Why is talk important?

Discuss...

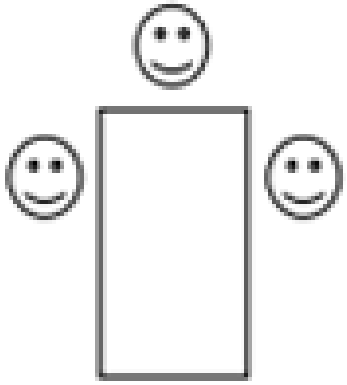
How do you promote mathematical talk in your classroom?

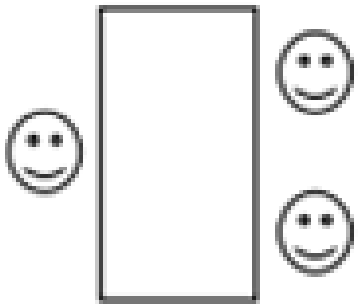
Why is talk important?

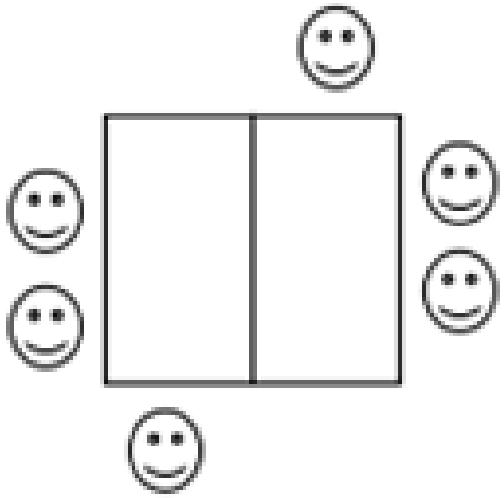
- **Think, Pair, Share**
  Think for 30 seconds, speak to partner for 1 minute, share with the group for 3 minutes.
- **Giving wait time**
  (allowing at least 3 seconds of wait time encourages all to think about it)
- **Pause, pounce, bounce**
  Keeps students on their toes, and listening to instructions.

Why is talk important?

- Thinking threes







"If you are allowing students to choose whether to participate in your classroom, you are exacerbating the achievement gap. What we have to do is to create classrooms which are inclusive, where the level of cognitive demand is high, and where participation is obligatory."

William, D. (2006)

Developing flexibility

Efficiency	Can carry out method easily
Accuracy	Careful recording, use of key facts, double checking
Flexibility	Knowledge of more than one approach. Able to choose appropriate one.

Three strands of fluency

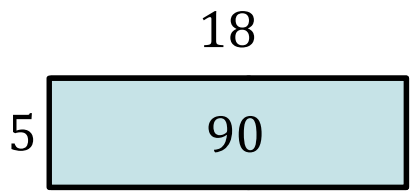
Russell. (2000)

Developing flexibility

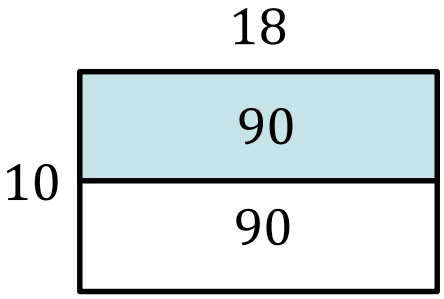
Calculate mentally:

$$18 \times 5$$

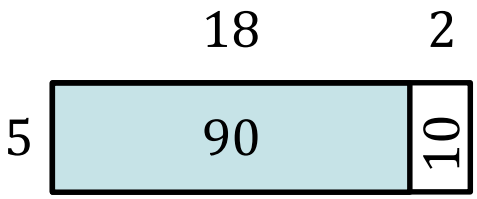
How did you do it?



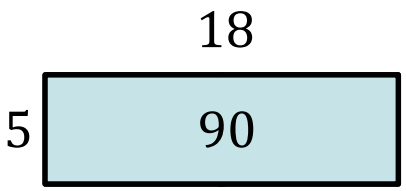
$10 \times 5 = 50$
$8 \times 5 = 40$
$50 + 40 = 90$



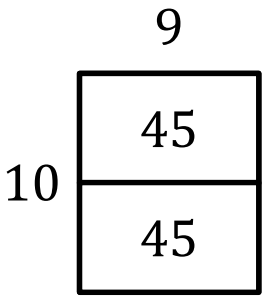
$18 \times 10 = 180$
$180 \div 2 = 90$

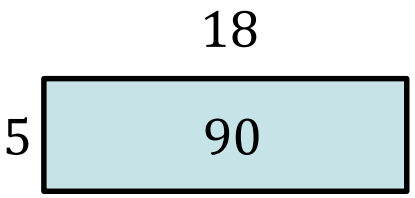


$20 \times 5 = 100$
$2 \times 5 = 10$
$100 - 10 = 90$



$9 \times 5 = 45$
$45 \times 2 = 90$





$9 \times 10 = 90$
$45 \times 2 = 90$

Developing flexibility

Calculate mentally:

$$197 \times 5$$

How did you do it?

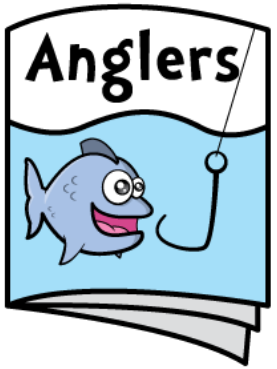
Developing flexibility

Sam gets £10.00 pocket money.

He spends £3.27 on a magazine.

How much does he have left?

Show all your working.



'Although demanding, the process of trying to put mathematical ideas into words has been crucial to forming insights into ways of thinking.'

Hatch and Shiu. (1997)

Assessment for learning

'Through careful eavesdropping of student conversations the teacher comes to understand what learners know, what they partly know and what they do not yet know.'

Black & Harrison (2004)

There are _____ right angles.

A	B	C	D
3	6	5	4

Task:

Look at the responses given by the children. Decide what each child knows, partially knows and does not know yet.

There are 3 right angles. A right angle makes an L shape.

I ruled out the last image because right angles need vertical and horizontal lines.

There are _____ right angles.

The last one is not 90° so there are 5

A right angle is 90° so the answer is A.

A	B	C	D
3	6	5	4

C because the L and T shapes meet at 90°

A – A right angle is always to the right of a straight line.

The purple lines make 2 right angles so the answer is C.

A right angle is where two lines meet so the answer is C.

Which clock shows **ten past 1**?

A

B

C

D

Explain why a child might give each answer.
What are their misconceptions?

Assessment for learning

Discuss...

25, 9, 16, 43

All of the numbers...

Some of the numbers...

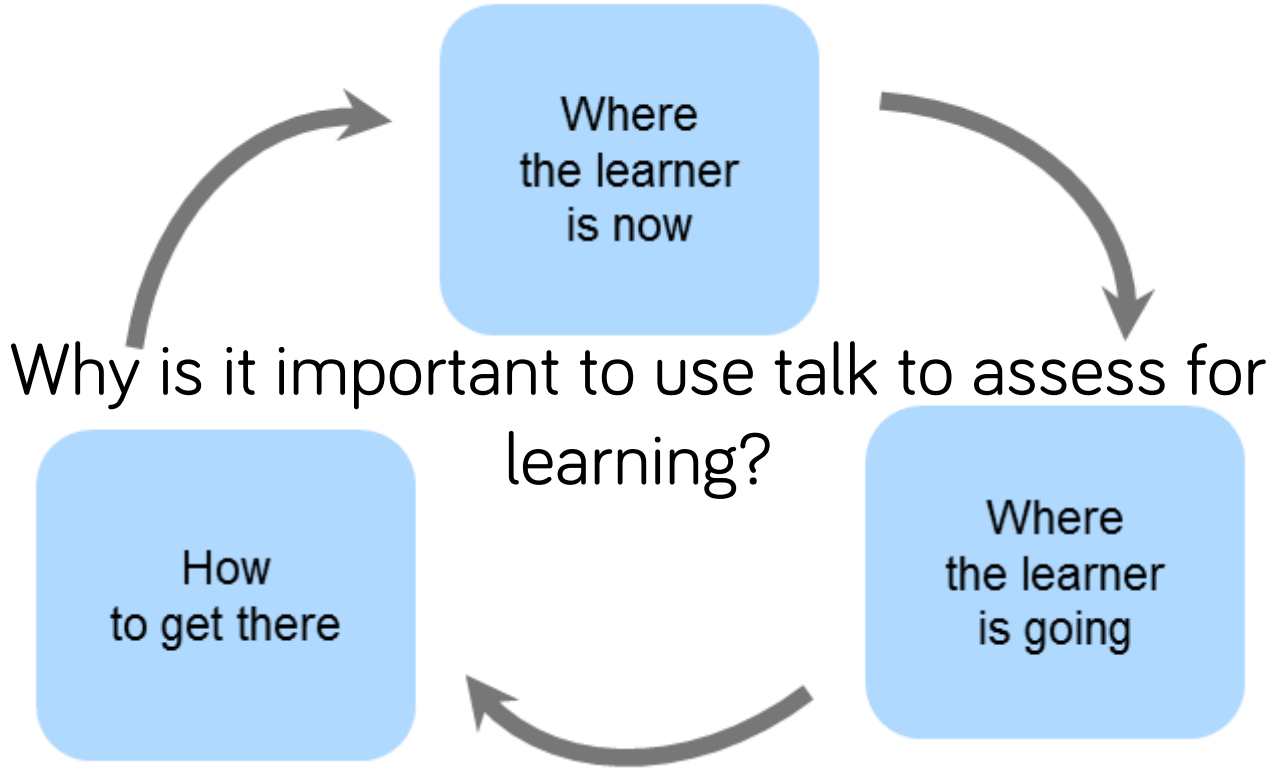
None of the numbers...

Assessment for learning

Discuss...

25, 9, 16, 43

Which one doesn't belong?



Why is it important to use talk to assess for learning?

Cambridge International Examinations
Teaching and Learning Team

Developing talk

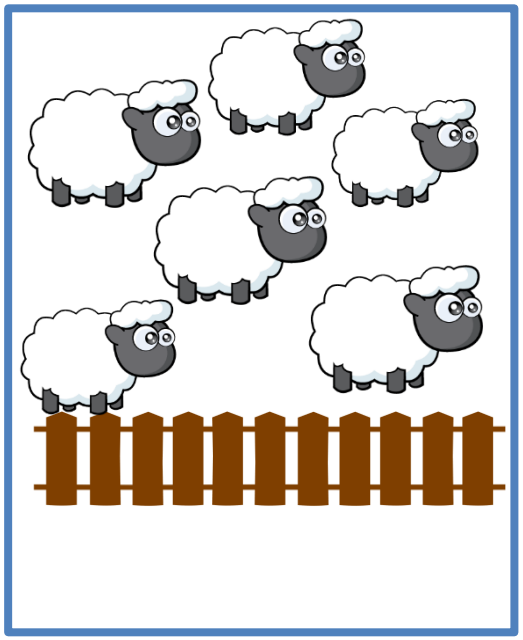
- Using CPA to support talk
- Modelling and explanation
- Thinking together

Using CPA to support talk

'Used well, manipulatives can enable pupils to inquire themselves- becoming independent learners and thinkers. They can also provide a common language with which to communicate cognitive models for abstract ideas.'

Drury, H. (2015)

First



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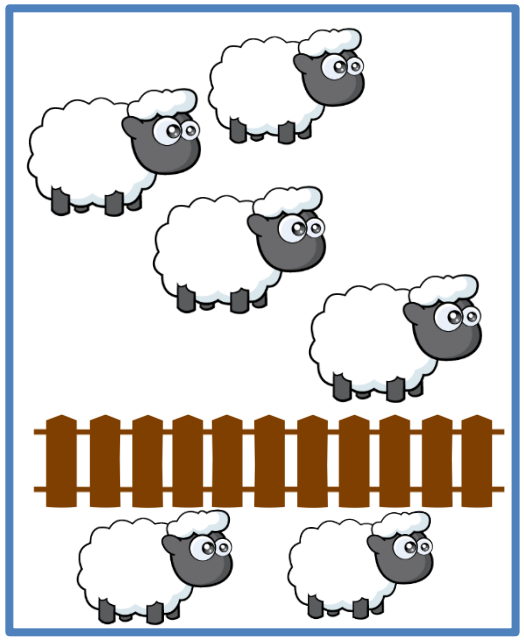

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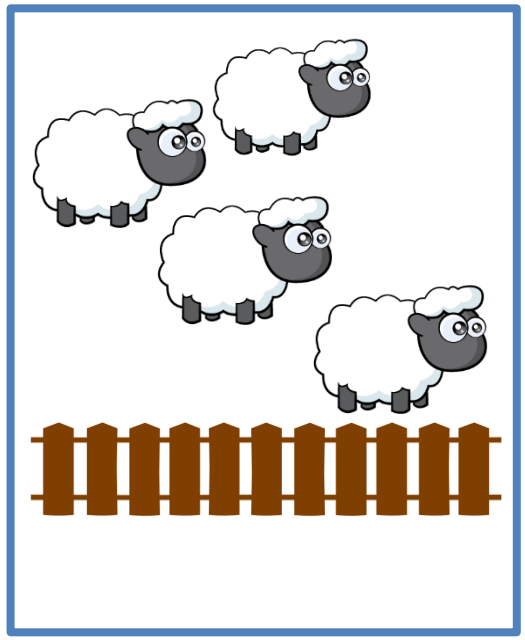
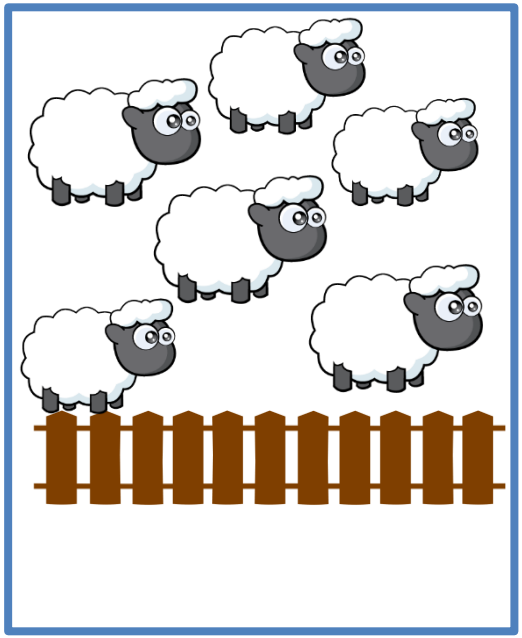


What can we use to represent the pictures?

First



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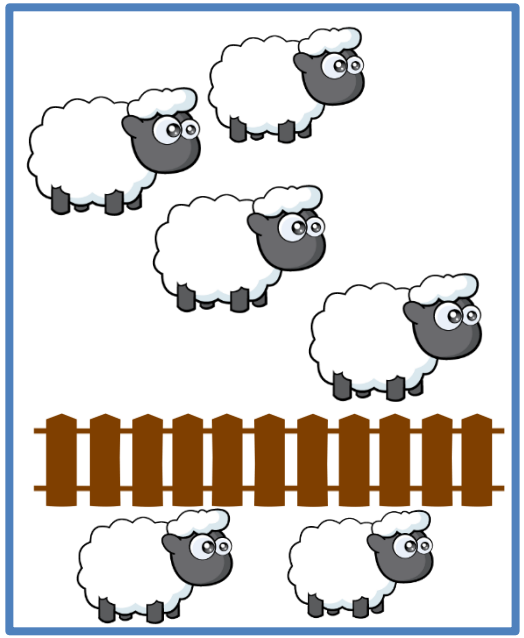

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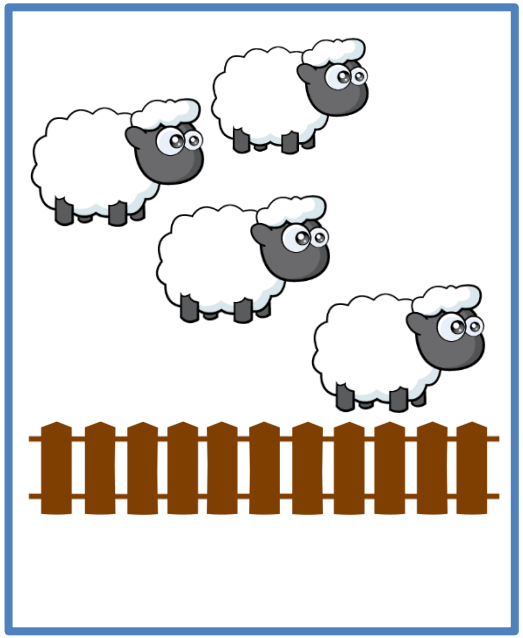
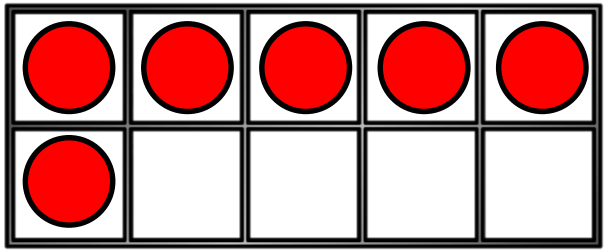
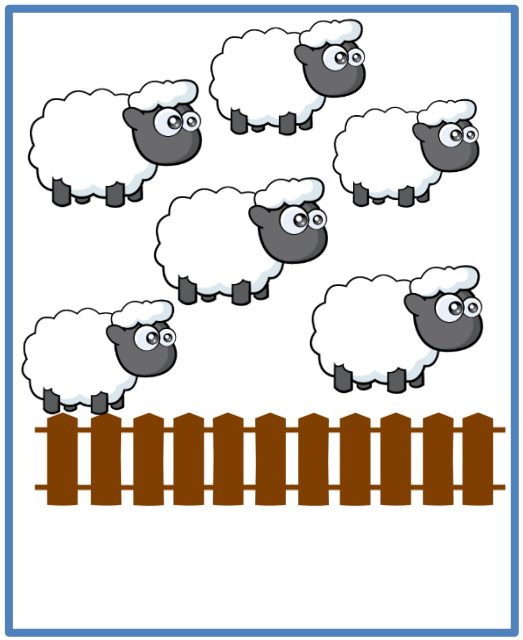




$$6 - 2 = 4$$

First



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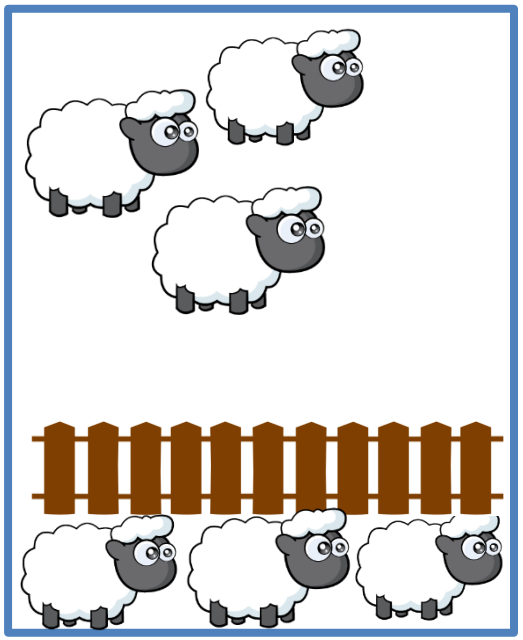

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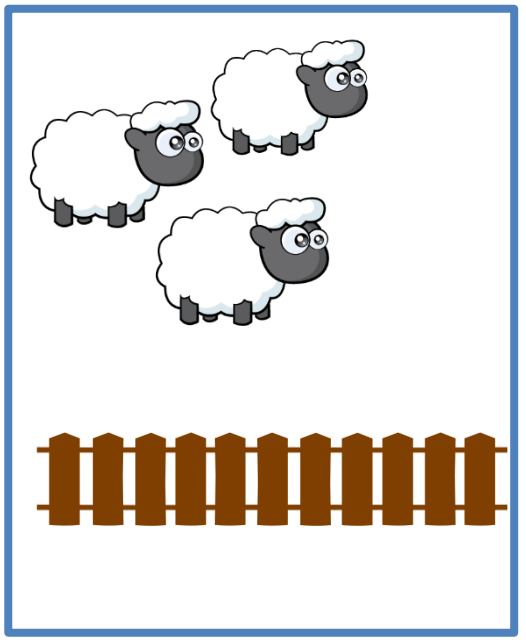
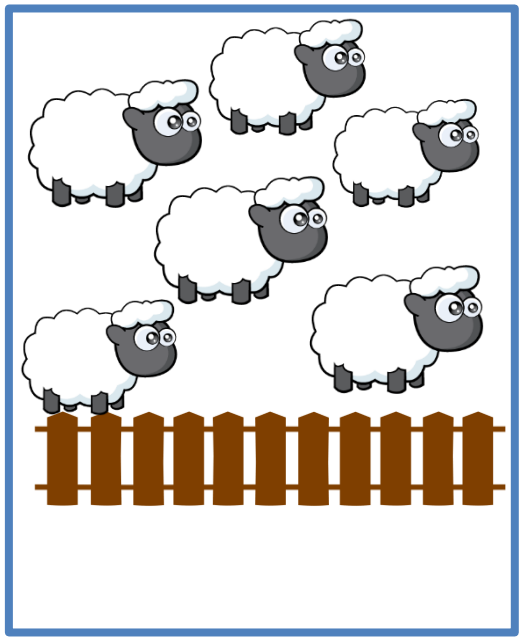


$$6 - 3 = 3$$

First



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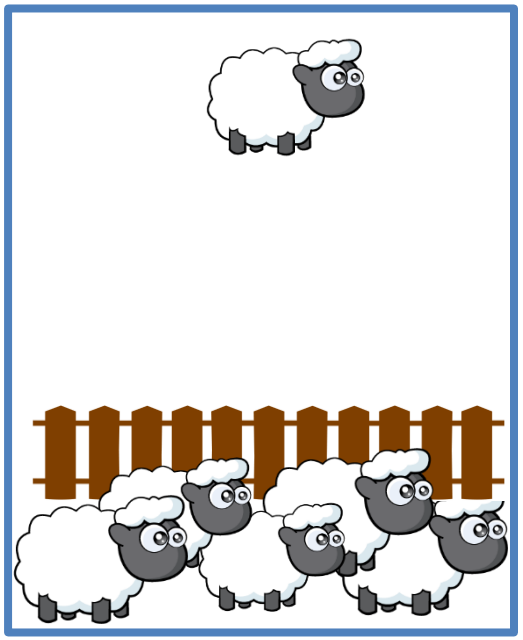

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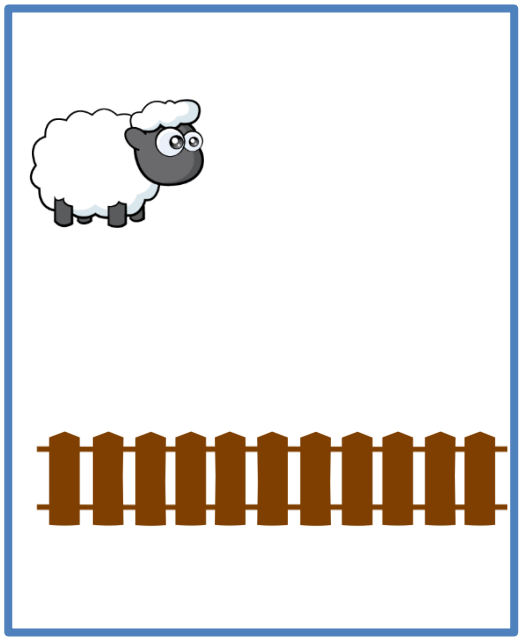
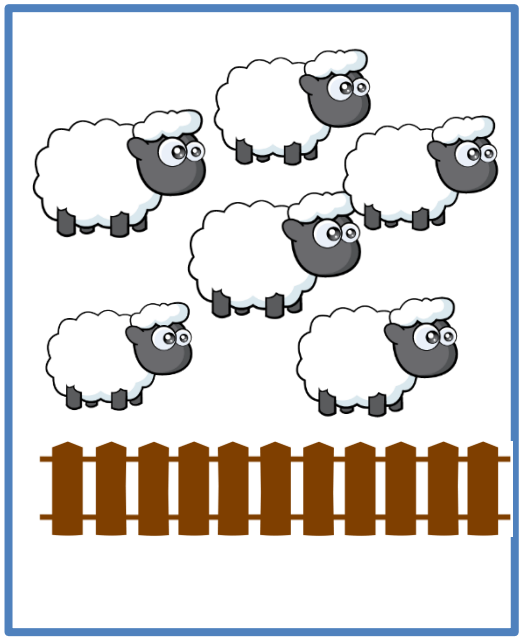


$$6 - \boxed{5} = 1$$

First



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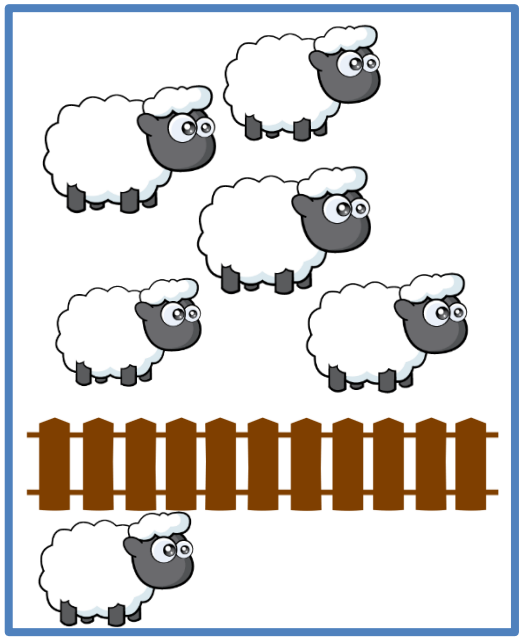

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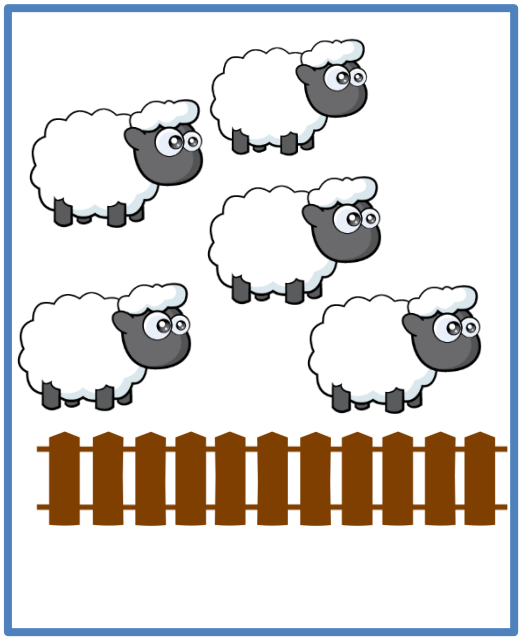


$$\boxed{6} - 1 = 5$$

Task

Can you create a first, then, now story to support the following number sentences?

$$6 - 0 = 6$$

$$6 - 6 = 0$$

Where else would a first, then, now structure support within the curriculum?

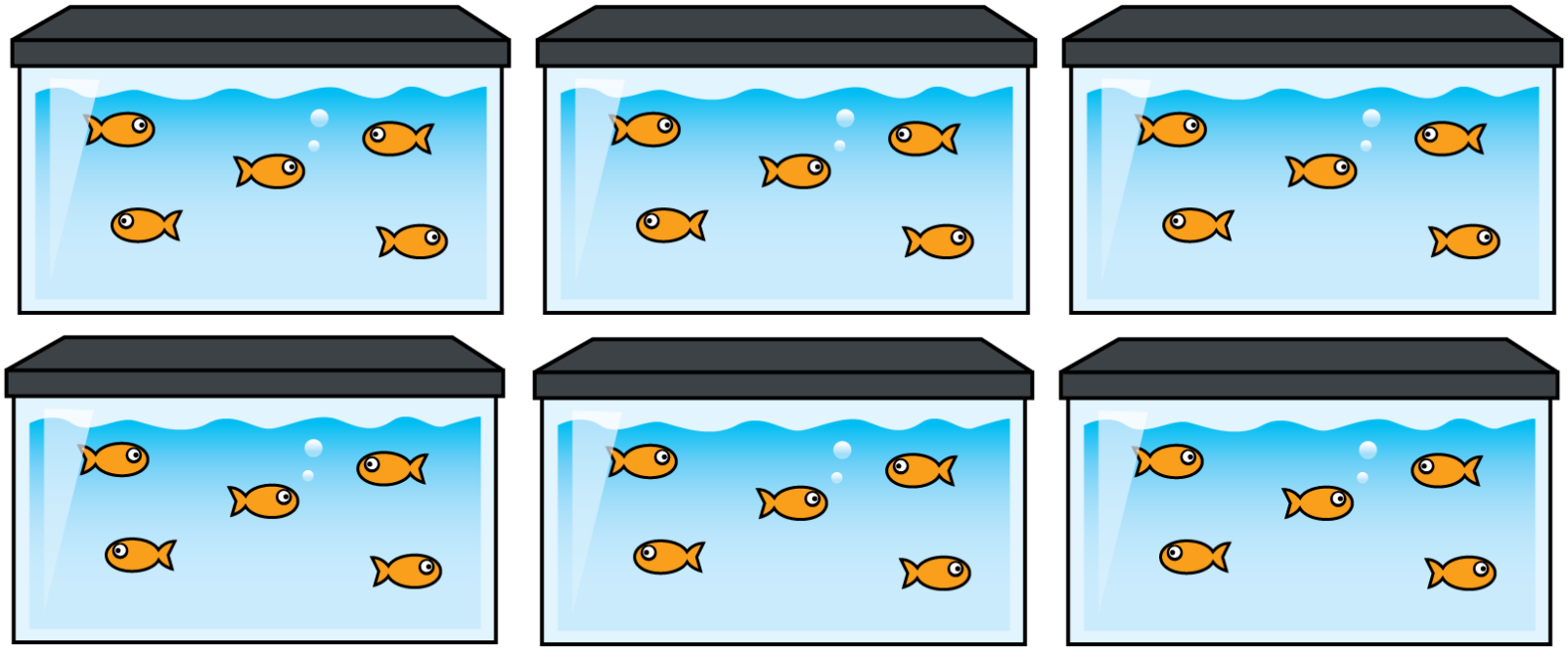
Discuss...

Which of these subtraction stories fit the 'First, Then, Now' structure?

There are 132 children in a year group. 29 of them are girls. How many are boys?	A sticker book holds 132 stickers. There are 29 spaces left. How many stickers have been stuck in?	132 children were in the dinner hall. 29 go out to play. How many children left in the hall?
Alfie needs to save £132 for his holiday. He has already saved £29. How much more does Alfie need to save?	There were 132 tadpoles in the pond. 29 of them grow into frogs. How many tadpoles are left in the pond?	Blue team had 132 table points. Red team had 29 points. How many more table point do Blue team have than Red team?

Stem sentences

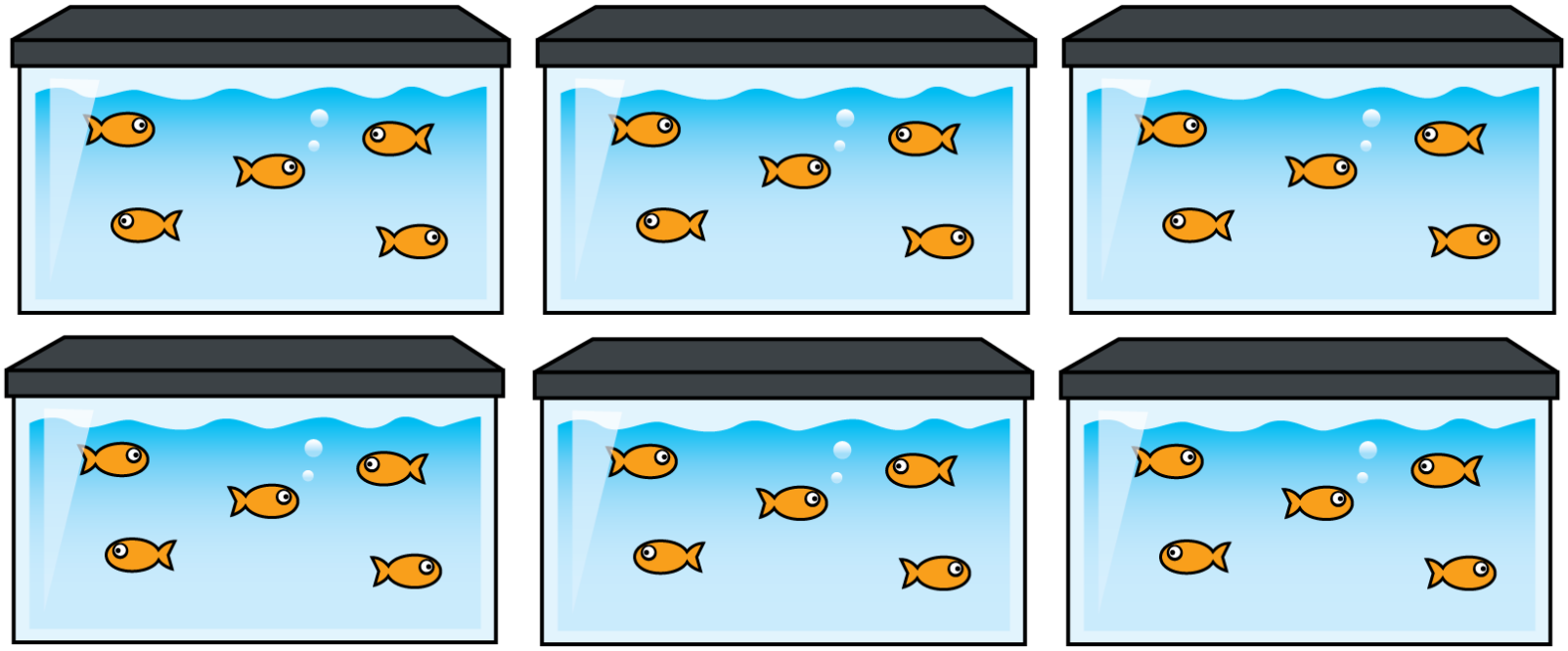
- Opportunity to respond in the form of a complete sentence to effectively communicate.
- Provide scaffolding to help students get started in speaking or writing without the added pressure of thinking about how to correctly formulate a response.
- Develops reasoning and conceptual understanding.



There are ____ fish tanks.

There are ____ fish in each tank.

There are ____ fish altogether.



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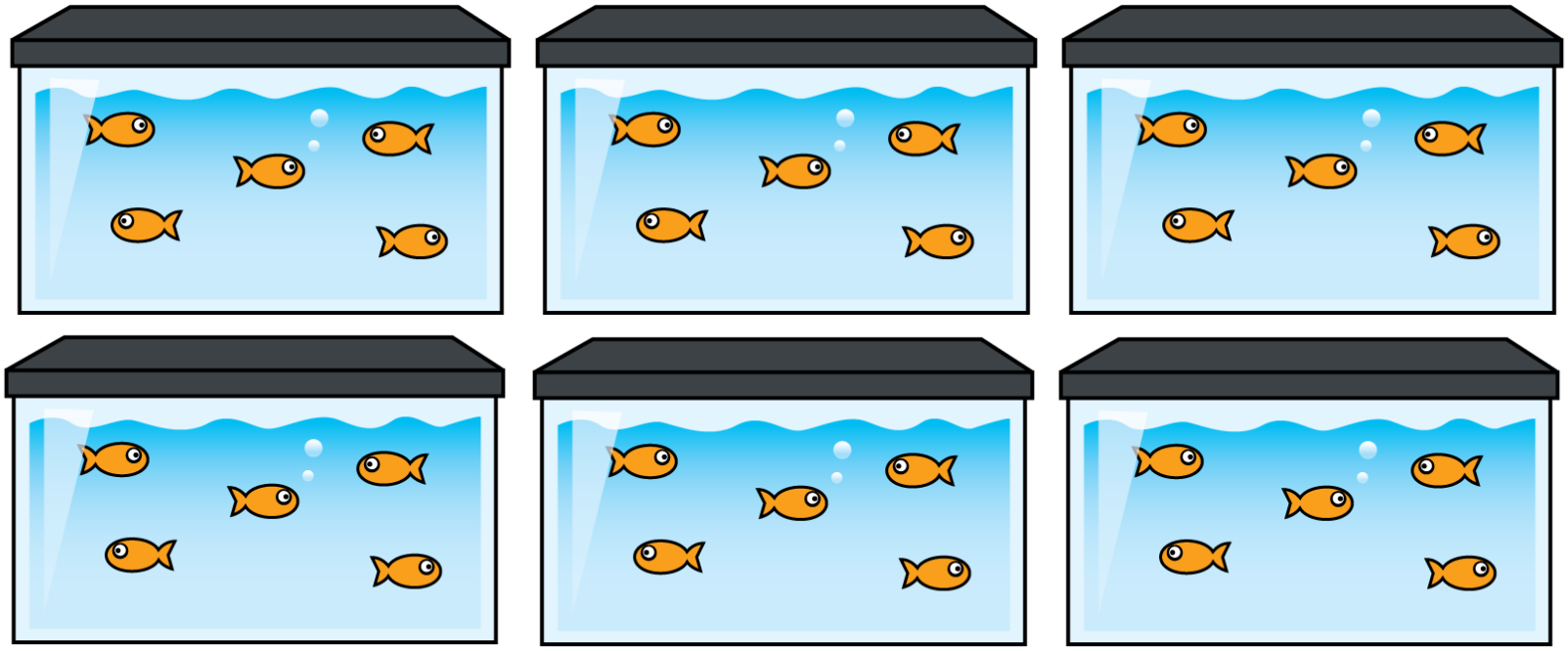

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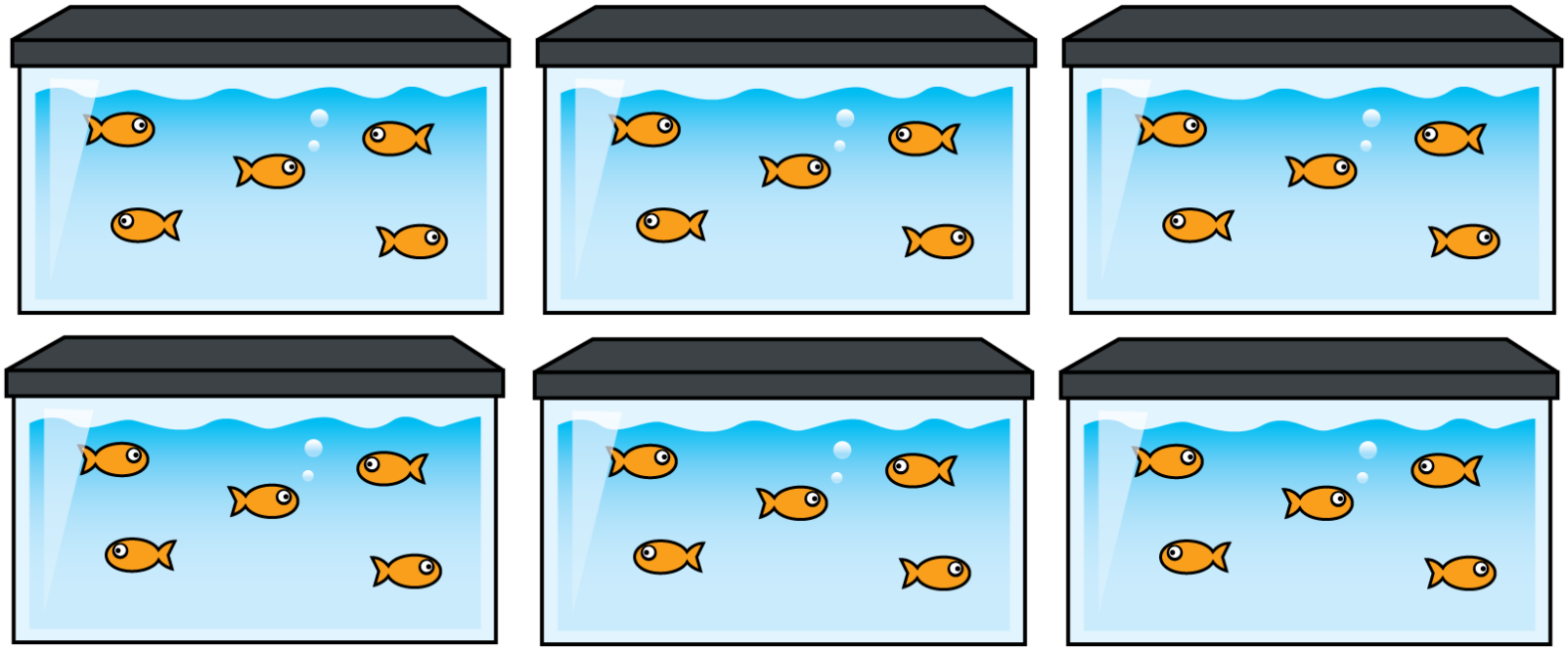
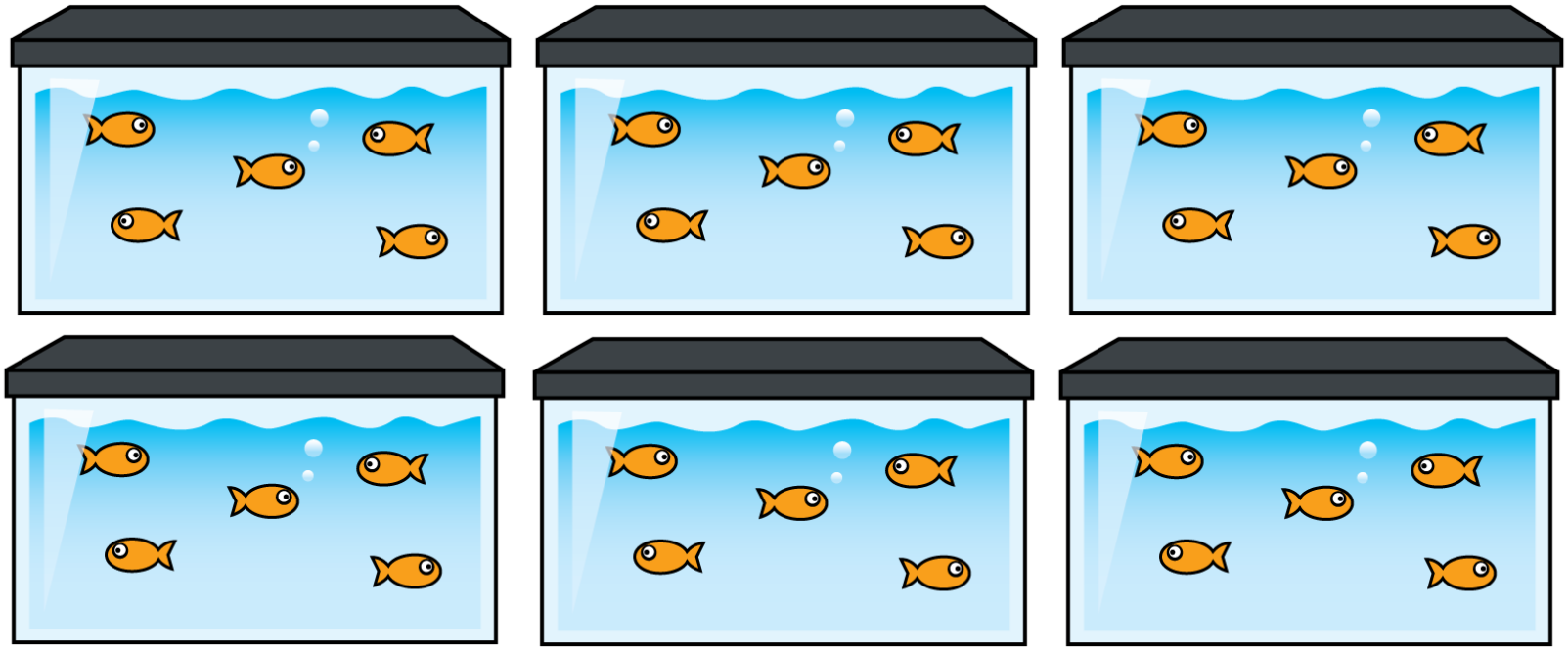
There are ____ fish tanks.



There are ____ fish altogether.

____ fish are blowing bubbles.

$\frac{\square}{\square}$ fish are blowing bubbles.



For every ____ fish, there is ____ tank.

For ____ fish, there are ____ tanks.

'By giving our students practice in talking with others, we give them frames for thinking on their own.'

Vygotsky.

Modelling and Explanation

Immersion

Imitate

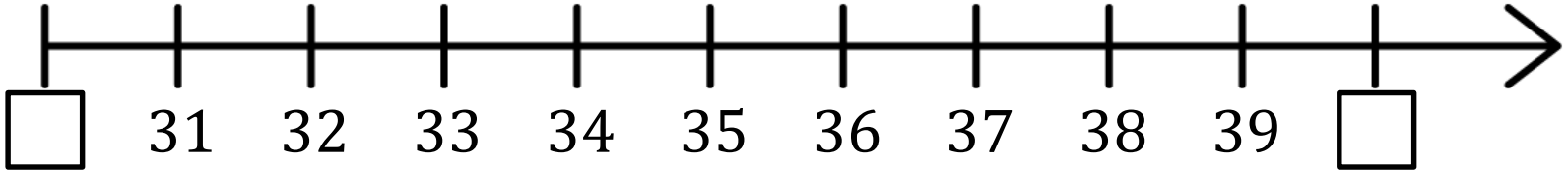
Innovate

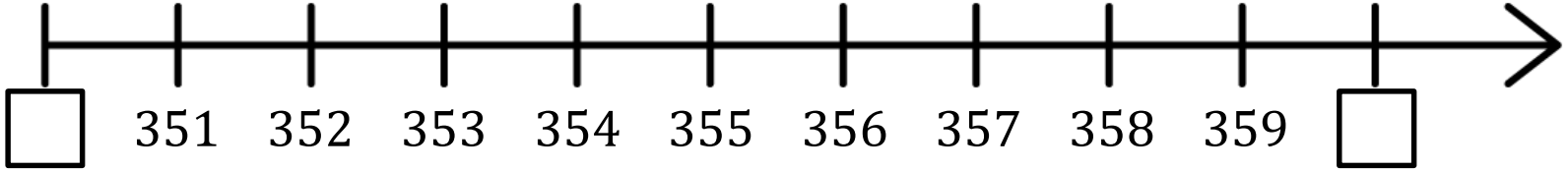
Invent

Sayce-Brown. (2015)

Immersion	The context of the problem is set: What do we already know? What do we need to find out? What Maths will we use?
Imitate	Pupils follow the teacher modelling a co-constructed method. Pupils copy the method and practise its use.
Innovate	A parameter is changed. What if? Learning happens.
Invent	Pupils explore the realms of possibility and create their own maths. Understanding is deepened.

Immersion



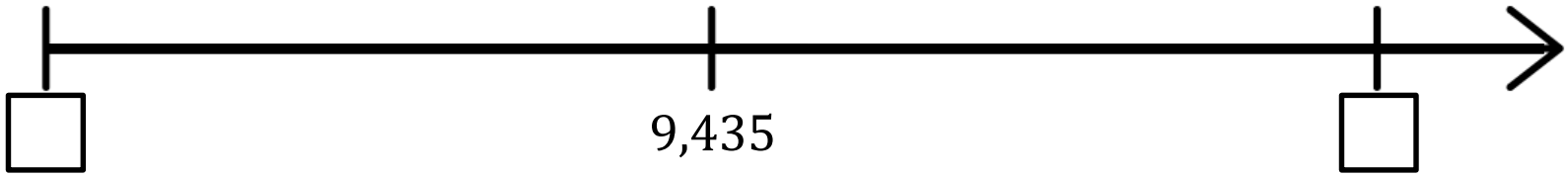


Imitate

____ is closer to ____ than ____

____ rounds to ____ to the nearest 10

Innovate



____ is closer to ____ than ____

____ rounds to ____ to the nearest 10

Invent

A number rounded to the nearest 10 is 370

What could the number be?

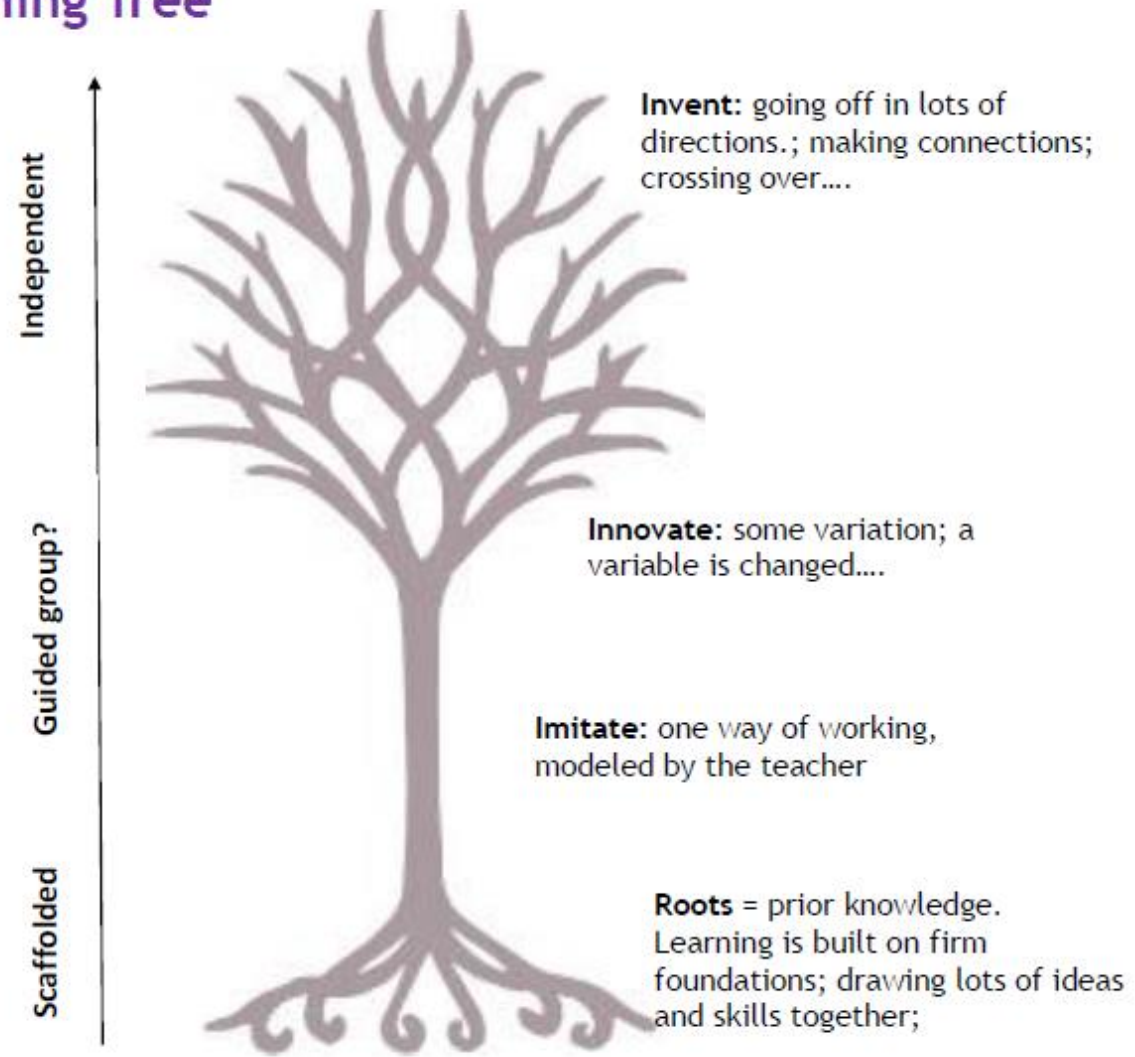
Use the sentence stems to answer the question.

It must be...

It could be...

It cannot be...

Learning Tree



Thinking together

'Most of the time, classroom recordings capture discussions in which children don't listen to each other, in which one person dominates the proceedings, in which they argue unproductively, or in which participants seem happy to go along with whatever anyone says without any reflection or debate.'

Mercer and Littlejohn. (2007)

Thinking together

Read through the ground rules for talk.

Which ones do you agree with?
Which ones do you disagree with?

Choose 4 key ground rules for talk.

We will listen when others are talking.	We will try to reach a shared agreement.	No-one can change their mind.	Everyone must do what the leader says.
Everyone will talk as loud as they can.	We will co-operate; try to get along with each other.	We will listen and think about each other's ideas.	We will ask for reasons.
If people find it hard to join in, we ignore them.	We will keep our ideas quiet so that no-one else can copy.	We understand that talking is thinking aloud.	We are going to stick to our own ideas and not share them.
We will make group decisions that we can all agree to.	We can ask each other questions to help us to understand everyone's ideas	The person who talks loudest is always right.	We will take it in turns to reach decisions

Thinking together

Always, sometimes, never.

- The difference between two die is even
- The total of two die is even
- If the difference is even then the total is even

'It is not simply that the learner hears several voices through dialogue but that the ideas from individuals get challenged, moulded and re-examined through the collective voice of the group.'

Isaacs. (1994)

Any Questions?

Thank you

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