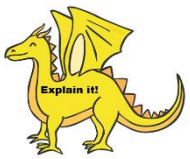
Progression in Reasoning

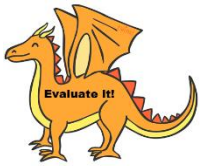
- *Step one*: Describing: simply tells what they did.
- *Step two*: Explaining: offers some reasons for what they did. These may or may not be correct. The argument may yet not hang together coherently. This is the beginning of inductive reasoning.



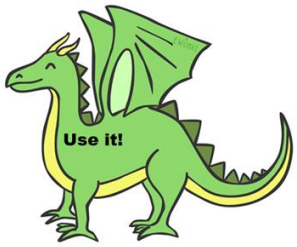
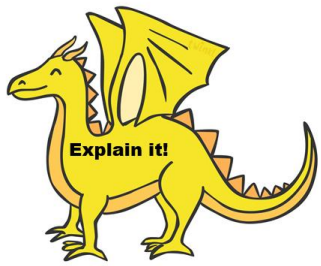
- *Step three*: Proving: a watertight argument that is mathematically sound, often based on generalisations and underlying structure. This is also called deductive reasoning.

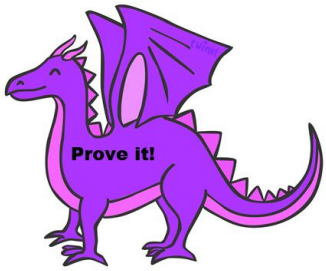
- *Step four*: Convincing: confident that their chain of reasoning is right and may use words such as, 'I reckon' or 'without doubt'. The underlying mathematical argument may or may not be accurate yet is likely to have more coherence and completeness than the explaining stage. This is called inductive reasoning.

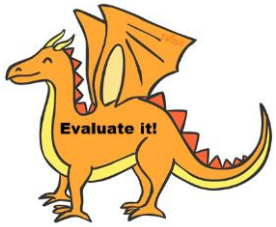
- *Step five*: Justifying: a correct logical argument that has a complete chain of reasoning to it and uses words such as 'because', 'therefore', 'and so', 'that leads to'



Progression in Questioning

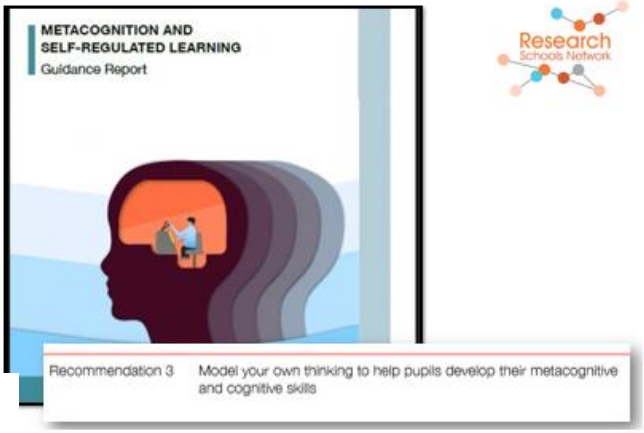
Dragon	KS1	KS2
 **EYFS** **Can they follow the number sequence?** **Show me what is next** **Show me which is more/ less?.** **What could you use to show me this number? (drawing and manipulatives)**	How can you find the answer the fastest? Can you group these in some way? Where can this number go? Which manipulatives could we use to help us? What comes next? What have we been working on that might help with this problem? What Maths skills do you have that will help you solve this problem?	Is there a more efficient method? Can you write it another way? What would be the best equipment to use to support us? Use your knowledge of……. to……..? When would we use this method? Is there a way to record what you've found that might help us see more patterns?
 **EYFS** **What is the mistake?** **What is hidden beneath the splat?** **Can you talk about the pattern? What do you see?** **Tell me a story?**	Both of these shapes have the same sides/corners etc. True or False? What is the first step you take to…..? Can you tell me how you got that answer? Do you agree or disagree, why? Can you draw it? What can you see? Can you see any patterns? What is the same and what is different?	Summarise how you solved the problem? Do you agree or disagree, why? Are there any other methods you could use to find the answer? How could you use this answer to work out….? What multiplication facts have you used to help you calculate 2400/6 Would you be able to use the same

	How did you group these? What's the same? What's different? Can you group these in some way? Can you see a pattern? What do you notice? How do you know that ….. is the missing number	method to solve a different problem?
	What have you found out? What can we use to help us find the answer? How do you know the answer is correct? How can you show me the answer is correct? Can you show me how you got that answer? Can you show me if it is true or false?	What have you discovered? Can you group these in some way? How can you use this equipment to check this answer? What do you know about counting that can help you with proving this answer is correct? How can this pattern help you find an answer? What have you discovered? How did you find that out? Why do you think that? What made you decide to do it that way?
	Spot the mistake I think this is false/True because….. Tell me what is wrong with … Is it ever false that …? (always true that …?) Are everybody's answers the same? Why/ why not? Do you agree or disagree?	What made you decide to do that? Why did you do it like that? Why have we got two different answers? Who is correct? Have we found all the possibilities? Who has a different solution? Are everybody's results the same? Why/ why not? Do you agree or disagree, why?

	**Heavily scaffolded** Is there a quicker way? How do you know you have found the only answer? Is there more than one answer? How do we know we have found out all the possible answers?	Why did you use that method? Can you explain this in a different way? How would the method change if….? How many more solutions can you find? What would happen if we change…..? Can you find a different way to reach your answer? Could you choose a different method to solve this question? Do you think we have found the best solution?

St George's approach to Mathematical Problem solving.

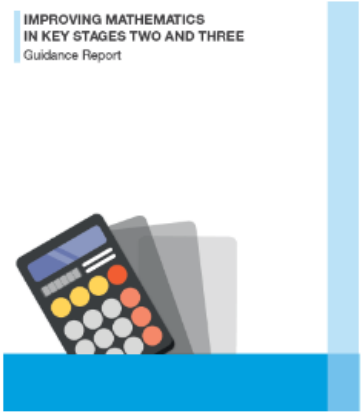
Our approach is based on a number of recommendations made in the guidance report published by the EEF.

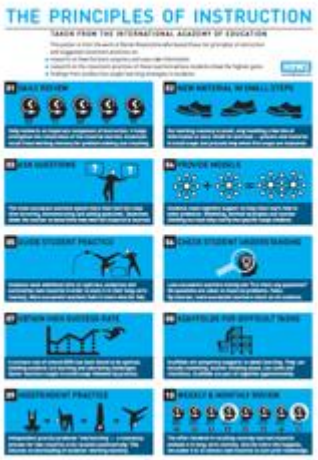


3
Teach pupils strategies for solving problems

- If pupils lack a well-rehearsed and readily available method to solve a problem they need to draw on problem-solving strategies to make sense of the unfamiliar situation
- Select problem-solving tasks for which pupils do not have ready-made solutions
- Teach them to use and compare different approaches
- Show them how to interrogate and use their existing knowledge to solve problems
- Use worked examples to enable them to analyse the use of different strategies
- Require pupils to monitor, reflect on, and communicate their problem solving

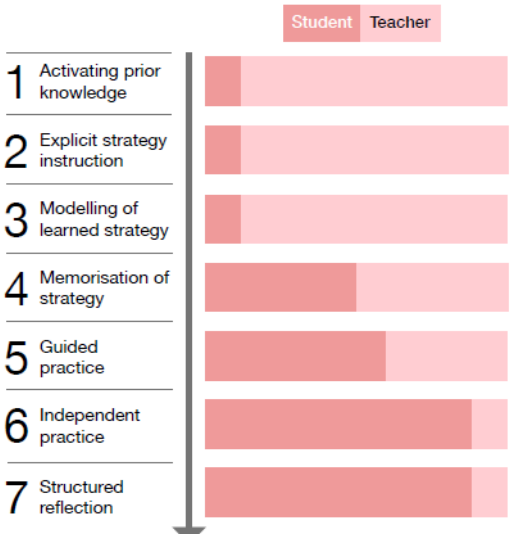
6
Use tasks and resources to challenge and support pupils' mathematics





- Modelling by the teacher is a cornerstone of effective teaching; revealing the thought processes of an expert learner helps to develop pupils' metacognitive skills.
- Teachers should verbalise their metacognitive thinking *('What do I know about problems like this? What ways of solving them have I used before?')* as they approach and work through a task.
- Scaffolded tasks, like worked examples, allow pupils to develop their metacognitive and cognitive skills without placing too many demands on their mental resources.

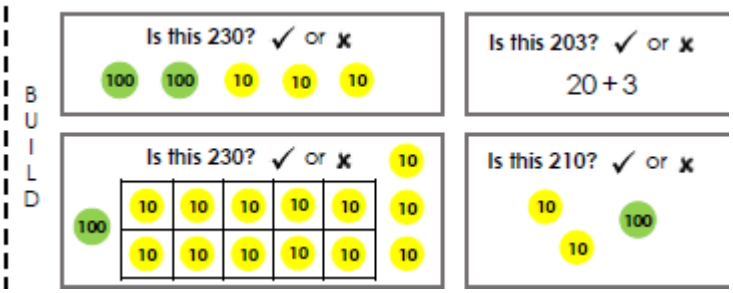
So at St Georges we have come up with an approach based on the 7 step model for teaching metacognition strategies below:

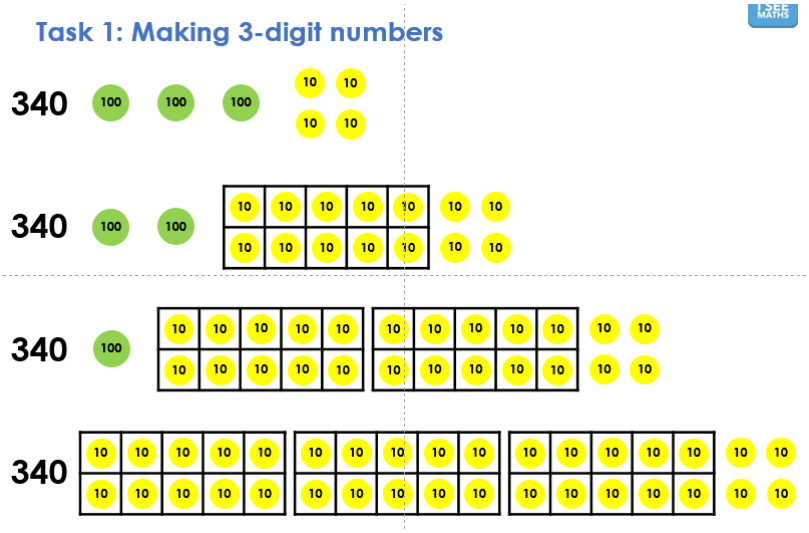


1. Activate prior knowledge- Build task
2. Share problem but withhold information and use simple numbers and discuss understanding of problem.
3. Share Worked example.
4. Model by thinking out loud- use visual aids and manipulatives to support.
5. Introduce a similar problem but a different context to complete independently but with support and scaffolds and extensions for those rapid graspers.
6. Check understanding and reflect- explain and evaluate.

An example of exploring and understanding the problem.

An example of materials used in the 6 step approach.





SUPPORT

Tip 1: 340 can be made with **two** 100 counters and some 10 counters. ***How many 10 counters would be needed?***

Tip 2: 340 can be made using only 10 counters. ***How many 10 counters to make 340?***

Remember: ten lots of 10 = 100

EXPLAIN

460 can be made with ☐ hundreds and **6** tens.

460 can be made with **3** hundreds and ☐ tens.

460 can be made with ☐ tens.

342 can be made with **3** hundreds, **3** tens and ☐ ones.

342 can be made with **2** hundreds, **4** tens and ☐ ones.

EXTEND

How can 423 be made using 1, 10 and 100 counters?

What are the fewest counters that can be used?

What are the most counters that can be used?

There are two ways to make 423 using 18 counters. Find them.