

The background features a light beige color with a pattern of thin, concentric circles and dashed lines. A large, solid red speech bubble is centered on the page, pointing downwards.

Visual Representations

Bar Modelling



- Flora Turner
- Winchcombe Abbey C of E Primary Academy
- Diocese of Gloucester Academies Trust
- Mathematics Subject Leader (since 2017/18)
- Music Subject Leader, KS1 Phase Leader and experienced KS1 Local Authority Moderator

Our context ...

With a higher than average % SEND, we have placed a high priority on ensuring that visual representations are accurate and consistent.

- 307 pupils on
- 21% pupils receive pupil Premium funding (close to average, 2022 IDSR)
- 16% pupils with SEND (above average)
- 4% (and rising) pupils have an Educational Health Care Plan (well above average)



What does Maths look like in our school?

- EYFS: *White Rose Maths* aligning with *CanDo Maths* verbal reasoning skills
- Y1-Y6: *CanDo Maths*
- Specific lesson design for Y1-Y6 involves the 'Do It' > 'Secure It' > 'Deepen It' lesson/task design
- **Blended approach when creating tasks**

What does Maths look like in our school?

- EYFS – White Rose Maths aligning with CanDo Maths verbal reasoning skills
- Years 1-6 – CanDo Maths:
... specific lesson design including ‘Do It’, ‘Secure It’, ‘Deepen It’ task design
- **Blended approach when creating tasks**

DSD approach – activity examples



'Do it' examples	'Secure it' examples	'Deepen it' examples
<ul style="list-style-type: none"> What is it/what is it not (particularly with shape) Fluency questions Practise 	<ul style="list-style-type: none"> True or false questions Explain to me how to... Writing/explaining their own steps to success for a given problem (great for vocabulary) Give somebody (within a scenario) some top tips for getting it correct next time Odd one out Multiple choice questions (<i>why is this one wrong? Why is this one correct?</i>) Alternative representations Prove it... Create your own rule Correct the mistake Questions focusing on the use of efficient methods 	<ul style="list-style-type: none"> Always/sometimes/never Missing box equations/digit card questions Word problems Write your own word problem Finding an answer with given boundaries/conditions ... <i>Add two 3-digit numbers where the total is an even number which, when rounded, rounds to 500.</i> Transferring to a different context Here's the answer, what's the question Substitution (moving into algebra)

DSD approach – EYFS questioning examples



Whole school approaches to DSD activity opportunities for the children.

Examples of questions that could be used in EYFS to support this whole school approach.

"How do you know?" should be an essential question, used constantly, especially during the Summer term to encourage children to start proving their thinking using mathematical vocabulary.

'Do it' examples	'Secure it' examples	'Deepen it' examples
<ul style="list-style-type: none"> What is it/what is it not (particularly with shape) <p><i>Which of these is not a triangle? How do you know?</i></p> <p><i>Which of these is not the number 4? How do you know?</i></p> <ul style="list-style-type: none"> Fluency questions Practise 	<ul style="list-style-type: none"> True or false questions <i>True or false, I am showing you four fingers...</i> Explain to me how to... Writing/explaining their own steps to success for a given problem (great for vocabulary) Give somebody (within a scenario) some top tips for getting it correct next time Odd one out <i>Which of your _____ (towers, drawings, numbers, shapes) is the odd one out?</i> Multiple choice questions (<i>why is this one wrong? Why is this one correct?</i>) <i>I think the answer to what you're doing could be _____ or _____. Which do you think is right?</i> 	<ul style="list-style-type: none"> Always/sometimes/never Missing box equations/digit card questions Word problems <i>Verbalise mathematical equations in the context of a worded problem.</i> Write your own word problem <i>Let's act out this equation together...</i> Finding an answer with given boundaries/conditions ... <i>Add two 3-digit numbers where the total is an even number which, when rounded, rounds to 500.</i> <i>Make the number _____ (e.g. 10) using some yellow counters and some red counters (etc.)</i> Transferring to a different context

What does Maths look like in our setting?

- EYFS: *White Rose Maths* aligning with *CanDo Maths* verbal reasoning skills
- Y1-Y6: *CanDo Maths*:
... specific lesson design including 'Do It', 'Secure It', 'Deepen It' task design
- Blended approach when creating tasks
- **'Maths Meetings'** timetabled separately to allow for deliberate practice of key mathematical skills
- **Mixed-age settings pose difficulty however this year the break-out teaching has proven to be successful**
- **Monthly 'Maths Challenge'**
- **Specialised Maths days (eg Maths Through Stories, STEM)**

Our Maths journey ...

- 2018/19 the new Maths lesson approach was trialled
- After staff questionnaire, support planning meetings were put in place to aid lesson mapping
- Pupil voice conducted regularly about new lesson design
- Regular 'Maths Meetings' were then introduced
- Calculation policy changed to reflect new ways of teaching
- 'CanDo' assessments introduced and the 'Question Level Analysis' spreadsheets used to plan 'Maths Meeting' sessions each half-term
- Monitoring conducted throughout > feedback to staff > changes implemented > pupil voice ...

2017-18	2018-19			2019-20		
	Autumn term	Spring term	Summer term	Autumn term	Spring term	Summer term
<p>Headlines: no consistent approach to teaching Maths, staff were beginning an awareness in teaching for mastery, Maths Passports was replaced with daily mathematical facts sessions called 'Number Sense' (following research).</p> <p>Shadowed Maths alongside the Maths subject lead (at the time).</p> <p>Changes were suggested to take 'Maths Passports' away and replace this with a more whole class approach to the learning of Maths facts.</p> <p>Took over Maths subject leadership.</p>	<p>Consistency was identified as an area of need by the Maths subject leader.</p> <p>Maths subject lead trialled the new Mathematics lesson design (DSD approach) within Year 2 setting. Discussions were had with members who had done some action research into the approach the previous year.</p> <p>Staff questionnaire administered to determine knowledge around the new lesson design</p> <p>Timetables were amended to ensure that everybody had a short Maths lesson and a Number Sense session in place.</p> <p>Staff meeting led to share new lesson design alongside twilight evening.</p> <p>Introduction of the 'Monthly Maths Challenge' to raise the profile of Maths across the school.</p>	<p>It was expected that all class teachers use the new DSD lesson design.</p> <p>Whole school pupil voice conducted within KS1 and KS2 to determine pupil attitudes towards new lesson design and actions moving forward.</p> <p>Documents created to support staff when planning e.g. DSD activity suggestions, WMLL</p> <p>Maths Through Stories Day to further develop profile of Maths in the world around us.</p> <p>Staff meetings led to teachers and TAs on key Maths updates with lesson design based on recent monitoring.</p>	<p>Supporting local schools with Maths subject leadership further developed Maths Subject Leader's CPD.</p> <p>Support planning meetings provided for particular members of staff in order to strengthen their knowledge of progressive planning.</p> <p>Documents created to respond to staff concerns e.g. how to approach live feedback etc.</p> <p>Staff meeting led on Active Maths – CPD links here with PE.</p>	<p>Name of Number Sense sessions amended to 'Maths Meetings' to ensure clarity of this session.</p> <p>CanDo Maths was bought in to give a structured approach to overview of manageable steps.</p> <p>CanDo Maths assessments were introduced for consistency and to ensure attainment tracked now that data is only submitted once per term.</p> <p>Staff encouraged to plan using the QLA from these assessments.</p> <p>Calculation policy reviewed and changed to respond to Can Do Maths.</p> <p>Introduction of 'Times Table Rockstars' to respond to needs arising from the pilot MTC.</p> <p>Staff meetings led for Teachers and TAs to update on lesson design.</p>	<p>Supporting local schools with Maths subject leadership further developed Maths Subject Leader's CPD.</p> <p>Data from the assessments used as a tool when monitoring – especially pupil voice during learning walks.</p> <p>NSPCC Number Day to further develop profile of Maths in the world around us.</p> <p>'Times Table Rockstars' rolled out to Year 5 pupils to maintain importance of tables presence.</p> <p>Staff meeting led to dive deeper into specifics: variation being a key theme.</p> <p>Focus on Maths in EYFS to ensure consistency moving into Year One and a focused view on what Maths looks like in this context – document updated and used during monitoring.</p> <p>Deep Dive into Maths conducted by the trust's deputy CEO to provide action points moving forward.</p>	<p>School closure: 'Times Table Rockstars' rolled out from Years 2-6</p> <p>Key documents created to move maths monitoring and leadership forward</p> <p>'Back to Maths plan' created and shared with staff to ensure gaps are properly addressed</p>

2020-21			2021-22			2022-23		
Autumn term	Spring term	Summer term	Autumn term	Spring term	Summer term	Autumn term	Spring term	Future plans
<p>Maths Subject leader left for maternity leave – due to return in July 2021.</p> <p>Maths subject leadership monitored by a member of SLT.</p> <p>On and off school closures and persistent absence due to the pandemic meant that things remained steady for Mathematics rather than implementing anything new.</p>	<p>Discussions held between staff about how to plug gaps and ensure that pupils were ready for the new year group.</p>	<p>Introduction of the Ready to Progress tests to inform teaching – gaps due to pandemic were addressed through Maths Meetings.</p> <p>Staff meeting held to discuss feedback from monitoring. STEM sentences were formalised, currently being trialled with sticking into books in KS2. Having a positive effect on learning.</p> <p>Introduction of a structured approach to Maths meetings – tighter expectations from Maths lead about what these should entail.</p> <p>Half termly Remember It assessments formalised.</p> <p>Introduction of times table baseline for LKS2</p>	<p>Maths lead led a TA staff meeting as part of their CPD programme. Particularly around feedback and marking.</p> <p>Maths lead led a staff meeting for teachers – CPD on bar modelling.</p> <p>Heavy focus on the MTC check for LKS2.</p>	<p>Maths lead led a TA staff meeting as part of their CPD programme. Particularly around feedback and marking.</p> <p>Maths lead led a staff meeting for teachers – CPD on bar modelling.</p> <p>Heavy focus on the MTC check for LKS2.</p>	<p>External SIP led a deep dive into Maths across the school.</p> <p>Meeting held with LKS2 and SLT to discuss outcomes from the MTC and actions moving forward.</p> <p>Pupil voice and monitoring continued to create actions for Autumn term.</p> <p>Meetings held with EYFS team to ensure Y1 readiness is planned for.</p>	<p>Monthly Maths challenge starting again to continue to raise the profile of Maths and put a higher priority on parental engagement and interest.</p> <p>Maths lead put in place that all classes will follow CanDo Maths outline for Maths Meetings. X1 session a week will be a weekly arithmetic test.</p> <p>Higher priority on assessment QLA's to inform the planning of deliberate practice sessions.</p> <p>Maths lead supporting other schools with their timetabling of Maths Meetings and how to structure these.</p>	<p>Maths lead led a staff meeting on lesson design.</p> <p>Maths lead led a TA staff meeting on scaffolding pupils, including a focus on 'learned helplessness'.</p> <p>Number Stacks intervention brought in and roll out begun.</p> <p>Three ECTs continue to take part in workgroups organised by local Maths Hub.</p> <p>Maths lead continues to take part in SLNM's organised by the local authority as well as trust-wide networking and PD meetings.</p>	<p>STEM sentences to be stuck into all books to hold a high priority on mathematical vocabulary, not just on working walls?? Evaluate impact.</p> <p>STEM day planned in for the Summer term.</p> <p>Monitoring the use of bar modelling as a visual more tightly and ensuring that our representation progression document is being followed.</p> <p>Calculation policy formalised for EYFS? To be discussed with other schools.</p>

Whilst
monitoring
our maths
journey ...

Teaching was
strong ...

Book looks
validated this ...

Triangulated
with positive
pupil voice ...

Our reported end of
Key Stage data was
not reflecting this ...

*What were we
going to do about
it?*

What were we going to do about it?

- Completed a self-evaluation checklist (*CanDo Maths*) to identify areas of need

A	B	C	D	E	F	G	H	I	J	K
	Focus	Ofsted Reference (M - mathematics, QoE - Quality of Education, L&M - Leadership & Management)	Our Rating	<p>0: Currently not a feature of our practice</p> <p>1: Sometimes happens in most classes</p> <p>2: Happens fairly often but not embedded</p> <p>3: Is a central feature of our practice</p>						
Intent	WhyNotWhat: The vision for mathematics in the school embraces the aims and content of the National Curriculum, champions a 'can do' attitude and embraces the principles of a mastery approach. All stakeholders can articulate the 'why' and not just 'what' we do/resources we use.	Leaders have a clear and ambitious vision for providing high-quality education to all pupils. This is realised through strong shared values, policies and practice. (L&M)								
	Problem Solvers: All pupils have many opportunities – in a lesson, within a unit – to solve problems by applying their mathematical understanding to a variety of problems with increasing sophistication, including in unfamiliar contexts and to model real-life scenarios.	Leaders adapt or construct a curriculum that is ambitious and designed to give all pupils the knowledge and cultural capital they need to succeed in life. (QoE)								
	The Answers Only The Beginning: Mathematical ideas are discussed and reasoned and not passively 'received' by pupils	the school's curriculum identifies opportunities when... solving problems will allow pupils to make useful connections between identified mathematical ideas or to anticipate practical problems they are likely to encounter in adult life. (M)								
	Convince Me: Tasks are deliberately designed to encourage pupils to describe, explain, justify, convince and/or prove	Teachers present subject matter clearly, promoting appropriate discussion about the subject matter being taught. (QoE)								
Implementation	Teach It, Keep It: The 'Mathematics Timetable' prioritises additional curriculum time beyond the mathematics lesson – a 'Maths On Track' (MOT) Meeting - to support deliberate practice, consolidation, pre-teach and/or immediate intervention.	Within the curriculum, there are sufficient opportunities planned to revisit previously learned knowledge, concepts and procedures; this is to ensure that, once learned, mathematical knowledge becomes deeply embedded in pupils' memories... (M)								
	The Responsive Teacher: Pupils' difficulties and misconceptions are identified through immediate same day/week formative and periodic summative assessment	there are objective assessments that can identify when all pupils have gained the intended understanding and unconscious competence in knowledge, concepts and procedures necessary before they move on to more complex content. (M)								
	Prevent The Gap: Pupils' difficulties and misconceptions are addressed with rapid intervention within the lesson, same day and diagnostic test informed intervention	there is flexibility in curriculum planning so that the school can address identified gaps in pupils' mathematical knowledge that hinder their capacity to learn and apply new content. There are pupils behind age-related expectations are provided with the opportunities to catch up with their peers. (M)								
		They are able to apply mathematical knowledge, concepts and procedures appropriately for								

- Conclusions were drawn that there were inconsistencies in two areas: **visual representations used by staff** and **pupil confidence with knowledge and fact recall when moving year groups after the summer holidays**
- 'Ready to Progress Tests' (*CanDo* resource) confirmed these findings. *It's not doing the assessments but it's "what is being done as a result of an assessment" ...*

Where to start?

- Revisited the *Intent* for mathematics and ensured this underpinned how we were approaching the subject as a school

Our intent statement for mathematics:

In Mathematics, it is our intent that pupils will foster a positive, 'can do' attitude where they feel safe to try new things and **aspire** to have a go at challenging concepts.

Our pupils will **achieve** a much deeper mathematical understanding through our lesson and activity design based around the mastery approach which ensures they do not 'race' through mathematical content, but rather explore concepts in more detail allowing them to enjoy the process of problem solving.

We encourage our pupils to **seek** curiosity from this process by providing them with the verbal reasoning skills needed to become well-rounded mathematicians – the answer is only the beginning so proving and justifying thoughts is central to our mathematical learning.

Mistake-sharing is a crucial part of our learning journeys and it is through celebrating these that we can fully adopt a whole class team approach where everybody has a chance to shine and truly **believe** they are the best mathematician they can be.

Our curriculum drivers ...



We **seek**
the
answers
to big
questions.

We
believe in
our own
potential.

We **aspire**
to be the
best that
we can be.

We
achieve
success.

Where to start?

- Revisited the intent for mathematics and ensured this underpinned how we were approaching the subject as a school
- **Revisited our 'What Maths Looks Like' document**

What does Maths look like in our school?



Mathematics - Main Lesson Design

EYFS

In EYFS, "Maths in our routines" is an overarching mind-set adopted by all staff. Children are encouraged to explore Mathematics in context, regularly highlighting where Maths is in the world around us. Four whole class Maths lessons will happen each week (20 minute input from White Rose Maths), involving whole class teaching followed by provision activities (during which, immediate intervention takes place for those individuals displaying misconceptions during the input). Subsequent lessons are consequently adapted according to how the pupils have accessed the provision.

Incidental Maths happens continuously and pupils are encouraged to apply their mathematical understanding during their play. Provision activities during other times of the week will include pre-teaching for the next week's concept as well as re-capping previous whole class sessions. To ensure that pupils are prepared for the whole school approach to Mathematics, during the Summer term, questions are carefully planned in so that regular opportunities are given for the pupils to secure and deepen their understanding. Pupil understanding is evidenced through a whole class floor book as well as inputting information to Tapestry.

EYFS > Year 1 transition (Autumn 1)

In our Year 1 settings, the first Autumn term will consist of allowing pupils to make choices about their mathematical learning. Like the whole school, a small step will be focused on each day but the children may choose to respond to this in different ways. They are offered the opportunity to complete the 'Do It' task directly into their book but they may choose to respond through art, role play or other practical activities. This is to ensure that a transition period occurs between continuous provision and formal mathematical learning as well as to allow opportunity for those pupils with gaps to achieve their GLD.

Years 1-6

Across the school, we teach the whole class so that everybody follows the learning journey together. Every lesson will be focused around a specifically-written 'WALT' (learning objective). The learning journey will be tracked across the 'Working Wall' and key concepts/methods/mathematical vocabulary will be clearly displayed to support pupils' learning. The learning journeys will follow 'manageable steps learning' – where the learning objectives are tightly focused and measurable within one lesson. Differentiation occurs through the use of adult support as well as immediate interventions during the 'Maths Meeting' session later that day. These may include re-teaching mathematical concepts/vocabulary as well as immediately picking up on any areas that are

Maths Meeting Sessions

Key Stage One – 'Mathematicians'

Key Stage Two – 'Maths Meeting'

This is a session that is discrete from the main Mathematics lesson and is dedicated to pupils practising their mental maths fluency, arithmetic skills and knowledge of numbers. Like our main Maths lessons, we follow the structure set out by 'Can Do Maths' when identifying focus for the session. One/two sessions a week are dedicated to deliberate practice and these are mapped out according to the areas that need developing which are identified through the previous half term's Remember It assessment.

Both Key Stages have access to 'journals' which they can use during their 'Maths Meeting' time to explore their own understanding. These books are unmarked and personal to pupils however, teachers can access these to take evidence from when assessing if needed.

How does Mathematics teaching and learning respond to the SMSC needs of the school?

SMSC	
Spiritual	Maths Challenge – aiming high for all pupils and setting self-challenge, exploring patterns in the world around us Self-reflection and adopting a growth mind-set when doing so Rising to the challenge and having faith and belief in self when working through DSD activities
Moral	Self/peer marking – trusting when somebody may be correct/incorrect Mutual respect when pupils are agreeing/disagreeing during SECURE IT tasks and offering reasoning to support ideas during mathematical debate
Social	Responsibility to be a good and fair citizen in an active community – encouragement of random selection during Maths teaching rather than constant hands up or deliberate choice of specific pupils Self/peer marking Maths Challenge – working together within an active community towards one shared goal
Cultural	Open discussions about method choice and respecting the different methods of others – accepting that what works for one may not work for another, linking P4C approach to discussions in school

Where to start?

- Revisited the curriculum to ensure it was appropriate for the approach
- Revisited our 'what good looks like' document
- **Conducted pupil and staff voice**
- **Monitored teaching and learning in more detail**







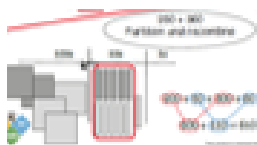

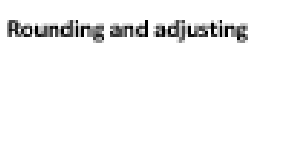
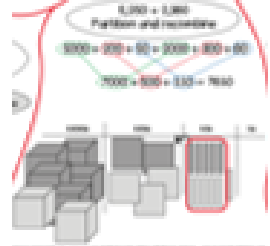
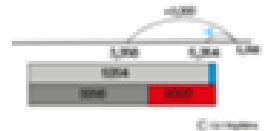
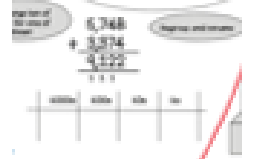
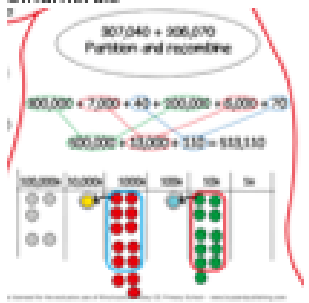
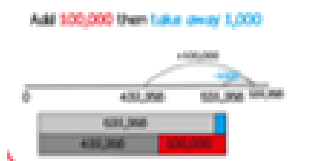

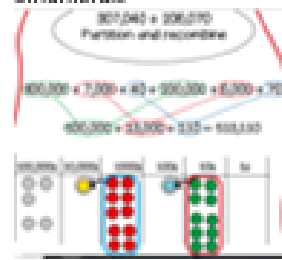


Some representations weren't being built upon progressively and were randomly introduced due to different teaching styles.

Where to start?

- Revisited the vision for Mathematics and ensured this underpinned how we were approaching the subject as a school
- Revisited our 'What Maths Looks Like' document
- Conducted pupil and staff voice
- Monitored teaching and learning in more detail
- **Re-drafted the calculation policy and began to explore bar modelling more formally**

Calculation policy: Method Progression Map



	Reception	Y1	Y2	Y3	Y4	Y5	Y6
Addition Mental methods to be taught after visual.	<p>Counting all:</p> <ol style="list-style-type: none"> 1.Real-life objects 2.Pictures of real-life objects  <p>3.Drawing using a representation and counting all</p> <p>Counting on in ones from a starting point:</p> <ol style="list-style-type: none"> 1.using a given number line to highlight the starting number and track the jumps being added 	<p>Counting all:</p> <ol style="list-style-type: none"> 1.mathematical objects (numicon, cubes, counters) 2.drawings  <p>Counting on in ones from a starting point:</p> <ol style="list-style-type: none"> 1.mathematical objects (numicon, cubes, counters) 2.given number line 	<p>Partitioning:</p> <p>Partition and recombine</p> <ol style="list-style-type: none"> 1.diennes 2.drawing the diennes  <p>Count on in tens and then in ones (if ones present)</p> <ol style="list-style-type: none"> 1.diennes 2.drawing the diennes 3. given number line 4. empty number line  <p>5. bar model</p> 	<p>Partitioning:</p> <p>Partition and recombine</p> <ol style="list-style-type: none"> 1.diennes 2. place value counters 3. drawings 4. numerals  <p>Counting on in hundreds, tens and then ones</p> <ol style="list-style-type: none"> 1.diennes/place value counters 2.drawings 3.empty number line 4. bar model <p>Formal written method (compact vertical)</p>  <p>Rounding and adjusting</p> 	<p>Partitioning:</p> <p>Partition and recombine</p> <ol style="list-style-type: none"> 1.diennes 2. place value counters 3. drawings 4. numerals  <p>Rounding and adjusting</p> <ol style="list-style-type: none"> 1.number line 2.bar model  <p>Formal written method (compact vertical)</p> 	<p>Partitioning:</p> <p>Partition and recombine</p> <ol style="list-style-type: none"> 1.place value counters 2.drawings 3.numerals  <p>Rounding and adjusting</p> <ol style="list-style-type: none"> 1.number line 2.bar model <p>Add 100,000 then take away 1,000</p>  <p>Formal written method (compact vertical)</p> 	<p>Partitioning:</p> <p>Partition and recombine</p> <ol style="list-style-type: none"> 1.place value counters 2.drawings 3.numerals  <p>Rounding and adjusting</p> <ol style="list-style-type: none"> 1.bar model  <p>Formal written method (compact vertical)</p> 

Bar Modelling

... “yeah, we do that” ...





Bar modelling can sometimes be mistakenly used for:

- sense making
- the “more able” only (eg “*Prove how you know that your answer is correct by representing it through a bar model*”)
- as a method when children don’t understand
- quickly during “SATs revision”

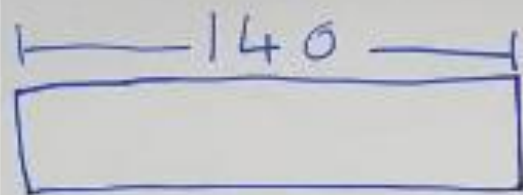
Bar Modelling

- Subject leader refreshed knowledge of bar modelling by completing *White Rose Maths* offer of bar modelling training (online videos that can be completed whenever)
- Subject leader led a staff meeting on bar modelling for all staff
- Subject leader put together a '**progression of representations**' document so that all staff were clear

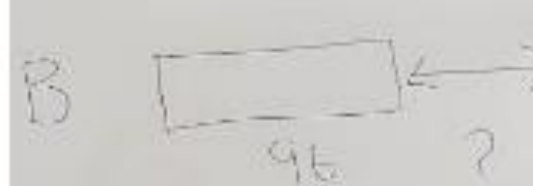
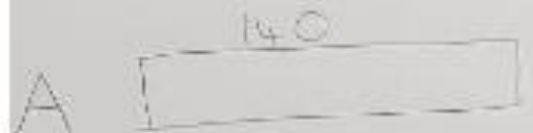
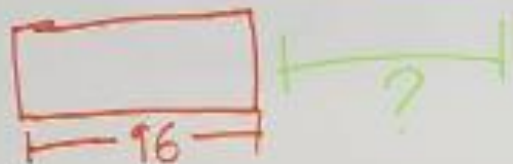
**‘Mistakes schools
make when
implementing bar
modelling ...’**

**An interesting article on TeachWire
outlines some areas to avoid:**

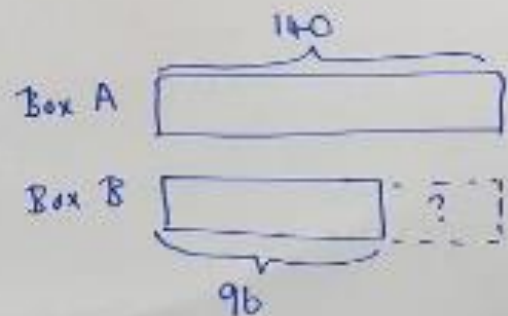
- Not fully using the CPA approach
- Lacking consistency across the school



(1)



(2)



(3)

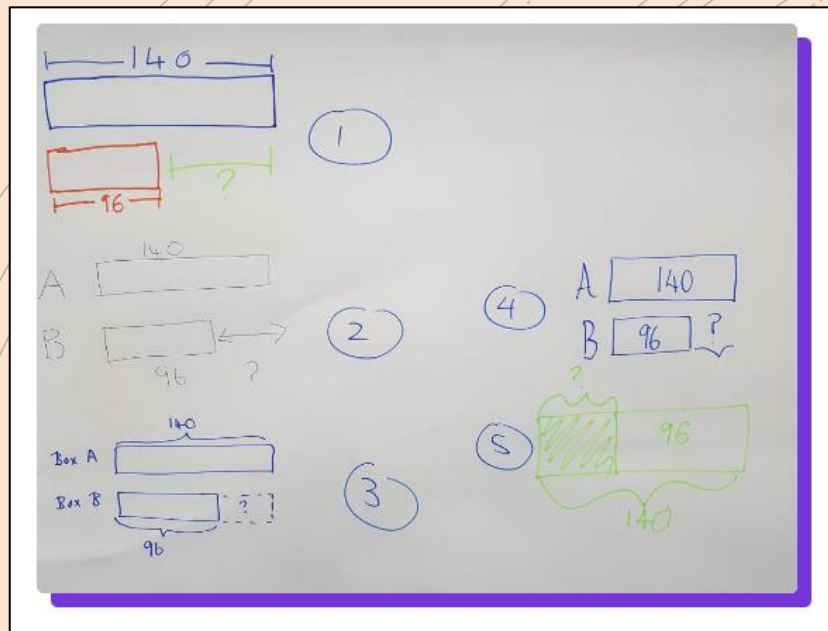
(4)



(5)



Should we allow teachers to draw them how they think is best? Is that a good whole school approach?



“Should we allow teachers to draw them how they think is best? Is that a good whole school approach?”





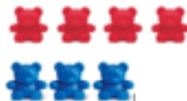

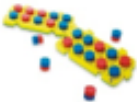
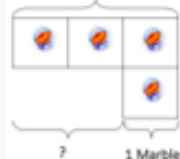

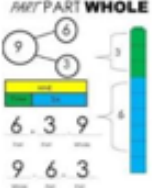

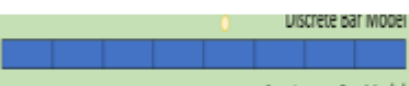
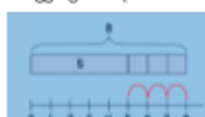
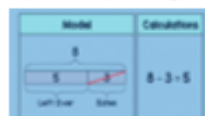
White Rose Maths produced an article **aimed at secondary specialists** stating the importance of learners being exposed to a variety of methods and representations.


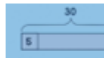


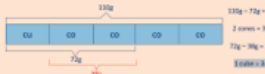
We feel that discussions around method efficiency are essential but are only fully effective once pupils (especially at primary level) have a concrete understanding of a method (or representation).

‘Mistakes schools
make when
implementing bar
modelling ...’

**An interesting article on *TeachWire*
outlines some areas to avoid:**

- Not fully using the CPA approach
- Lacking consistency across the school
- **Neglecting Early Years**

	EYFS	Y1	Y2
<p>Bar Modelling</p> <p><i>Bar Models will initially be used to represent one number (e.g. part-part-whole) / to compare two values before being used at the end of KS1 moving into Year 3 to represent questions/problems.</i></p>	<p>Across the year:</p> <ul style="list-style-type: none"> Discussions of 'part-part' e.g. "5 is made up of 2 and 3" Representing two parts using different amounts of objects Lining objects up accurately in a row for counting and separating the two parts  <ul style="list-style-type: none"> Numicon utilised to create different parts of a number on top of one another Part-part-whole circle structure to be explored using objects  <ul style="list-style-type: none"> Lining up two sets of objects and comparing which has the greater amount 	<p><u>Autumn term</u>, physical part-part-whole work mirroring EYFS:</p>  <ul style="list-style-type: none"> Numerals written onto templates to label what has been created using resources Numicon utilised to represent numbers Using tens frames to represent numbers in different ways  <p>Spring term onwards:</p> <ul style="list-style-type: none"> Objects and then pictures are used to represent the values of the bars e.g.  <ul style="list-style-type: none"> Children are able to independently draw their own number representations for part-part-whole 	<ul style="list-style-type: none"> Numerical part-part-whole is used straight away. Cubes > drawings of cubes are used in straight lines to represent these part-part-wholes <p>PART PART WHOLE</p>  <ul style="list-style-type: none"> Counters and/or cubes are used to represent amount when comparing numbers  <ul style="list-style-type: none"> Discrete bar models only:  <p>Spring term onwards</p> <ul style="list-style-type: none"> Continuous bar models used to teach aggregation. Augmentation will be used to model what's happening during aggregation (referenced below)  <ul style="list-style-type: none"> Bar modelling is used to represent problems (including finding the difference)  <p>Reduction</p> <p>Concrete > pictorial > numerical</p>

Y3-4	Y5	Y6
<ul style="list-style-type: none"> Bar modelling used to solve addition and subtraction as per year 2 outline. This will include comparison when finding the difference. Bar modelling used to solve multiplication and division problems  <p>Sharing</p>  <p>Grouping</p> <ul style="list-style-type: none"> Bar modelling used to solve unit fraction problems: 	<ul style="list-style-type: none"> Bar modelling used when solving problems involving scaling e.g. "three times as much" 	<ul style="list-style-type: none"> Bar modelling used to represent multi-step pre-algebraic problems  <ul style="list-style-type: none"> Bar modelling used to represent problems involving ratio Bar modelling used to represent algebraic problems – only as a form of visualisation <p>Important: these problems can get complex so most efficient way is to solve them algebraically. Bar model acts as a visual to explain what is happening when the equation is balanced.</p>

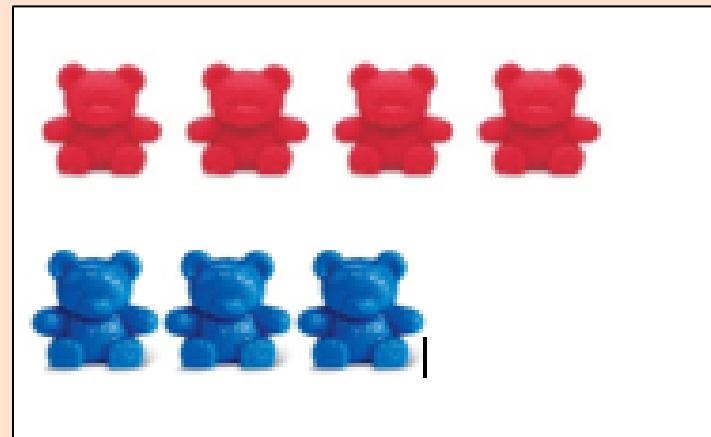
A red speech bubble graphic with a white border, containing the text 'To note ...'. The bubble has a tail pointing towards the bottom left.

To note ...

- We are aware that this is not an exhaustive list of what 'bar modelling' has to offer
- It is where we are currently with mapping out the progression across school

Importance of early bar modelling

- It became clear that introducing the foundations for bar modelling into EYFS and KS1 was the most important focus for our thinking



EYFS

Across the year:

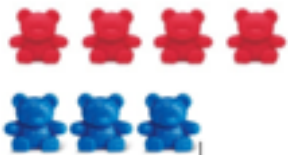
- Discussions of 'part-part' e.g. "5 is made up of 2 and 3"
- Representing two parts using different amounts of objects
- Lining objects up accurately in a row for counting and separating the two parts



- Numicon utilised to create different parts of a number on top of one another
- Part-part-whole circle structure to be explored using objects



- Lining up two sets of objects and comparing which has the greater amount



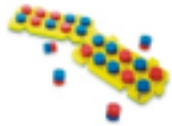
EYFS

- Building up from EYFS is essential for our vocabulary journey
- Language of "5 is made from 2 and 3" used throughout and "we can show 5 bears by using 2 bears and 3 bears"
- Lining objects up in rows for accurate counting
- Lining objects up in rows for accurate comparison work

Autumn term, physical part-part-whole work
mirroring EYFS:

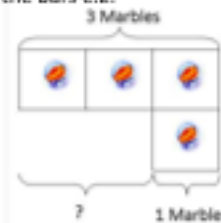


- Numerals written onto templates to label what has been created using resources
- Numicon utilised to represent numbers
- Using tens frames to represent numbers in different ways



Spring term onwards:

- Objects and then pictures are used to represent the values of the bars e.g.



- Children are able to independently draw their own number representations for part-part-whole

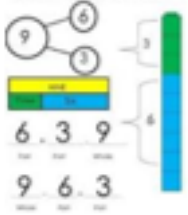


Year One

- Autumn term mirrors EYFS with physical part-part-whole work
- Numerals are written onto templates to show what each Numicon piece represents
- Tens frames utilised to represent numbers
- Objects and pictures of objects used to represent values (eg for comparison work)
- 'Part-part-wholes' are written in numerical form

- Numerical part-part-whole is used straight away. Cubes > drawings of cubes are used in straight lines to represent these part-part-wholes

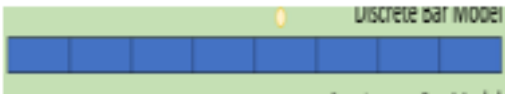
PART PART WHOLE



- Counters and/or cubes are used to represent amount when comparing numbers

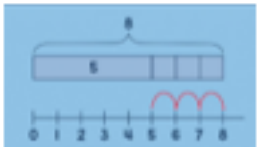


- Discrete bar models only:

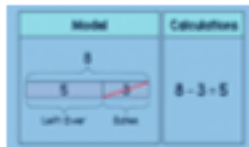


Spring term onwards

- Continuous bar models used to teach aggregation.
- Augmentation will be used to model what's happening during aggregation (referenced below)



- Bar modelling is used to represent addition and subtraction problems:



Reduction



Comparison model

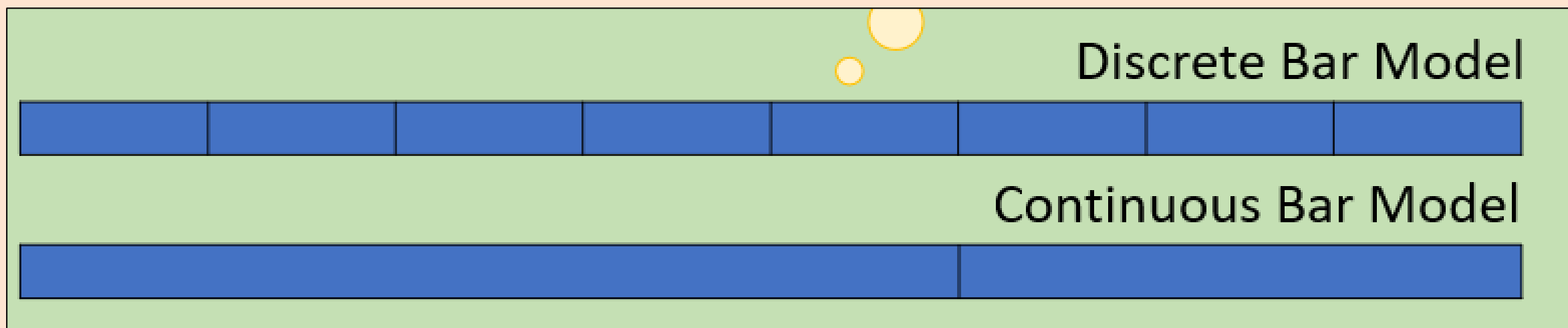
Concrete > pictorial > numeral pattern to be followed whenever used.

Year Two

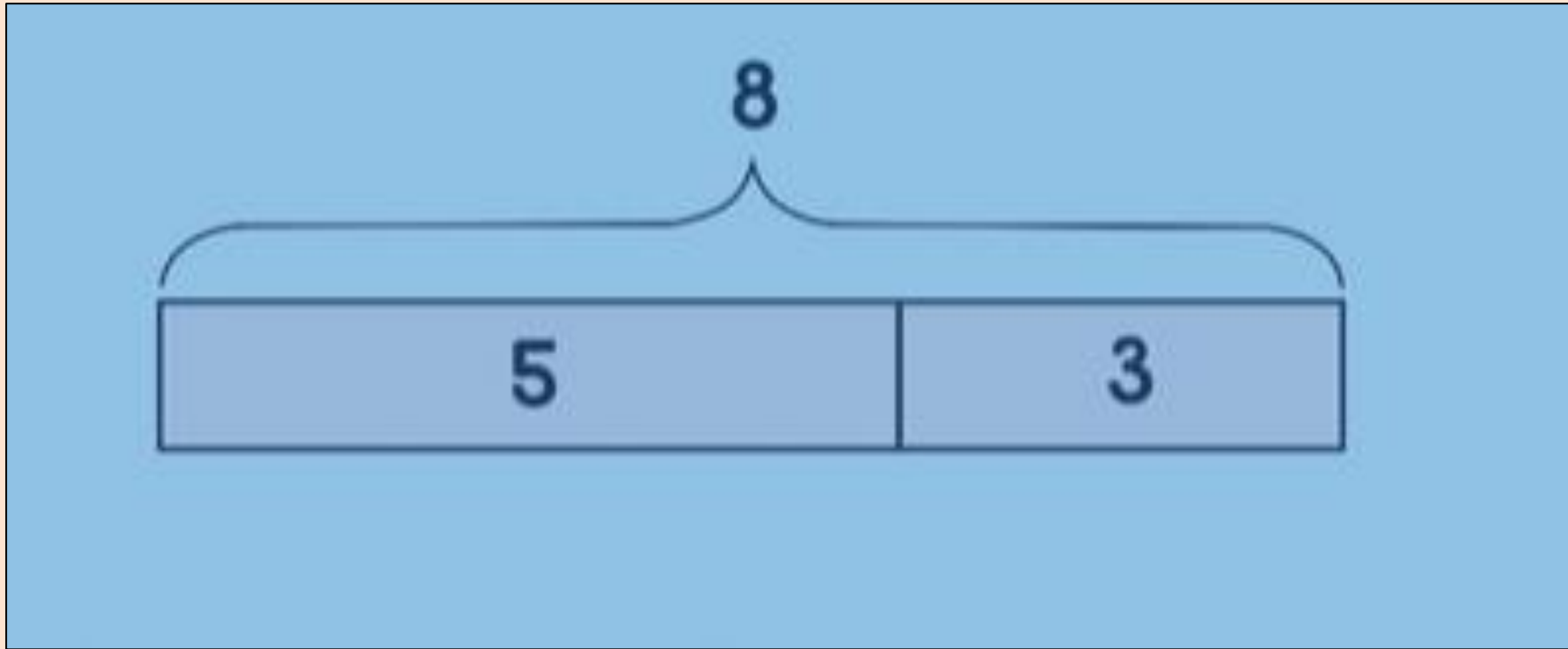
- Part-part-whole in numerical form is used straight away to represent number facts
- These are then shown alongside cubes (1-digit numbers only) – firstly, shown vertically and then moving to layering one on top of the other
- These are then drawn with a 1:1 correspondence as discrete bar models (eg the rectangle representing '6' would be 6 squares wide at this point)
- During the spring, aggregation using continuous bars is encouraged (where *two parts* come together to create the *whole*). Bar modelling is used to represent addition and subtraction problems
- The *concrete > pictorial > numeral* pattern is followed right up until the end of the year

Discrete bar models are used until Summer term in Y2.

We then model using continuous bar models.

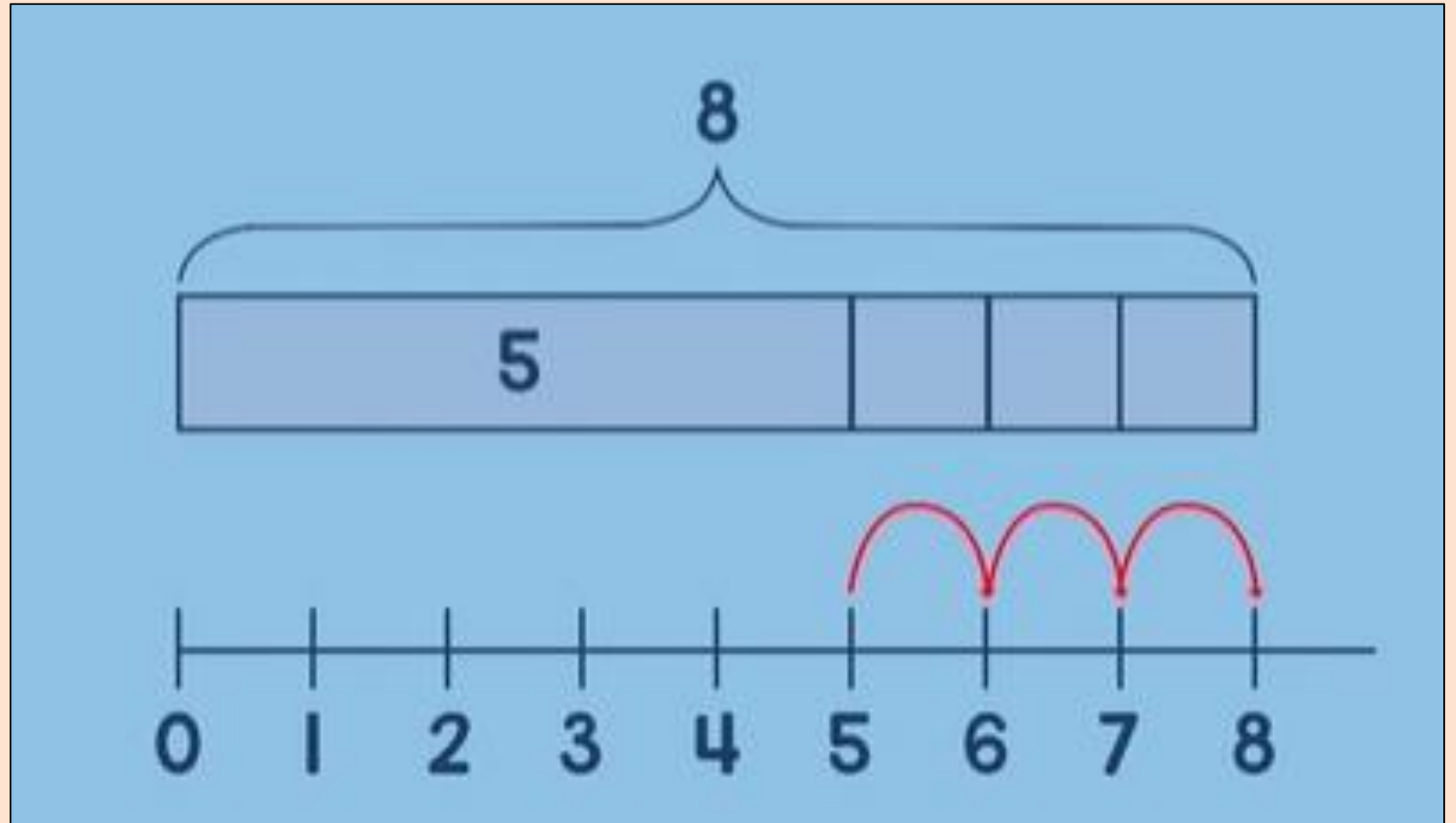


**Aggregation is where two parts
come together to make a whole:**



Some children struggle with aggregation so we often combine both models to encourage them to develop their counting on ...

**Augmentation =
start with one
amount and
count on ...**



What prior knowledge does a pupil need to be able to make sense of this question?

Peter has 15 grapes. Jane has 11 grapes.

How many more grapes does Peter have than Jane?

How would we expect a Y2 pupil to solve this question?

Peter has 15 grapes. Jane has 11 grapes.

How many more grapes does Peter have than Jane?

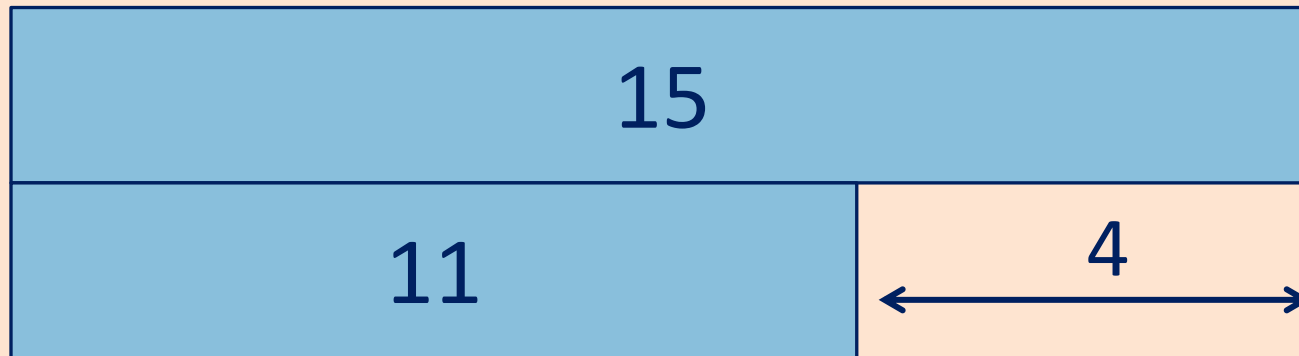
$$15 + 11 = 26 \dots ?!$$

How might a representation help a struggling Y2 pupil to solve this?

Peter has 15 grapes. Jane has 11 grapes.

How many more grapes does Peter have than Jane?

Placing bars underneath helps to avoid the accidental addition misconception.



$$11 + ? = 15$$

...

$$11 + 4 = 15$$

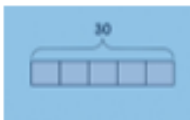
Peter has 4 more grapes than Jane.

Year Three and Year Four

Y3-4

Continuing as before for children who are struggling with representing using bar modelling, but to also include:

- Bar modelling used to solve addition and subtraction as per year 2 outline. This will include comparison when finding the difference.
- Bar modelling used to solve multiplication and division problems



Sharing



Grouping

- Bar modelling used to solve unit fraction problems:



- *Bar modelling continues to be used to represent the comparison of values, represent addition and subtraction problems (including the comparison model/finding the difference)*
- Bar modelling is used to represent multiplication and division worded problems through sharing and grouping
- Bar modelling is used to solve unit fraction problems

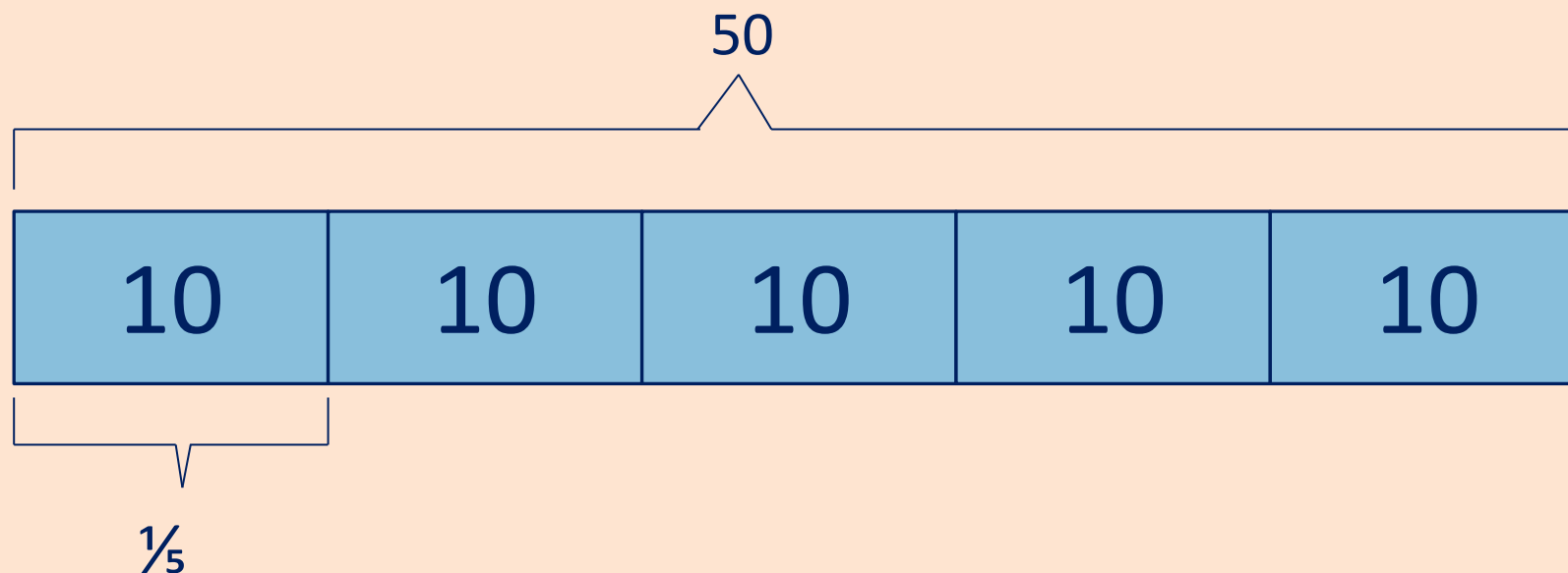
What prior knowledge does a pupil need to be able to make sense of this question?

$\frac{1}{5}$ of a number is 10. What is the number?

$\frac{1}{5}$ of 10 = ... ?!

How might we expect a Y3 pupil to make sense of this question?

$\frac{1}{5}$ of a number is 10. What is the number?



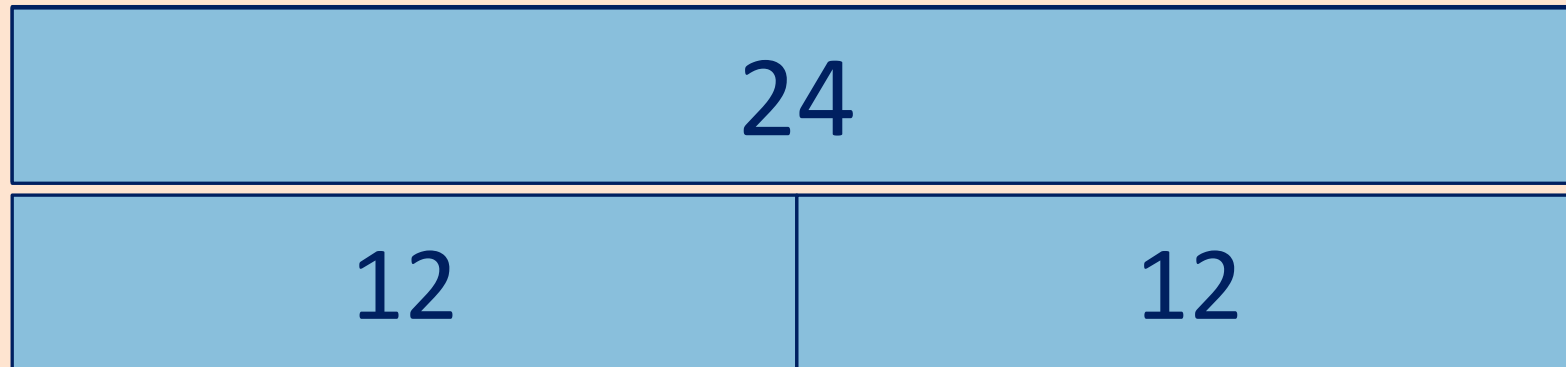
$$5 \times 10 = 50$$

$$\frac{1}{5} \text{ of } 50 = 10$$

The number
is 50.

What about this?

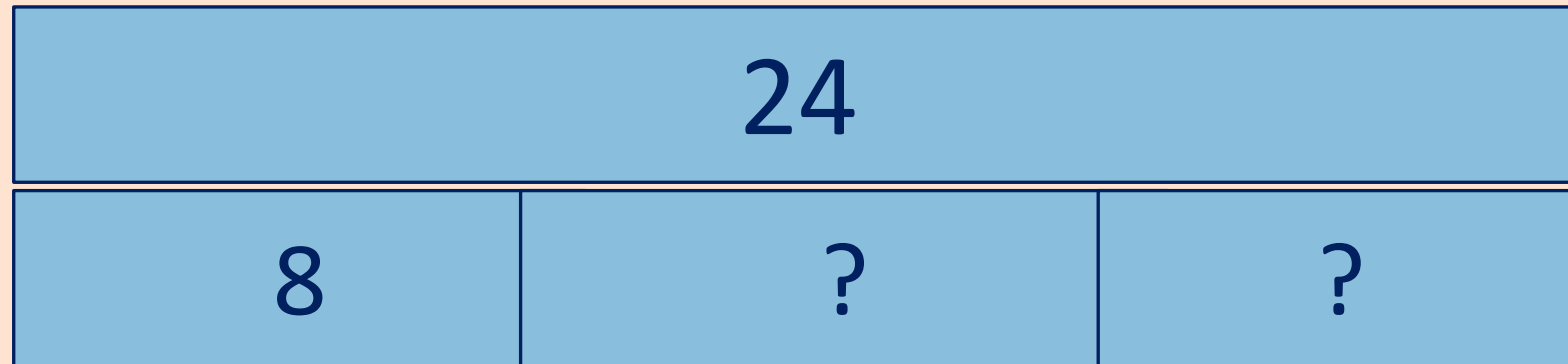
Jamie is thinking of a number.
One half of Jamie's number is 12.
What is $\frac{1}{3}$ of Jamie's number?



$\frac{1}{2}$ of ? = 12.
 $12 \times 2 = 24$.
 $\frac{1}{2}$ of 24 = 12.

Therefore ...

Jamie is thinking of a number.
One half of Jamie's number is 12.
What is $\frac{1}{3}$ of Jon's number?



$\frac{1}{3}$

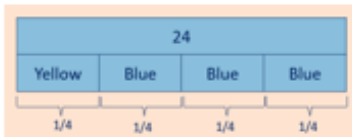
$$24 \div 3 = 8$$

$$\frac{1}{3} \text{ of } 24 = 8$$

Year Five and Year Six

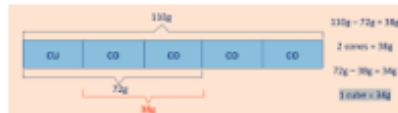
Continuing as before for children who are struggling with representing using bar modelling, but to also include:

- Bar modelling used when solving problems involving scaling e.g. “three times as much”



Continuing as before for children who are struggling with representing using bar modelling, but to also include:

- Bar modelling used to represent multi-step pre-algebraic problems



- Bar modelling used to represent problems involving ratio
- Bar modelling used to represent algebraic problems – only as a form of visualisation

Important: these problems can get complex so most efficient way is to solve them algebraically. Bar model acts as a visual to explain what is happening when the equation is balanced.

- Bar modelling continues to be used to represent the comparison of values, represent addition and subtraction problems (including the comparison model/finding the difference), multiplication and division and fractions
- Bar modelling to be used when solving problems involving scaling
- Used to represent multi-step, pre-algebraic problems
- Representing problems involving ratio
- Used as a tool to visualize algebraic problems but only as a form of visualisation

What prior knowledge does a pupil need to be able to make sense of this question?

The blue jug contains three times as much water as the yellow jug.

There are 32 litres of water in total.

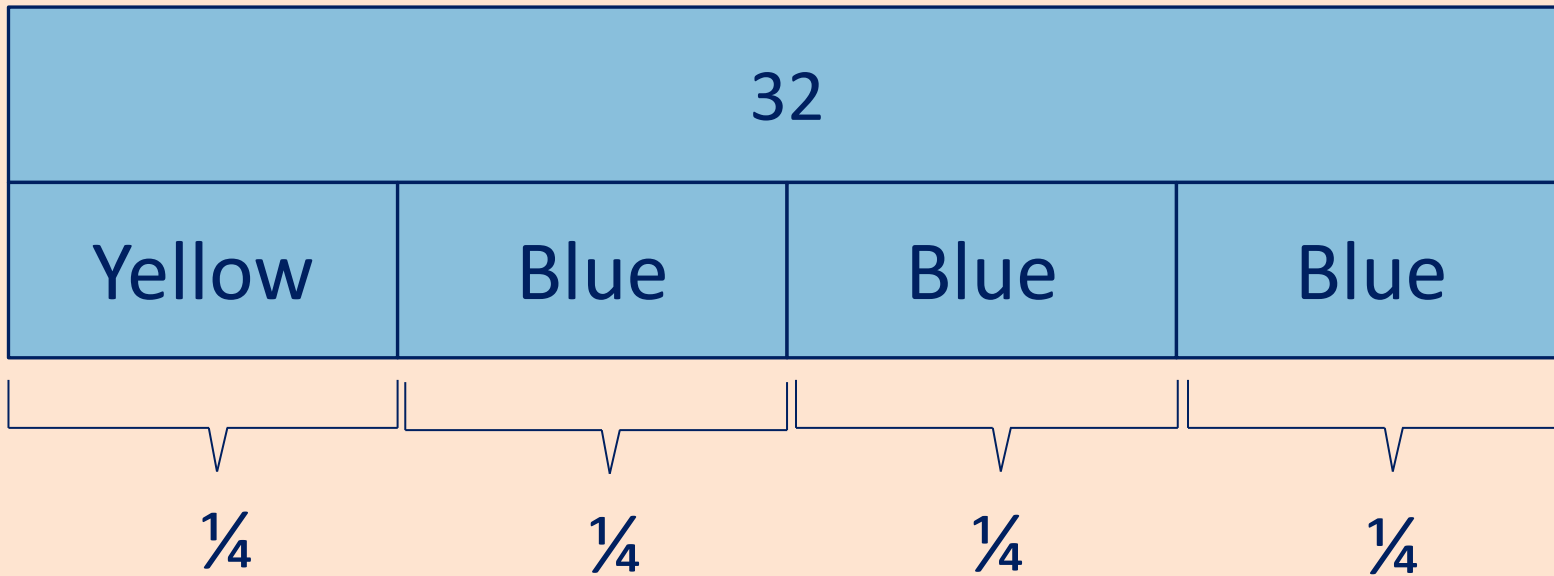
How much water is in the blue jug?

$$32 \div 3 = \dots ?!$$

The blue jug contains three times as much water as the yellow jug.

There are 32 litres of water in total.

How much water is in the blue jug?



$$32 \div 4 = 8$$

$$\frac{1}{4} \text{ of } 32 = 8$$

$$3 \times 8 = 24$$

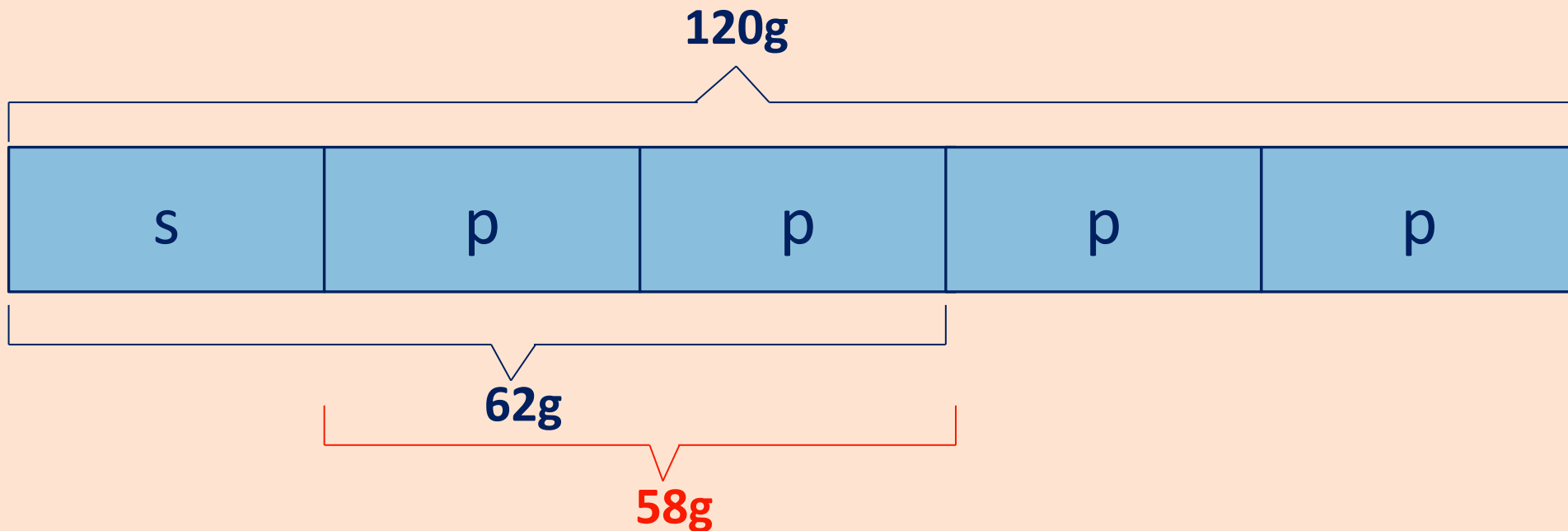
24 litres

Pre-algebra ...

The mass of 1 sharpener and 4 pens is 120g.

The mass of 1 sharpener and 2 pens is 62g.

What is the mass of 1 sharpener?



$$120\text{g} - 62\text{g} = 58\text{g}$$

$$2 \text{ pens} = 58\text{g}$$

$$62\text{g} - 58\text{g} = 4\text{g}$$

$$1 \text{ sharpener} = 4\text{g}$$

Take away the question ... “what do you notice?”

Charlotte has $\frac{1}{2}$ as many cards as Issy.

Issy has $\frac{1}{3}$ as many cards as James.

James has 84 more cards than Issy.

~~How many cards are there in total?~~

Who has the
longest bar?

Who has the
shortest bar?

Our Bar Modelling Rules

- No rubbers allowed, especially when subtracting! Crossing out gives a clearer representation of what is happening when a value has been subtracted
- The calculations are written alongside the bar model
- ‘Sense making’ of questions is key when exploring worded mathematical problems
- Numbers are written inside the bars, totals are bracketed outside of the bars (there are different representations for this on commercial resources so we’ve found it important to be consistent across school)
- Consistently asking: “What do we already know?”
- Consistently following the whole school pedagogical approach of ‘I Do > We Do > You Do’

The bar model doesn’t perform the calculation, but it helps pupils to see which calculation to perform.

Useful resources

...

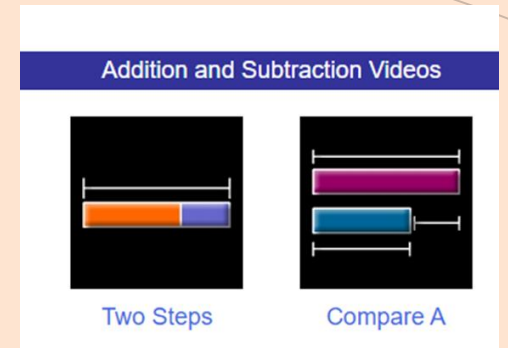
Free Bar Modelling PowerPoint And Other Ways To Showcase The Use Of The Bar Model

Third Space Learning

www.mathsplayground.com

Thinking Blocks videos.

Thinking Blocks modelling tool.

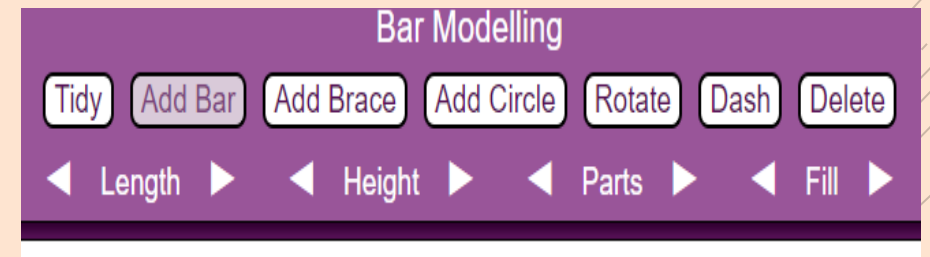


<http://moldingminds.com/video-introduction-to-the-bar-model/>

Article and video on an introduction to bar modelling.

www.mathsbot.com

Manipulatives bar.



Where next for us?



- Continue to add detail to the bar modelling progression
- Lead a further staff meeting to ensure all are confident when implementing the progression
- Monitoring to continue, matching tightly to the progression document
- Conduct pupil voice to analyse pupil responses to the visual representations they find most useful

Image credits:

- Winchcombe Abbey CofE Primary School photo: Gloucestershire Live. (2021). *Winchcombe Abbey CE Primary School*. [Photograph]. Gloucestershire: Gloucestershire Live.
- Necker Island: The CEO Magazine. (2019). *Necker Island*. [Photograph]. Brookvale: The CEO Magazine.
- Willy Wonka: The CEO Magazine. (2021). *Condescending Wonka*. [Photograph]. Unknown: Tenor.com.
- White Rose Bar Modelling representations provided through paid training videos, accessible at: <https://whiterosemaths.com/professional-development?page=1>
- TeachWire article: TeachWire. (undated). *8 mistakes schools make teaching the bar model method in maths (and how to avoid them)*. [Online]. www.teachwire.net. Available at: <https://www.teachwire.net/news/8-mistakes-schools-make-teaching-the-bar-model-method-in-maths/> [Accessed 2 March 2023].
- White Rose Maths Article and Picture: White Rose Maths. (2019). *Why Multiple Methods is the Way Forward*. [Online]. whiterosemaths. Last Updated: October 2019. Available at: <https://whiterosemaths.com/latest-news/why-multiple-methods-is-the-way-forward> [Accessed 23 May 2023].