Haggonfields Primary School

DIOCESE OF SOUTHWELL & NOTTINGHAM MULTI ACADEMY TRUST

Recording of Mathematical Calculations

Intent

At Haggonfields Primary, we follow the 'White Rose Hub' Mathematics' block planning scheme. This builds on skills sequentially, alongside regular recap and revisiting. Through regular recall learned material is embedded in the long-term memory. A vital aspect of revisiting is to become secure and fluent in the four mathematical calculations; addition, subtraction, multiplication and division.

The 'White Rose Hub' as part of their provision have a substantial Calculation Policy for its members to follow

Addition and Subtraction

https://assets.whiteroseeducation.com/new-schemes/Addition%20and%20subtraction%20calculation%20policy%20July%202022%20v2.pdf

Multiplication and Division

https://assets.whiteroseeducation.com/new-schemes/Multiplication%20and%20Division%20calculation%20policy%20July%202022.pdf

At Haggonfields this Calculation Policy is used as an integral part of planning. Therefore, pupils' fluency and rapid recall is developed thus enabling the confident learning of the Mathematics' Curriculum (DfE, 2013).

This document has been written to highlight the journey that each mathematical calculation takes. The guidance shows how pupils' learning is modelled and scaffolded by 'Concrete' materials and 'Pictorial' representation in order that 'Abstract' recording is deeply understood. It is intended that this secure deep understanding enables a true mastery of mathematics. Skills can be transferred between learning blocks, reasoning can be confidently explained and problems considered, tackled and solved effectively. Skills are also presented in context so that learning is useful. Pupils' resilience is boosted by having a deep understanding of skills as the learning allows multiple methods of calculation to be accessed so that answers can be checked independently and miscalculations used as learning opportunities.

The final section of this policy identifies the teaching of multiplication tables in recognition of the essential role it plays in the calculating of multiplication and division.

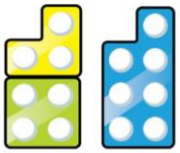
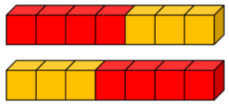
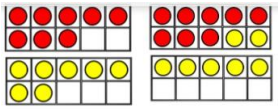
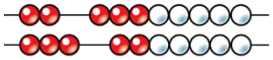
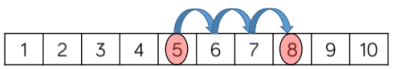
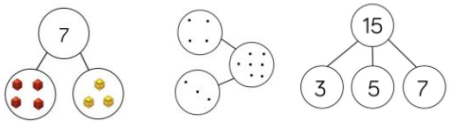
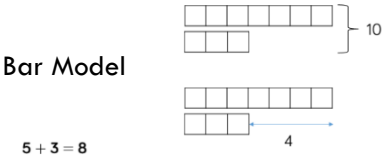
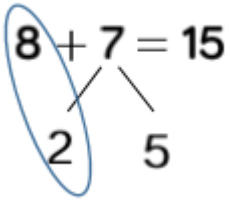
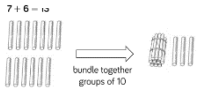
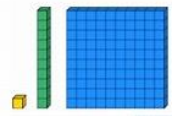
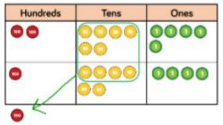
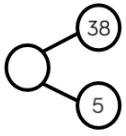
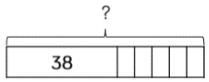
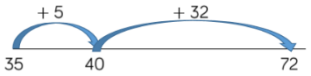
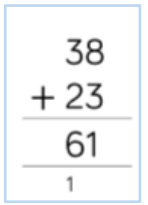
Aims

The aims of the calculation policy guidance at Haggonfields Primary is to provide:

- ★ An overview of the different models and images that can be used to support teaching.
- ★ Links between operations so that mathematics is taught with a mastery approach.

It is noted that concrete models and pictorial representation are not exclusive, a cumulative approach allows pupils to build upon skills and knowledge.

Addition

Skill	Concrete Model	Pictorial Representation	Abstract Recording
Add two 1-digit numbers to 10 Add 1 and 2-digit numbers to 20 Add three 1-digit numbers	Numicon  Cubes   Tens Frame Bead Strings   Number Track	Part-Whole Model  Bar Model  Labelled Number Line	$7 = 4 + 3$ $7 = 3 + 4$ 
Add 1-digit and 2-digit numbers to 100 Add two 2- digit numbers Add numbers with up to 3 digits	Straws   Dienes Hundred Square   PV counters	Part-Whole Model   Bar Model Labelled and Blank Number Lines 	$265 + 164 = 429$ 

It is noted that concrete models and pictorial representation are not exclusive, a cumulative approach allows pupils to build upon skills and knowledge.

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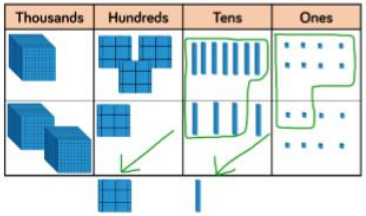
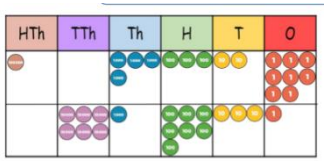
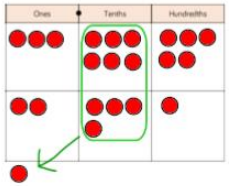
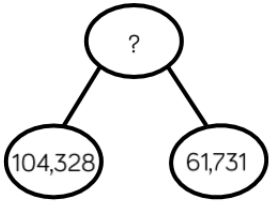
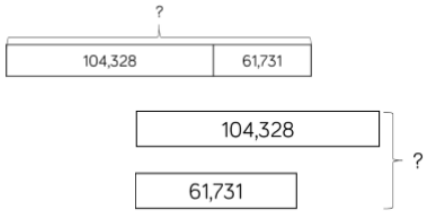
<td>Add numbers with up to 4 digits

Add numbers with more than 4 digits

Add numbers with up to 3 decimal places</td>
<td>Dienes
 

PV counters
 

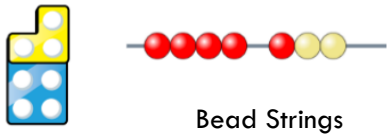
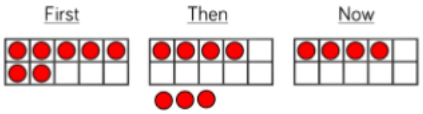
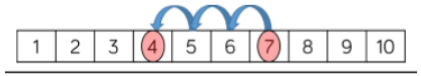
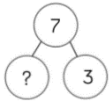
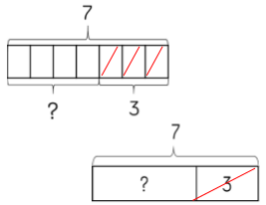
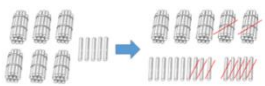
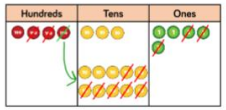
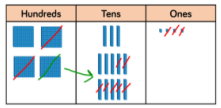
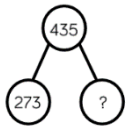
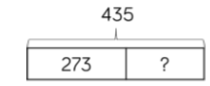
  </td>
<td>Part-Whole Model
 

Bar Model
 
</td>
<td>104,328 + 61,731 = 166,059

3.65
+ 2.41
6.06
1</td>
</tr>
</table>

It is noted that concrete models and pictorial representation are not exclusive, a cumulative approach allows pupils to build upon skills and knowledge.

Subtraction

Skill	Concrete Model	Pictorial Representation	Abstract Recording
Subtract two 1-digit numbers to 10 Subtract 1 and 2- digit numbers to 20	Numicon  Bead Strings Tens Frame   Number Track	Part-Whole Model  Bar Model   Labelled Number Line	$7 - 3 = 4$ $14 - 6 = 8$ 4 2
Subtract 1and 2-digit numbers to 100 Subtract numbers with up to 3 digits	Straws  Hundred Square   Dienes  PV counters	Part-Whole Model   Bar Model Labelled and Blank Number Lines 	$65 - 28 = 37$ $\begin{array}{r} {}^{3}\not{4}{}^{1}\not{5} \\ -\ 273 \\ \hline 262 \end{array}$

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Subtract numbers with more than 4 digits

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 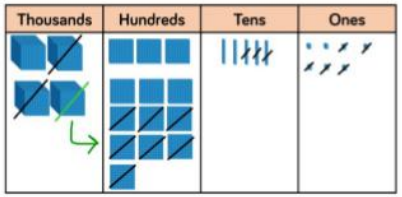

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 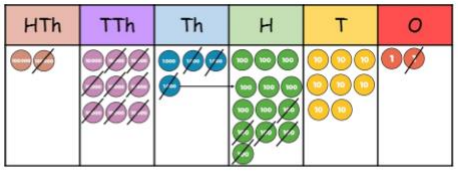

 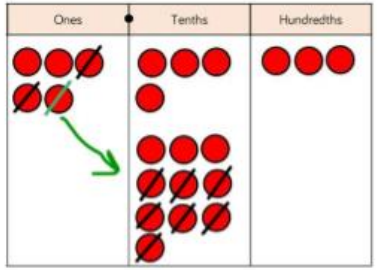
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 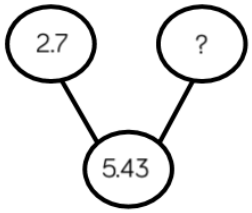

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 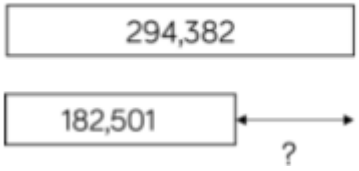
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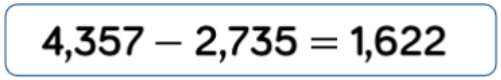
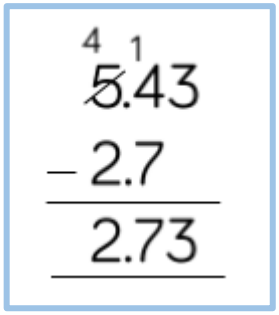
<td> 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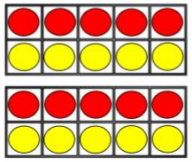
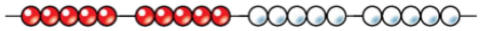
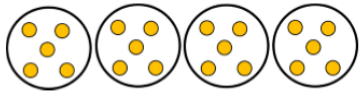
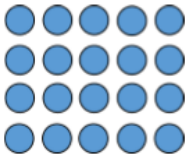
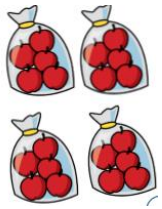
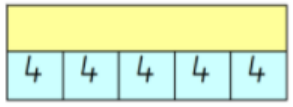
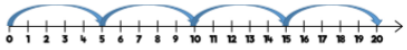
Multiplication

Skill	Concrete Model	Pictorial Representation	Abstract Recording
Solve one step problems with multiplication One bag holds 5 apples. How many apples do 4 bags hold? **Multiplication is represented as repeated addition in many ways.**	Numicon   Tens Frame Bead Strings  Counters   Arrays	Drawing  Bar Model  Labelled Number Line 	$5+5+5+5=20$ $4\times5=20$ $5\times4=20$

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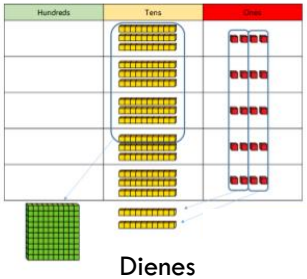
Multiply 2-digit by 1-digit numbers

Multiply 3-digit by 1-digit numbers

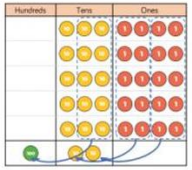
Multiply 4-digit by 1-digit numbers

Representation is used to support the understanding of these methods as times table knowledge should be firmly embedded.



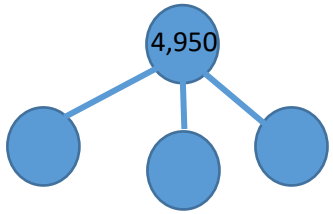
Dienes

PV counters

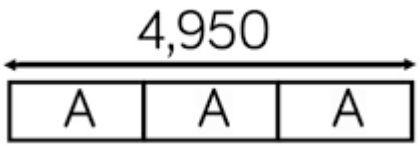


Cuisenaire Rods

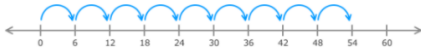
Part-Whole Model



Bar Model



Blank Number Lines



$34 \times 5 = 170$

	H	T	O	
		3	4	
×			5	
		2	0	(5 × 4)
+	1	5	0	(5 × 30)
	1	7	0	

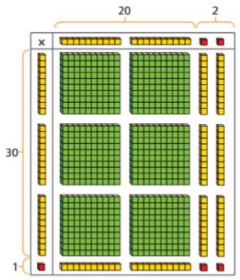
	H	T	O
		3	4
×			5
	1	7	0
	1	2	

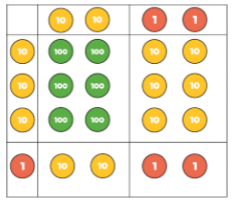
Multiply 2-digit by 2-digit numbers

Multiply 3-digit by 2-digit numbers

Multiply 4-digit by 2-digit numbers

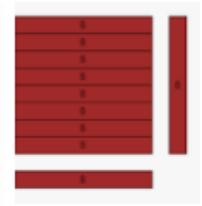
Dienes





PV counters

When multiplying a multi-digit number by 2-digits use the area model to help understand the size of the numbers.



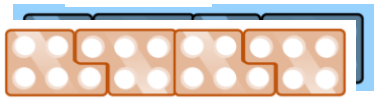
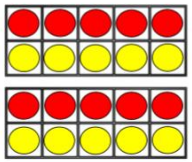
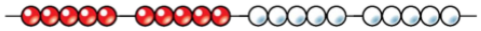
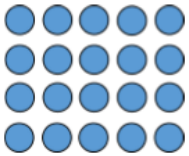
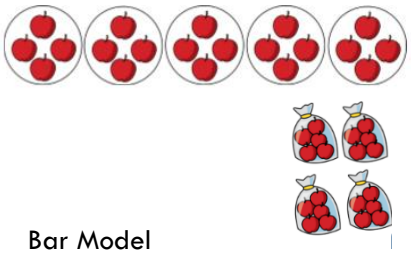
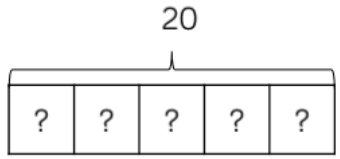
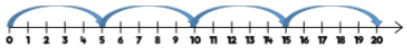
$234 \times 32 = 7{,}488$

×	200	30	4
30	6,000	900	120
2	400	60	8

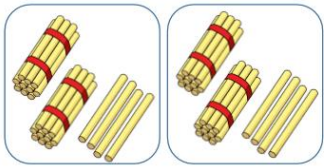
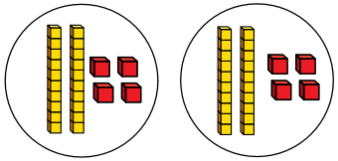
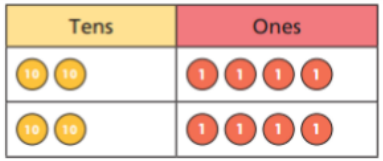
TTh	Th	H	T	O
	2	7	3	9
×			2	8
2 2	1 5	9 3	1 7	2
1 5	4	7 1	8	0
7	6	6	9	2
	1			

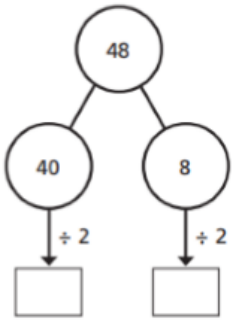
It is noted that concrete models and pictorial representation are not exclusive, a cumulative approach allows pupils to build upon skills and knowledge.

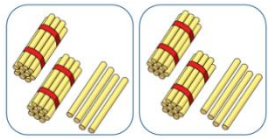
Division

Skill	Concrete Model	Pictorial Representation	Abstract Recording
Solve one step problems with division (sharing) Solve one step problems with division (grouping) There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag?	Numicon  Tens Frame  Bead Strings  Counters  Arrays 	Drawing  Bar Model  Labelled Number Line 	**Initially division is solved using concrete materials and pictorial representations. When confidence grows the division symbol is introduced.** $20 \div 5 = 4$

It is noted that concrete models and pictorial representation are not exclusive, a cumulative approach allows pupils to build upon skills and knowledge.

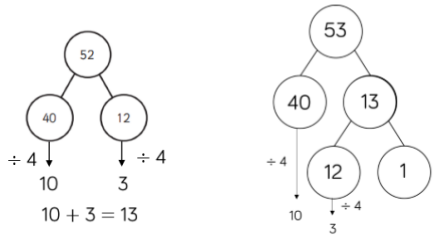
<table>
<tr>
<td>Divide 2-digit by 1-digit numbers (no exchange)</td>
<td>

Straws
Dienes

PV counters


</td>
<td>
Part-Whole Model


</td>
<td>48 ÷ 2 = 24</td>
</tr>
<tr>
<td>Divide 2-digit by 1-digit numbers (sharing no exchange)
Divide 2-digit by 1-digit numbers (sharing with exchange)
Divide 2-digit by 1-digit numbers (sharing with remainders)</td>
<td>

Straws

Dienes

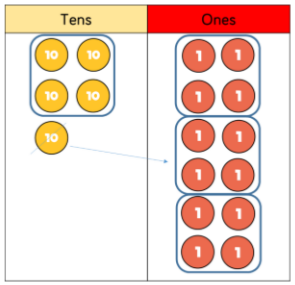
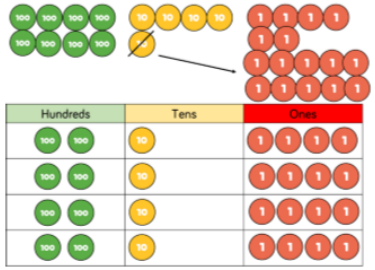
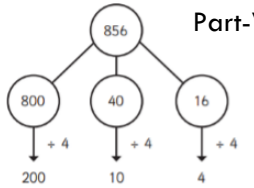
PV counters
</td>
<td>
Bar Model

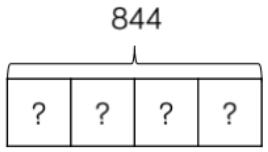
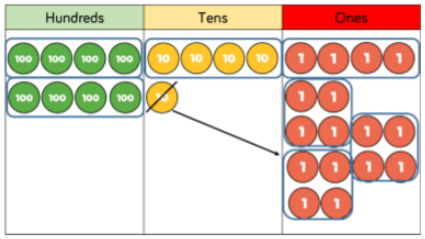

Part-Whole Model


</td>
<td>52 ÷ 4 = 13

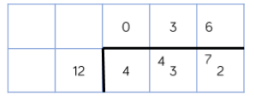
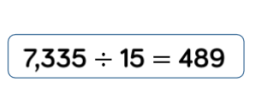
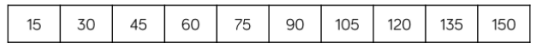
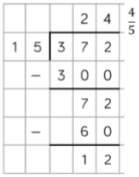
53 ÷ 4 = 13 r1</td>
</tr>
</table>

It is noted that concrete models and pictorial representation are not exclusive, a cumulative approach allows pupils to build upon skills and knowledge.

<table>
<tr>
<td>Divide 2-Digit by 1-Digit (grouping)</td>
<td>PV counters
 
</td>
<td></td>
<td>52 ÷ 4 = 13
 
</td>
</tr>
<tr>
<td>Divide 3-Digit by 1-Digit (sharing)</td>
<td>PV counters
 
</td>
<td>Part-Whole Model
 

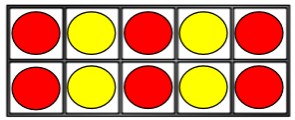
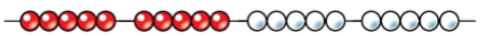
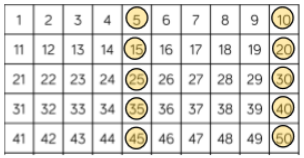
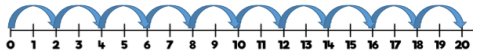
Bar Model
 
</td>
<td>844 ÷ 4 = 211</td>
</tr>
<tr>
<td>Divide 3-Digit by 1-Digit (grouping)
Divide 4-Digit by 1-Digit (grouping)</td>
<td>PV counters
 
</td>
<td></td>
<td>856 ÷ 4 = 214
 
</td>
</tr>
</table>

It is noted that concrete models and pictorial representation are not exclusive, a cumulative approach allows pupils to build upon skills and knowledge.

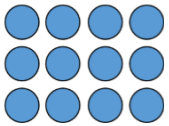
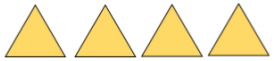
Divide Multi-Digit by 2-Digit (short division)			 $432 \div 12 = 36$  
Divide Multi-Digit by 2-Digit (long division)			$372 \div 15 = 24\ r12$  $1 \times 15 = 15$ $2 \times 15 = 30$ $3 \times 15 = 45$ $4 \times 15 = 60$ $5 \times 15 = 75$ $10 \times 15 = 150$  $372 \div 15 = 24\frac{4}{5}$

It is noted that concrete models and pictorial representation are not exclusive, a cumulative approach allows pupils to build upon skills and knowledge.

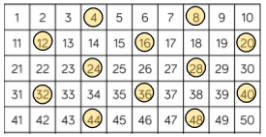
Multiplication Tables

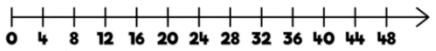
Skill	Concrete Model	Visual Representation	Recall
Recall and use the multiplication facts for the 2, 5 and 10 times' table.	Numicon   Tens Frame Bead Strings  Everyday objects   Number Grid	 Counting stick  Labelled Number Line	**Regular counting in multiples both forwards and backwards.** **Supported by a number line or hundred square.** **Look for patterns in the ones as well as odds and evens**

It is noted that concrete models and pictorial representation are not exclusive, a cumulative approach allows pupils to build upon skills and knowledge.

<table>
<tr>
<td>Recall and use the multiplication facts for the 3, 4 and 8 times' table.</td>
<td>

Array


Shapes
Numicon


Number Grid
<table>
<tr><td>4</td><td>8</td><td>12</td><td>16</td><td>20</td></tr>
<tr><td>24</td><td>28</td><td>32</td><td>36</td><td>40</td></tr>
<tr><td>44</td><td>48</td><td>52</td><td>56</td><td>60</td></tr>
</table>
</td>
<td>

Counting stick


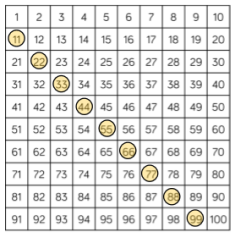
Labelled Number Lines
</td>
<td>
Regular counting in multiples both forwards and backwards.

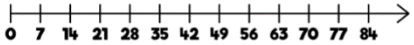
Supported by a number line or hundred square.

Look for patterns in the ones as well as odds and evens

Make links to previous tables (4 to 2 and 8 to 4)
</td>
</tr>
<tr>
<td>Recall and use the multiplication facts for the 6, 9, 7, 11 and 12 times' table.</td>
<td>

PV counters

Dienes

<table>
<tr><td>9</td><td>18</td><td>27</td><td>36</td><td>45</td></tr>
<tr><td>54</td><td>63</td><td>72</td><td>81</td><td>90</td></tr>
</table>
Number Grid
</td>
<td>

Counting stick


Labelled Number Lines
</td>
<td>
Regular counting in multiples both forwards and backwards.

Supported by a number line or hundred square.

Look for patterns in the ones as well as odds and evens

Make links to previous tables (9 and 6 to 3 and 12 to 4 and 6)
</td>
</tr>
</table>

It is noted that concrete models and pictorial representation are not exclusive, a cumulative approach allows pupils to build upon skills and knowledge.