Coordinating Mathematical Success Using **Teaching for Mastery**

MATHSHUBS NORTH NORTH WEST

Declarative knowledge (facts) and procedural knowledge (methods)

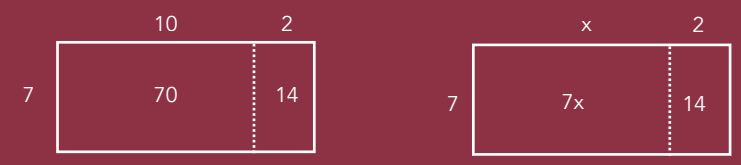
Lesson design links to prior learning to ensure all can access the new learning and identifies carefully sequenced steps in progression to build secure understanding.

"The curriculum should **identify and sequence key facts, formulae, concepts and vocabulary.** This helps pupils to avoid relying on derivation, guesswork or looking for clues"

"There is a difference between methods that help pupils to understand concepts and perform mental calculations and methods that are efficient and useful now and in the next stage of learning"

"The curriculum needs to sequence the teaching of mathematical methods carefully. **It should allow for some early methods,** such as parsing, derivation and complex diagrams, **to fade over time** (designed obsolescence)"

Examples, representations and models are carefully selected to expose the structure of mathematical concepts and emphasise connections, enabling pupils to develop a deep knowledge of mathematics



The area model for multiplication can be linked to prior learning and developed into algebraic methods.

"Pupils should learn the **most efficient, systematic and accurate mathematical methods**, so that they can use them for more complex calculations and in their next stage of learning"

Curriculum intent: identifying what pupils need to know and do

"The curriculum should identify and sequence declarative, procedural and conditional knowledge so that pupils' knowledge builds steadily over time"

"Linked facts and methods should ideally be sequenced to take advantage of the way that knowing facts helps pupils to learn methods and knowing methods helps them to learn facts"

Significant time is spent developing deep understanding of the key ideas that are needed to underpin future learning.

Pupils are taught through whole-class interactive teaching, enabling all to master the concepts necessary for the next part of the curriculum sequence.

"Declarative and procedural knowledge can be combined and taught as strategies for problem-solving"

"A well-sequenced curriculum, systematic teaching and opportunities for **practice help pupils to become proficient in mathematics.** This leads to success and motivation in the subject".

Curriculum design ensures a **coherent** and detailed sequence of essential content to support sustained progression over time.

Practice is a vital part of learning, but the practice must be designed to both reinforce pupils' procedural fluency and develop their conceptual understanding.

Conditional knowledge (strategies)

Mathematical learning behaviours are developed such that pupils focus and engage fully as learners who reason and seek to make connections.

"Pupils should be able to **recall facts and methods** to some level of automaticity before using them for wider problem-solving. The curriculum should reflect this optimal sequencing"

"'Problem-solving' is not a generic skill, and pupils cannot become problem-solvers by imitating the activities of experts. **Pupils need to learn strategies** and the most useful combinations of facts and methods to solve types of problem"

In a typical lesson, the teacher leads back and forth interaction, including questioning, short tasks, explanation, demonstration, and discussion, enabling pupils to think, reason and apply their knowledge to solve problems

"Since it is not possible for pupils to encounter every possible problem, a suitable curriculum identifies strategies to solve a range of problem types (topic-specific)"

Procedural fluency and conceptual understanding are developed in tandem because each supports the development of the other.

Read more about the **Essence of Mathematics Teaching for Mastery**

Variation

Representations

Coherence

Fluency

Mathematical Thinking

Pedagogy: consolidation of learning and new learning

Procedural variation considers how the student will 'proceed' through a learning sequence. **Purposeful changes** are made in order that pupils' attention is drawn to **key features** of the mathematics

"Practice helps pupils to **understand and remember mathematical knowledge**. There are broadly 2 types of practice. Type 1 involves retrieving and rehearsing facts, methods and strategies to the point of familiarity, speed and accuracy. Type 2 practice is more exploratory. It requires pupils to explain relationships, prove that they understand them and **describe their reasoning**"

"Pupils need **quantity and quality of practice** to help them understand and commit knowledge to long-term memory"

"Tasks should help pupils to focus on the mathematics to be learned. They should provide for overlearning and, ideally, include **variation**"

Use of p**recise mathematical language** enables all pupils to **communicate their reasoning** and thinking effectively.

Conceptual variation involves varying how a concept is represented to **draw attention to critical features**. Often **more than one representation** is required to look at the concept from different perspectives and gain comprehensive knowledge.

"Support for learning and understanding should be gradually withdrawn over time. Tasks should give pupils **opportunities to be successful**, rather than having to rely on guesswork or unstructured trial and error"

No procedural variation	Procedural variation
1) 7 - 6	1) 5 + -3
2) 12 + -5	2) 5 + -4
3) -6 - 9	3) 5 + -5
4) -15 - -8	4) 5 + -6
5) 6 + - 4	5) 5 + -7
6) 17 - -6 + 8	6) 5 + -8

Students are drawn to the key features of directed number in this example. This allows them to spot patterns, predict and describe how their answers are changing and will change.

"The novice, whether they are starting school or starting a new topic, needs more instruction rather than less. **Teaching should help them on the journey to expertise**. Ideally, teaching should be systematic, follow the curriculum sequence and help pupils to understand. A systematic approach works well for pupils of **all ages and stages**"

Assessment

"Frequent, **well-timed, low-stakes testing** is useful for checking pupils' knowledge of key facts and methods"

"This helps pupils to remember and gives leaders an **insight into the gaps** in pupils' knowledge"

"Summative assessment should **assess what pupils have learned and rehearsed**, rather than what they do not know and cannot do"

If a pupil fails to grasp a concept or procedure, this is identified quickly, and gaps in understanding are addressed systematically to prevent them falling behind.

Meeting the needs of pupils

"A well-sequenced path to proficiency, with the **small steps** identified, is important for all pupils and **crucial for pupils with SEND**"

Teaching for mastery assumes everyone can learn and enjoy mathematics"

"It helps pupils to keep up, minimising the need for catch-up support"

"Many pupils with SEND benefit from explicit, systematic instruction and from practice in rehearsal of declarative and procedural knowledge"

Key number facts are learnt to automaticity, and other key mathematical facts are learned deeply and practised regularly, to avoid cognitive overload in working memory and enable pupils to focus on new learning.

"They may also **need more time** to complete tasks and **opportunities to practise**, rather than different tasks or curriculums"

Systems at the school level

"School-level systems **strengthen the consistency** of a pupil's journey to proficiency. They include monitoring approaches, staff training, resource allocation, teaching and learning expectations, and ways of raising the subject's status, and ways of sharing information between stakeholders"

"**Professional development should be a planned and purposeful pathway** to expertise in teaching and subject leadership"

Teachers continually develop their specialist knowledge for teaching mathematics, working collaboratively to refine and improve their teaching.