St Mary's Fields Primary School

Mathematics Policy

Policy Date:	November 2020		**Version:**		
Policy Review Date:	Autumn 2023		Mrs R Dulieu (Headteacher)	Signature R.L. Dulieu	Date 7/12/21
Ratified by Governing Body: December 2021					
Name: Raj Gill-Harrison			Signature **R Gill-Harrison (digitally signed)**		Date 7/12/21

Introduction

This policy outlines the approach to teaching, learning and assessment of mathematics at St Mary's Fields Primary School, including how this contributes to the overall aims of the school's curriculum.

In September 2017, the school began transitioning towards a mastery approach to the teaching and learning of mathematics. The rationale behind moving to a mastery approach lies within the research of Skemp (1976) and Guskey (2009), the NCETM/Maths Hub-led Teaching for Mastery programme as well as the 2014 National Curriculum, which states:

> *The expectation is that most pupils will move through the programmes of study at broadly the same pace.*
>
> *Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content.*
>
> *Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.*

We also believe that a mastery approach will meet the needs of our learners most effectively because it is an approach that promotes confidence and deep understanding, which are vital to our pupils' success not only in mathematics but also in other curriculum areas and wider life.

Teaching for mastery is still a relatively new approach to the school and therefore continues to be developed and refined. In October 2019, we began working with other schools as part of the Maths Hub's Teaching for Mastery programme in order to develop and share good practice. The school also purchased textbook and practice book resources from Power Maths to support the development of its mastery curriculum.

Aims of our mathematics curriculum

The 2014 national curriculum's mathematics programme of study aims to ensure that all children become fluent in the fundamentals of mathematics, are able to reason mathematically and can solve problems by applying their mathematics.

Mathematics at St Mary's Fields Primary School endeavours to meet these aims through a mastery approach that supports all children with becoming confident and enthusiastic mathematicians. We are committed to ensuring that our learners leave primary school being able to apply their mathematical skills and knowledge effectively in a range of real-life contexts.

Through the problems that they explore in lessons, our learners are taught to recognise the many ways in which mathematics is relevant and important to wider life and other academic areas. This is reinforced through extra-curricular opportunities to develop financial literacy through School Council and 'Young Apprentice' projects.

Our curriculum cultivates positive attitudes by ensuring that children regularly experience success in the mathematics through effective scaffolding and modelling. We seek to develop children's enjoyment of solving complex problems and engaging in deeper mathematical thinking by drawing their attention to relevant character muscles during lessons. This is to ensure that they begin to appreciate that perseverance and challenging themselves is as important to the learning process as being able to find solutions quickly.

We support our learners with acquiring the language required to communicate their mathematical understanding and ideas effectively both verbally and in writing. This is achieved through explicit teaching and modelling of vocabulary and reasoning.

As part of the school's wider aims, the curriculum also focuses on developing children into:

- Reflective learners
- Independent learners
- Team players
- Creative thinkers
- Self–motivators
- Effective participators

Teaching for mastery in mathematics at St Mary's Fields Primary School

Our approach to teaching mathematics is built around the key principles of teaching for mastery in order to support the high ambitions of our curriculum.

We believe that the term 'mastery' does not refer to being more-able or high achieving. Instead, we believe mastery means that learning is sufficiently:

- Embedded
- Deep
- Connected
- Fluent

This is our ambition for every learner across the curriculum; not just more-able children.

The table below outlines how the key teaching for mastery principles support the aims of the mathematics curriculum at St Mary's Fields Primary School:

Aim	**Key teaching for mastery principles**
To support all children with becoming confident and enthusiastic mathematicians.	Every classroom has an ethos in which all children can and will achieve success in maths. Lessons are taught whole-class with pupils having the opportunity to work in mixed ability pairs or groups. Pupils work towards the same lesson content at the same time, enabling them to share their ideas and provide peer support. Where possible, children still struggling with a concept at the end of a session are provided with additional support before the next lesson to keep them on track.
To develop positive attitudes towards mathematics by ensuring that children regularly experience success in the subject and develop an enjoyment of solving complex problems and engaging in deeper mathematical thinking.	Lessons focus on small steps in learning in order to provide a scaffold for struggling learners and give confident learners the time to explore concepts in great depth. Lessons create a 'low floor, high ceiling' – children are provided with the same learning opportunities with independent activities gradually removing scaffolds to increase challenge and independence. Learners who have mastered the small step in learning are stretched by additional opportunities to describe procedures, evaluate methods, investigate concepts or create their own problems/methods.
All children become fluent in the fundamentals of mathematics, are able to reason mathematically and can solve problems by applying their	The teacher leads a back and forth interaction that includes exploration, questioning, discussion, explanation and practice tasks. This promotes reasoning and allows fluency in procedure and conceptual understanding to be developed in

mathematics. Children learn to recognise the many ways in which mathematics is relevant and important to other academic areas as well as wider life. Children acquire the language required to communicate their mathematical understanding and ideas effectively both verbally and in writing.	tandem. Problems are carefully selected and ordered to promote mathematical thinking, make connections and avoid mechanical repetition. This is known as 'intelligent practice'.

Our approach to teaching mathematics is underpinned by strong pedagogical theory and practices. According to Piaget (1952), learners add to their existing knowledge (schema) and learning takes places when their existing knowledge is challenged. Our approach to teaching mathematics supports this by providing pupils with the opportunity to challenge their existing knowledge through open exploration of mathematical problems. Based on Vygotsky's theory around sociocultural theory of cognitive development, learning through social interaction also plays a large role in lessons. Pupils explore approaches to problem-solving in mixed ability pairs or groups. This enables them to draw upon the expertise of a 'More Knowledgeable Other' to work within their zone of proximal development. The zone of proximal development refers to when a child learns under the guidance of another, which then allows them to become increasingly independent. The zone is referred to as 'proximal' because the child is close to independence but still needs support in order to achieve this. Teachers also make regular links to prior learning through reflection opportunities and learning reviews. Pupils are provided with opportunities to record their mathematical thinking in a variety of ways to support meta-cognition too.

In EYFS, pupils explore mathematical concepts through activities and problems based on real-life contexts. Learning opportunities are planned and designed to promote high-quality discussion and strong conceptual understanding through practical exploration and application. This involves a careful balance between child-initiated play, meaningful experiences and adult-directed activity in order to achieve this. Pupils are explicitly taught key vocabulary and are encouraged to explore concepts using a range of representations, suitably preparing them for the representations, structures and concepts they will encounter in Key Stage 1.

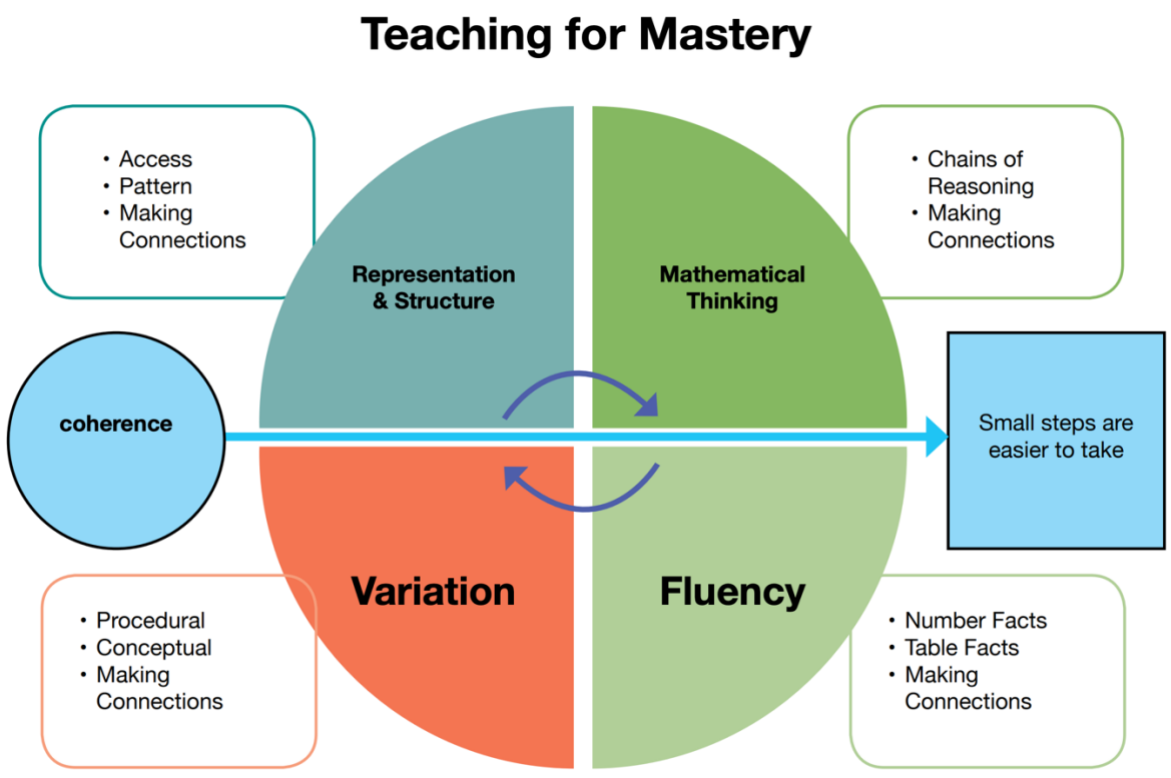
In Key Stage 1 and 2, pupils then explore problems that become less scaffolded as their confidence grows and teachers use a concrete, pictorial, abstract approach (Bruner, 1966) to promote deep conceptual understanding. Pupils will encounter the use of concrete resources as well as pictorial and abstract representations throughout a learning journey. This ensures that their instrumental understanding (learning to perform a procedure) and understanding relational (learning to explain the procedure) is developed concurrently. As outlined by Skemp (1976), both are important to mastering a concept.

The resources that we use have been developed based on variation theory. Variation is when certain aspects of a concept are varied while other aspects are kept constant, so that those aspects that vary are understood better. This promotes better overall conceptual understanding.

Teachers will use textbooks and practice books written by Power Maths to support the planning and delivery of their mathematics lessons. These resources have been selected because they have been specifically designed to support the teaching for mastery approach we have adopted and support the pedagogy outlined above. They also promote a growth mindset (Dweck, 2006) through the use of characters that exemplify key character muscles (perseverance, creativity, confidence and questioning). This supports the school's work on character development and cultivating positive attitudes towards mathematics and problem-solving.

In order to meet the needs of their children, teachers can and will use other resources in addition to the Power Maths books. This may include materials from the White Rose Hub schemes of learning and NCETM Mastery Professional Development resources. Teachers will also utilise the Department for Education and NCETM's maths guidance (published in June 2020) to support their planning of lessons and interventions in order to ensure that pupils develop the skills and knowledge needed to continue making good progress in maths.

Features of a maths lesson – drawn from research evidence:



Coherence

Coherence is about presenting a clear, logical learning journey. Lessons should be broken down into small, connected steps that gradually unfold concepts. This makes new learning accessible to children. Once a concept has been understood and mastered, opportunities to revisit it and apply it in future steps of

learning helps to children to see important mathematical connections. The ability to generalise and apply concepts to a range of contexts is key to mastering it.

An important strategy for coherence is using a whole-class ping-pong approach when exploring and modelling new concepts. This is when the teacher orchestrates a back-and-forth dialogue with pupils as they complete practice activities. Through this facilitation of discussions, explanations, modelling, and questioning through independent practice, the teacher is able to scaffold learning for all pupils to achieve. It also allows them to make progression through each small step explicit, monitor pupils' progress at every stage, address misconceptions promptly and explore concepts in depth before moving on.

Possible causes of cognitive overload in maths:

New learning requires free working memory but all working memory may be taken up due to:

- Weak prior knowledge – no connections to which new learning can be linked.
- The complexity of the rule or method – smaller steps in learning are needed.
- The enormity of the problem – simpler problems are needed at the early stages of exploring a new concept.
- Not knowing where to start – coherence has not been achieved.

In these circumstances, the child is not in a position to access the learning fully.

<u>Representation and Structure</u>

Representations used in lessons expose the mathematical structure being taught, the aim being that the children will eventually be able to perform calculations without the support of the representations.

Examples of common representations and structures:

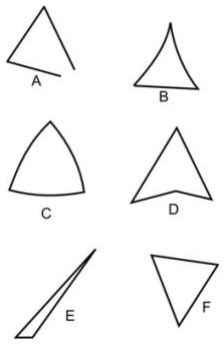
- Part-whole model
- Bar model
- Arrays
- Use of manipulatives to represent problems

<u>Variation</u>

To promote a deep and holistic understanding of a concept, concepts should be presented to children in a variety of ways. Examples should be given that display a concept as well as those that don't display it – children's understanding is then developed through an exploration of what is changing and what is staying the same, helping them to make important connections. By carefully varying practice questions, mechanical repetition can also be avoided, and thinking can be encouraged.

Variation can include:

- Conceptual variation – providing different representations of the same idea strengthens our understanding of what 'it' is. For example, exploring the examples and non-examples of a triangle below can help children to secure their understanding of the properties of a triangle.



- Procedural variation – choosing to vary one aspect to expose a mathematical structure or connection. For example, the calculations below vary the amounts and unknowns in each question. This allows the teacher to encourage the children to make generalisations and connections about the maths involved.

Complete the following sentences.

a) 350p = £3 and ☐p

b) 429p = £☐ and ☐p

c) 504p = £☐ and ☐p

d) ☐p = £1 and 85p

e) ☐p = £3 and 8p

f) 4☐p = £☐ and 48p

g) 1,870p = £☐ and ☐p

Fluency

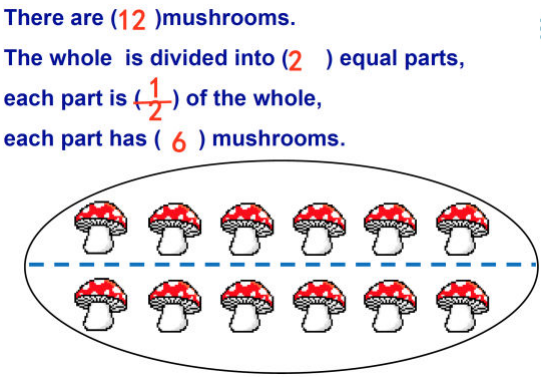
Quick and efficient recall of facts and procedures and the flexibility to move between different contexts and representations of mathematics. Automaticity with procedures and facts is important because it frees their minds to think about concepts.

Strategies for developing fluency:

- Repetition – *I say, you say, you say, you say, we all say*
  This technique enables the teacher to provide a sentence stem for children to communicate their ideas with mathematical precision and clarity. These sentence structures often express key conceptual ideas or generalities and provide a framework to embed conceptual knowledge and build understanding. For example: *If the whole is divided into three equal parts, one part is one third of one third of the whole.*

  Having modelled the sentence, the teacher then asks individual children to repeat this, before asking the whole class to chorus chant the sentence. This provides children with a valuable sentence for talking about fractions. Repeated use helps to embed key conceptual knowledge.

- Cloze procedures:



Mathematical Thinking

If taught ideas are to be understood deeply, they must not merely be passively received but must be worked on by the student: thought about, reasoned with and discussed with others.

Assessment

Learning is an alteration in long-term memory. To ensure that this alteration has taken place, teachers in Key Stage 1 and 2 will use the following summative assessments:

- End of unit activities from the Power Maths textbooks and practice books following the completion of a unit.
- White Rose Hub end of unit assessments, which are administered after the following unit. Teachers will use these to address lingering misconceptions if necessary.
- Standardised maths assessments at the end of each term to monitor progress, inform teacher judgements and provide a further opportunity to revisit prior learning.
- Assessment questions developed in line with the Department for Education and NCETM's maths guidance.

Where assessments have evidenced that an individual has struggled with a key area/concept rather than a single question, this is addressed with that individual child. If the majority of the class is not secure in a concept, additional lesson(s) are planned to revisit it.

In EYFS, the development of children's mathematical understanding will be assessed through observation and recorded using Tapestry.

There is a programme of moderation between teachers in the school and between schools in the school's development group. The mathematics coordinator will also carry out moderation of books periodically to ensure consistency of judgements.

Supplementary mathematics learning

Pupils are given opportunities to consolidate and apply their learning in mathematics beyond lessons through regular arithmetic practice and homework activities. In the spring term of Year 2, pupils are introduced to Times Tables Rockstars so that they can develop fluent recall of the 2, 5 and 10 times tables. In Key Stage 2, pupils are introduced to the 3, 4 and 8 times tables in Year 3 and the 6, 7, 11 and 12 times tables in Year 4. They are expected to continue using Times Tables Rockstars regularly so that they can develop fluent recall of these times tables.

Teachers will also exploit opportunities for pupils to apply their mathematics skills in other subject areas, such as drawing graphs in science and exploring geometry and shapes in art.

Homework

As per the school's homework and behaviour policies, teachers will set consolidation and fluency activities for children to complete at home as and when appropriate. Children who complete this work will be rewarded in school. Once children have been introduced to Times Tables Rockstars in the spring term of Year 2, there is an expectation that they will practise their times tables regularly using this programme. This will support pupils with being able to recall all facts up to 12 x 12 in under 5 seconds by the end of Year 4. This is a national expectation and pupils in Year 4 take a statutory check in the summer term to assess whether they have met this expectation.

Inclusion

If a child cannot access their year group's curriculum, an assessment (such as the Sandwell Early Numeracy Test or assessment questions developed in line with the Department for Education and NCETM's maths guidance) will be administered to identify the gaps in learning that are contributing to this. They will then be provided with appropriate learning activities to address these gaps and may also receive additional provision outside of lessons.

As much as possible, teaching assistants will be utilised to deliver interventions, such as 1stClass@Number, to support children who are not on track to achieve end-of-year expectations with catching up with their peers. The focus of these interventions will be on ensuring that the children become secure in the relevant Ready to Progress criteria (outlined in the Department for Education and NCETM's maths guidance) because it is these objectives that most impact a child's attainment and progress in maths. If a child has not met a lesson's learning objective, the teacher or a teaching assistant will address this with the pupil as soon as possible, ideally on the same day, to avoid creating gaps in learning.

Classroom environment expectations

Every classroom will have a mathematics working wall which displays:

- Mind maps/key vocabulary for the current learning journey.
- Time prompts around the clock:
    - In EYFS and Year 1, there will be prompts for o'clock, half past, quarter past and quarter to.
    - From Year 2 onwards, there will be prompts for 5 past, 10 past, 10 to and 5 to. (Year 2 teachers may choose to display both sets of prompts.)
- Worked examples of current learning as a scaffold during lessons**.**

Presentation guidelines

- Pupils should work in pencil in all mathematics books.
- A ruler is to be used for all straight lines.
- If the date and LO is handwritten by pupils, the date is written at the top of the page on the left-hand side in 6-digit format (01/09/18). A line is left before writing the learning objective. Both are underlined.
- All single digits and mathematical symbols are to be written in their own box.
- All sheets that are stuck in are trimmed so that they do not stick out of the book.
- Work is stuck into books when a visual representation is needed to help, or if the context of a reasoning/problem solving exercise needs to be made obvious. Otherwise, children work in books without sheets.
- Any sheets which are stuck into books are of a suitable size to be clear and easy to read.

Monitoring and evaluation of teaching and learning

There will be a programme of learning walks, observations and book scrutinies carried out by the mathematics coordinator and senior leadership team as part of the school's monitoring schedule.

Roles and responsibilities

The mathematics coordinator provides long term planning and schemes of learning to support teachers' planning and delivery of mathematics. They will monitor the use of these through book scrutinies, observations and learning walks. They are also responsible for liaising with the development group and other external agencies to keep abreast of current developments in the curriculum area. They will support staff with making judgements through moderation and by providing suitable assessment materials.

Teaching staff are responsible for using the schemes of learning provided to plan lessons to meet the needs of their class and enable pupils to make good progress in mathematics. They are responsible for taking into account the attainments of the children for whom they are responsible for teaching and delivering engaging lessons that ensure that learning takes place. It is the teachers' responsibility to assess children and to use these assessments to inform future planning. They are also responsible for the deployment of support staff working in their class during mathematics lessons.

The governor for mathematics is responsible for meeting with the mathematics coordinator to discuss subject strengths and areas for development and for reporting these to the governing body.

Other policies

This policy is informed by other school policies and therefore should be read alongside them. This includes St Mary Field Primary School's:

- Assessment policy
- Calculation policies
- English as an Additional Language policy
- Homework policy
- Feedback and Presentation policy
- More-able policy
- Special Educational Needs policy
- Teaching and Learning policy
- Classroom environment policy

Monitoring and review of this policy

This policy was approved by the full governing body in 2020. It is due for review by 2022.