

Maths at Hannah More



Content

1. Introduction

2. Maths **lessons** at Hannah More

- Lesson structure
- Concrete-pictorial-abstract
- Mixed ability pairs
- Stem sentences and oral rehearsal
- Open questioning
- Opportunities to reason
- Rapid graspers
- Teaching assistants (TAs)

3. Maths **teaching** at Hannah More

- Calculation policy
- Marking
- Mental maths
- Assessment

4. **Mathematicians** at Hannah More

- Higher attaining pupils
- Mathematicians with SEN

Introduction

The introduction of the 2014 national curriculum represented a seismic shift in mathematics teaching. Where once children could progress through the curriculum with shallow understanding, children are now expected to acquire and demonstrate a deep understanding ('mastery') of mathematical concepts.

The introduction of *Maths at Hannah More* was (and still is) supported by a strong programme of staff professional development, both of subject knowledge and pedagogical approaches. Using the mastery approach, lessons have been designed more purposefully, children have gained a deeper understanding of mathematics and attainment has improved across the school.

We believe that all children (and adults) can 'do' maths and start with the highest expectation of every pupil, no matter their starting point. Through *Maths at Hannah More*, we develop curious and independent learners. Classes spend time exploring concepts in depth and move forward in learning together, with no-one being 'left behind', all while rapid graspers are extended through rich challenges. We develop flexible, fluent mathematicians through the rigorous teaching of number/multiplication facts and a wide range of mental and written calculation methods. Children reason about mathematics and solve a variety of increasingly challenging problems, supported by a heavy emphasis on developing strong mathematical language. As a result, pupils will leave Hannah More as resilient learners with the mathematical skills needed for effective learning in secondary school and beyond.

This document outlines the latest iteration of Maths at Hannah More, refined and developed with teachers and staff.

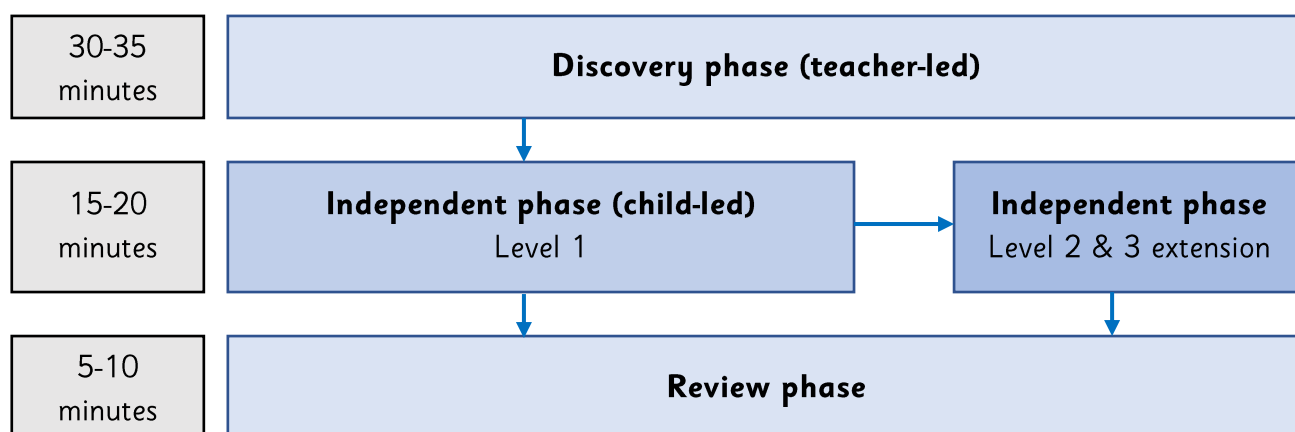
Maths lessons at Hannah More

In line with our core principles, a typical maths lesson at Hannah More features:

- A lesson structure that keeps children active throughout the lesson exploring new ideas and discussing their mathematics
- The CPA approach being used to develop understanding of new concepts - concrete (make it)-pictorial (draw it)-abstract (write it)
- Children working closely in mixed-ability pairs/ trios
- Oral rehearsal of key concepts using stem sentences
- Open questioning designed to assess and support children's conceptual understanding
- Opportunities to reason, both verbally and in writing
- Rapid graspers extended through deeper, richer challenges
- Teaching assistants employed strategically to both support and challenge

Lesson structure

Most maths lessons at Hannah More follow a three-phase structure. Each phase is a vital stepping stone on the way to developing a deep understanding and offers children opportunities to think mathematically. The timings listed below are indicative, not prescriptive – some lessons may be better structured by a shorter first and second phase followed by an additional first and second phase, for example.



Discovery phase

The first phase is a teacher-led discovery session where children explore new ideas. The teacher introduces the learning objective and guides pupils through a step-by-step journey towards this objective. Children are constantly engaged in small, rich tasks, often supported by manipulatives or models. Through skilful use of questioning and discussion, children's mental and verbal reasoning are constantly developed. Oral rehearsal of key concepts through the use of stem sentences consolidates children's understanding. Talk and paired discussion is a key part of this discovery session as is the opportunity to prove/disprove thinking.

Independent phase

In this phase, children work independently on an activity (Level 1) to consolidate and demonstrate and their understanding of the learning objective. This activity is typically a sheet only one page long and follows a progression similar to the discovery phase. Children must be offered a written reasoning opportunity in the Level 1 activity.

Challenge

Children who complete the Level 1 activity are given access to Level 2 (deeper, more challenging though still closed activity) and Level 3 challenges which aim to explicitly develop defined problem-solving skills. Teachers may decide that children who have already demonstrated a secure understanding of the given objective can skip to Level 2 or 3 before completing Level 1 (see Rapid graspers). Level 3 may last for one lesson or be engaged with over multiple lessons.

Support

In the independent phase, additional support will be provided to children who have been identified by the teacher as struggling or having a weaker understanding of the given objective.

Reteaching or remodelling should occur here, led either by the teacher or a teaching assistant. Children may not access the Level 1 activity though adults should ensure some recording of their work is made at this stage. If the teacher is working with the support group, a teaching assistant can continue to monitor the progress of the other children.

Later in the afternoon, during the reactive slot, those children will then be offered the opportunity to complete the Level 1 activity independently with the LSA (or teacher) observing and intervening where necessary.

Review

In this portion of the lesson, the teacher will review learning and progress towards the learning objective with the whole class. This may involve reviewing Level 1, challenging children to justify their answers, or addressing any misconceptions that have arisen. It may also be a time to review Level 2 or 3 challenges, an opportunity for teaching key reasoning and problem-solving skills.

Mixed ability pairing/ trios

In the first phase of maths lessons, children sit in mixed ability pairs and work collaboratively on tasks and challenges. Paired work/ trios will need to be actively taught, particularly at the beginning of the year, and regularly reviewed with children. Careful attention should be paid to pairings to ensure confident, articulate children can support those who may struggle more (and in so doing consolidate their own understanding). Pairs/ trios should be regularly changed and children should value the opportunity to work with others.

Concrete-pictorial-abstract (CPA) approach

Maths teaching at Hannah More uses the concrete-pictorial-abstract (CPA) approach. This approach develops a deep, sustainable understanding of concepts across the maths curriculum and aims to both support and challenge children's thinking. All parts of CPA may feature in a single lesson, though it is more likely to be developed across a series of lessons in a given area of study.

Concrete (Make it)

Pupils at Hannah More are introduced to new abstract concepts using concrete materials. This can be known as the 'doing' stage. Children will handle physical objects (manipulatives) and in so doing help make real otherwise tricky concepts.

In the concrete stage, children may use a number of different resources. For example, the abstract concept of 'ten' can be represented by ten apples, ten multilink cubes, ten Dienes cubes, a tens rod, different

Cuisenaire rods adding up to ten and the tens place value counter. All are concrete materials, as they can be held and manipulated, but some are more 'real' and some are more abstract than others.

Pictorial (Draw it)

Once children have secured a good level of understanding through concrete resources, they will move to pictorial representations. This can be known as the 'seeing' stage. Children will see and draw representations of abstract concepts building on their concrete understanding.

Using the example of 10, they may now draw ten apples, ten circles, build a bar of ten or represent ten using different length bars (to name just a few).

Abstract (Write it)

The aim is that all pupils will, once they have demonstrated solid understanding of concrete and pictorial representations, be able to represent abstract concepts using abstract representations, such as numerals, symbols and other notation. Returning to the example of 10, pupils will now be able to write ten as numerals, words, explain the value of the 1 in 10 and use 10 in calculations involving mathematical symbols.

By the time they leave Year 6, all pupils should have developed a deep understanding of mathematical concepts in the abstract and must experience concrete and pictorial representations before this can properly be achieved. It is likely that children will spend much longer using concrete representations in younger year groups and less time in older year groups. However, it is just as valid for abstract representations to be found in a Year 1 class as it is for concrete representations to be found in a Year 6 class. Children's journey along the CPA will not necessarily be linear; well-understood abstract concepts may be built-on or made harder requiring a return to concrete and pictorial representations. The skill of the teacher is knowing when and how to move children from concrete to pictorial to abstract.

The CPA approach also offers opportunities to challenge rapid graspers. They may be challenged, for example, to demonstrate their understanding of mathematical concepts in a variety of different ways or given opportunities to work out how to use a new manipulative before others, thereby becoming the expert.

Oral rehearsal

Oral rehearsal of key concepts forms an integral part of all maths lessons at Hannah More, in line with our wider approach to teaching oracy. Oral rehearsal develops children's conceptual understanding, builds their mathematical vocabulary and supports their ability to reason verbally and in writing.

Key concepts are encapsulated in short sentences that children repeat through an 'I say, you say, you say, you say, we all say' approach. Stem sentences do not have to be limited to a single sentence, but they should be as short and succinct as possible.

There are two types of stem sentences: variable and generalisation.

Variable

In a variable stem sentence, key elements need to be filled in by children before the stem can be rehearsed. Variable stem sentences are useful for breaking down a process.

For example, in a lesson on finding unit fractions of amounts, the following stem sentence might be used:

The whole amount is ____.
The amount is divided into ____ equal groups.
One group contains ____.

In a later lesson, as children move to finding non-unit fractions of amounts, the stem sentence may progress.

The whole amount is ____.
The amount is divided into ____ equal groups of ____.
____ groups contain ____.

As the learning sequence moves forward and children begin to calculate fractions of amounts mentally, the stem sentence may develop further.

The whole amount is ____.
The amount is divided into ____ equal groups of ____.
____ x ____ = ____.

Generalisation

A generalisation contains no variable elements but encapsulates a key learning point. For example, in a lesson on adding fractions with the same denominator, the following generalisation may be used:

When adding fractions with the same denominator, the denominator stays the same.

Though they should be pre-planned, children should be encouraged to identify the generalisation for themselves. In the instance above, children could use manipulatives/models to add pairs of fractions with the same denominator and then explain what they notice about the answer.

Open questioning

Open questioning is a key part of effective teaching in any subject but carefully selected questions can be used in maths to check understanding, push learning forward and develop children's reasoning. Using open questions such as 'How do you know?' or 'What do you notice?' can also provide depth to those children in need of stretch.

Opportunities to reason

Children should be provided with opportunities to reason throughout every lesson. In the first phase input, a reasoning question should be presented with children given time to discuss with their partner. Written responses using sentence stems could be directly taught here. Children should also be provided with an opportunity to reason in writing in the second phase (Level 1) activity.

Rapid graspers

Children may demonstrate that they have achieved the given learning objective early on in a lesson, either in the discovery phase or quickly in the independent phase. These children can be termed 'rapid graspers'. They may vary lesson by lesson and teachers should keep a close eye out for them.

Though each child's achievement should be judged on evidence from that lesson, teachers should also be aware that previously high-attaining children will be likely to pick up concepts more quickly than others. Teachers should be sure to offer children additional challenge as appropriate, either through parallel questioning in the discovery phase (see Mathematicians at Hannah More: Higher attaining pupils), or through quicker progress on to Level 2 & 3 activities during the second phase.

Teaching assistants (TAs)

Additional adults should be deployed strategically throughout a lesson to ensure the highest achievement for all children

Mathematicians with SEN

In the discovery phase of the main lesson, class-based TAs may be required to deliver a separate input to pupils receiving Alternative Teaching. These will have been pre-planned by teachers and TAs will have been trained to deliver them.

Independent phase

In the activity phase of the lesson, teaching assistants should have returned from supporting any mathematicians with SEN. Now they should be directed by the teacher. This may involve providing focused support to any children the teacher has determined are in need (or supervising the main class while the teacher delivers this support. It is important that teachers communicate potential misconceptions and strategies for overcoming these in advance with the TA.

Alternatively, the TA could be asked to support other children to solve the Level 2 or 3 challenges, unpicking problem-solving skills required. This will likely be with rapid graspers. Once again, the judgement of the teacher is key here in deciding how best the LSA is deployed and will require clear lines of communication before and during lessons.

Reactive

Children who struggled during the discovery phase of a lesson should have had reteaching/remodelling during the independent phase and will be ready to attempt the Level 1 challenge independently by the afternoon. The TA's role here is to allow children to work independently and intervening only where issues arise.

Maths **teaching** at Hannah More

Maths teaching at Hannah More follows the national curriculum. The school's long-term maths plan is informed by the White Rose small step guidance materials as well as the NCETM curriculum prioritisation map. These also support teachers' medium and short-term planning, though teachers are encouraged to be flexible and exercise their own judgements about the precise order of small steps.

All curriculum objectives are grouped into 'blocks' of between 1 to 6 weeks' worth of teaching. The learning journey of each block is planned by teachers in advance using on a medium-term planning document. This indicates the order and anticipated length of small steps as well as identifies the manipulatives, models and methods that will support children's conceptual understanding.

Calculation policy

In line with the White Rose scheme of work, teachers use the White Rose calculation policy for the teaching of addition, subtraction, multiplication and division. The policy aligns with the White Rose scheme of work used at Hannah More and provides guidance on the progression from concrete to pictorial to abstract.

Marking

Marking is an important tool for providing feedback to children, assessing understanding and supporting future learning but it should be minimal and light touch. In line with the school marking policy, teachers mark all maths work at the end of each day. Where a child has achieved the learning objective, this is highlighted in yellow pen. Where a child has failed to achieve the learning objective, this is highlighted in pink pen and catch-up strategies put into place.

Correct answers are highlighted yellow. Errors that can be corrected by children independently (e.g., minor miscalculations or lack of attention to detail) are underlined in pink and children correct these at the beginning of the next lesson using green pen. Errors that cannot be corrected independently are be marked with a pink dot and, where feasible, addressed with adult support and corrected in green pen. Marking stations, where the correct answers are set out, can be placed around the room as another way of providing immediate feedback.

Verbal feedback delivered in lesson is the most powerful form of feedback. Written feedback is therefore minimal. Occasionally (once a week or so) children are offered a next step to respond to, either more of the same problem to consolidate their understanding or a more challenging problem that children could access independently.

All marking and feedback should be for the benefit the children and teacher planning, rather than for outside observers. The very best marking and feedback is purposeful, relevant and minimal.

Mental maths

The development of quick and accurate mental arithmetic skills is a vital part of building children's mathematical fluency. Teachers at Hannah More build children's mental maths through the daily maths lesson as well as through addition teaching.

In Reception to Year 2, the school uses the Mastering Number scheme provided by the NCETM to develop quick, efficient mental calculation skills. In Years 3 and 4, focus is placed on the speedy recall of

multiplication facts up to 12×12 , supporting children with more challenging curriculum content in future years. Daily sessions are used to develop this. In later years, teachers regularly provide opportunities to revise and utilise the skills previously developed. All pupils also have access to out of school resources, such as Numbots and Times Table Rockstars, to provide further opportunities to practise.

Assessment

The *Assessment at Hannah More* policy is followed in maths teaching. Nfer tests provide teachers with a benchmark of children's progress towards the yearly expected standard while White Rose end of block/term assessments measure children's achievement of taught learning objectives. Teacher judgement is also utilised, recognising that teachers hold the greatest understanding of children's achievement.

Mathematicians at Hannah More

In line with the national curriculum for mathematics, teachers at Hannah More aim to ensure that all pupils:

Fluency	Reasoning	Problem Solving
become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.	reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language	can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

Higher attaining mathematicians

Though maths teaching at Hannah More seeks to avoid automatically labelling pupils, we recognise our responsibility to monitor the outcomes and progress of previously higher attaining pupils.

These may be pupils who exceeded Early Learning Goals in Reception and/or were assessed as working at greater depth in Key Stage 1, or they may be pupils who were judged to have exceeded the standard in their previous year group. Internal assessments ensure that those judged to have exceeded expectations have demonstrated deep conceptual understanding as well as quick recall/procedural fluency.

During the discovery phase of lessons, higher attaining pupils may be offered parallel questions that stretch their thinking. For example, in the first phase of a Year 5 lesson on multiplying decimal numbers by 100, children may be working practically with a partner to calculate 0.35×100 using counters on a place value grid. A parallel question – 0.35×99 – may be displayed at the same time to be attempted once pair has completed the main question if they have time. The question is open to all to answer but higher attaining pupils are likely to be able to find the answer independently, stretching their own thinking and supporting the thinking of their partner in the process.

In the independent phase of the lesson, in line with the principles laid out in the Maths lessons at Hannah More section, pupils work together on the same lesson task initially but challenge for rapid graspers is provided in the form of deeper, richer problems. Teachers look out carefully for higher attaining mathematicians during lessons and will move them onto more stretching challenges quickly when confident they have achieved the given learning objective. Children may be re-paired or moved to sit with other children attempting the same problem to promote discussion and discovery together. In the final phase of maths lessons, higher attaining mathematicians may be called upon to share their findings/understanding during whole class discussion on Level 2 and 3 problems.

It is important that key problem-solving skills are directly taught to pupils, particularly higher attaining pupils, to ensure that they can work independently to apply new knowledge. This teaching could be provided in the second phase of maths lessons, or it could be provided as an afternoon intervention.

Mathematicians with SEN

While our maths curriculum aims to develop the very highest standards of learning for all children, leaving no children behind, we also recognise that some children may struggle to access the full curriculum and not achieve age-related expectation. This may be because of cognition, communication, or social, emotional and mental health difficulties, or because of previous underachievement and gaps in learning. These children are identified as 'mathematicians with SEN' and will be given Adaptive Teaching in line with their needs.

At each assessment period, mathematicians with SEN follow the assessment process and materials of the year group whose curriculum objectives they are following.