Cottesbrooke Infant & Nursery School
Mathematics Policy
January 2018

Introduction

Mathematics teaches us how to make sense of the world around us through developing a child's ability to calculate, to communicate, to reason and to solve problems. It enables children to understand and appreciate relationships and pattern in both number and space in their everyday lives. Through their growing knowledge and understanding, children learn to appreciate that maths can be an exciting and stimulating subject to learn which has relevance to their own everyday lives.

At Cottesbrooke Infant & Nursery School, we provide a broad and balanced curriculum for all children. We encourage children to reflect on their learning, sharing objectives and talking about and discussing their learning. Teachers, children, parents and governors are all working together to raise standards for all our children.

Aims and objectives

The national curriculum for mathematics has three main aims:

Fluency

- ensuring that children 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.

Reasoning

- ensuring that children can reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language

Problem solving

- ensuring that children 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.

In our school we aim:

- to promote enjoyment, enthusiasm and motivation for learning through practical activity, exploration and discussion;
- to promote fluency, confidence and competence with numbers and the number system;
- to promote problem solving and decision making through the selection of appropriate strategies;
- to develop the ability to reason in a logical way in a range of contexts;
- to develop a practical understanding of the ways in which information is gathered and presented;
- to explore features of shape and space, and develop measuring skills in a range of contexts;
- to be aware of the patterns and relationships in the structure of mathematics, developing connections;
- to understand the importance of mathematics in everyday life and its links with other areas of the curriculum.

Teaching and Learning

At Cottesbrooke Infant & Nursery School we follow a Mastery approach to teaching the Mathematics curriculum. Questioning, discussion and vocabulary development are extremely important in lessons. The lesson has three main parts, an anchor task, guided practise and independent practise. The lesson will be split; allowing the teacher to assess the children's learning and plan the structure of the children's independent work. Children work in mixed ability pairs and all children are treated equally. Throughout the

lesson one small new piece of information is taught, initially using concrete resources, then moving on to pictorial representations or models and finally abstract application of the concept.

Lesson Structure (Key Stage 1):
Children start the lesson with a problem, known as an **anchor task**. This will usually be at their tables using concrete resources and will involve working with their talk partner. The teacher and teaching assistant will use this time to walk around and listen in on the conversations to assess who has grasped the concept easily and who needs more support

There will then be a class discussion about the task with lots of talk about different ways of representing and solving the problem. The focus is less on the actual answer and more on the methods and reasoning involved. The teacher will then share the learning objective for the lesson, teach one small new piece of learning and the children will practise some similar tasks with the help of their partner or a teacher if needed. During this time the children may move from using concrete resources to drawing pictorial representations and models on a mini whiteboard. This is known as **guided practise.**

In the second half of the lesson, children will have time to complete **independent practise** of the new concept and record their understanding. This is when the teacher will work with a group of children who have been identified through the first half of the lesson as needing extra support. They will complete the same task as the other children but will have the support of the teacher and resources as needed. During this time the Teaching Assistant will move amongst the other children, supporting and deepening understanding where needed. When the children have completed the given task, they will move onto a 'deeper thinking' challenge that is available to all. This will be highlighted in green by the teacher.

The Mastery approach ensures that all children stay together, learning one small new concept each day. Every child should be secure with the new learning at the end of the lesson. If a child is identified as having not understood the concept during the lesson, the teacher will highlight the work in pink. At a later point in the day there will be a **catch up** session which is run by the teacher. This allows the teacher to work again with any children identified as needing a little more support to become secure with the concept from the lesson. When all children are secure with the concept, the whole class will move on to new learning.

For further information about the school's policy on the use of concrete resources and pictorial models to teach specific methods, see the calculations policy.

Recording
Children will work in one of two books during the 'independent practise' part of each lesson. They may work on carefully selected questions on a worksheet which will be stuck into their maths exercise book or they may demonstrate their new learning in their journals. Journals have blank pages where children are encouraged to show what they have learnt through recording pictures, models and number sentences. Both books give children the space to move onto a 'deeper thinking' challenge that encourages the child to think more deeply about a concept. For example they may be given a fact and asked to prove it using pictures or resources. They may be asked if certain facts are true or false and to explain how they know. They may be asked to find all the possible ways of solving a problem e.g.? + ? = 14 and then explain how they know they have found all of the possibilities. They could also be asked to write their own word problem based on a number sentence.

Lesson Structure (EYFS):
Children work in mixed ability pairs on the carpet during maths directed times. This will usually involve using concrete resources to understand the mathematical concept that is being taught. During focus activities, children will have the opportunity to demonstrate their understanding to the teacher using resources independently and through oral explanation. Children may occasionally record their thinking on a worksheet or a whiteboard.

Throughout Foundation Stage, children are also encouraged to use and develop mathematics through play in all areas of provision. A range of mathematical resources, such as number lines and Numicon are available throughout. Concepts of shape, space, direction, size, length, capacity and mass are developed through sand, water and tactile play, outdoor provision, small world play, storytelling and nursery rhymes.

Teachers plan structured activities as well as time for child initiated activities, which enable the children to practise skills, gain confidence and competence in their use. We provide all the children with a wide range of opportunities to develop their understanding of number, measurement, pattern, shape and space through varied activities that allow them to enjoy, explore, practise and talk confidently about mathematics.

Planning

In Key Stage 1, planning is based on the planning provided by the White Rose Maths Hub.

Long term planning: A yearly overview is provided. This maps out when topics will be covered over the year. Topics are chunked together so that learning is sustainable.

Medium term planning: 'Blocks' of planning are provided, listing the objectives to be covered in each topic. Each curriculum statement is broken down into 'small steps' giving examples of tasks that will develop and demonstrate children's fluency, reasoning and problem solving within each area.

Short term planning: Lessons are planned daily on Smartboard, based on the small steps on the medium term planning as well as the children's learning the day before.

A version of the White Rose planning is also available for Reception.

Cross Curricular links
Children are encouraged to investigate connections between Mathematics and other areas of learning. The skills, concepts and knowledge learned in Maths lessons are reinforced, consolidated and extended within the whole curriculum. At the beginning of a new topic staff identify cross curricular links to other subject areas taught.
For example Science also involves the use of many Mathematical skills. Children will measure using standard and non-standard measures as well as collecting, classifying and recording data. Art and Design Technology require children to investigate and understand pattern, space and shape. History is dependent upon children understanding chronological order, ordinal vocabulary and the correct use and reading of dates. Religious Education requires children to order and sequence events. The understanding of position and direction is a key geographical skill and is important within Physical Education.

Inclusion
All pupils will have an equal opportunity to reach their full potential across the Mathematics Curriculum regardless of their race, gender, cultural background, ability or of any physical or sensory disability. There is no differentiation in maths lessons and all children are given an equal opportunity to achieve.

The school makes provision to support children with SEN on an individual basis to enable every child to access the Mathematics curriculum. Extra support or differentiated work may be given to a very small number of identified children who are unable to access the curriculum for their year group. Support may include the use of an adult, use of concrete resources throughout the lesson, differentiated or scaffolded activities, support programmes and interventions.

More Able Children

There is no differentiation in maths lessons. Children who rapidly grasp the concept being taught during a specific lesson will be moved on to deeper thinking challenges. This may be before they complete the initial task if they demonstrate a secure conceptual understanding.
Children will not be accelerated beyond the objectives for their year group but will instead be asked to think more deeply about the concept they have been taught.

Assessment, Recording and Reporting

At Cottesbrooke Infants we recognise that Assessment for Learning lies at the heart of promoting learning and in raising standards of attainment. We further recognise that effective Assessment for Learning depends on using the information gained. Assessment for Learning (AfL) is integral to the daily teaching of Mathematics, with adjustments being made to the planning and teaching as the lesson progresses. Staff make assessments of the children's learning on a daily basis through observations, listening to the children, engaging them in conversation about what they are learning, asking open ended questions and checking understanding. AFL will also impact the lesson for the following day. If a large number of children have not achieved the day's objective, staff will come together and plan to re-teach the concept. All classes will stay together and children who are secure with the concept will be given tasks enabling them to think more deeply within the same area.

Class teachers also carry out their own summative assessments at the end of a unit of and record this information on Target Tracker. This allows gaps in knowledge to be easily identified.

Assessment 'steps' are updated each half term to show individual children's attainment. The Assessment Leader holds a Pupil Progress Meeting each half term with each class teacher to discuss the progress of the children in their class. Appropriate intervention is put in place to support vulnerable learners and suitable challenge is planned for children exceeding in objectives. Time is also set aside to moderate assessments made each term within year groups.

All parents receive an annual written report on which there is a summary of their child's achievements in mathematics over the year. At the end of KS1 each pupil's level of attainment against national standards is included as part of their annual written report. In Foundation Stage each child will be given an annual report detailing the level of attainment in terms of the Early Learning Goal for Number and Shape, Space and Measure.

Marking

See the separate school Maths Marking Policy for details of Maths marking.

Resources

A wide range of resources in the form of models, images and more structured resources are available to use in school. We have a large stock of resources for practical mathematics including number cards, money, 2D and 3D shapes, clocks, timers, weighing scales, jugs, thermometers, place value equipment, unifix, double sided counters, Numicon and much more. These are stored either in the Maths cupboard or in individual classrooms. Each classroom also has access to tens frames and place value boards as well and mini whiteboards for drawing pictures and models such as part part whole models and bar models.

Fundamental British Values and Universal Virtues

Cottesbrooke Infant & Nursery School promotes the fundamental British values of democracy, the rule of law, individual liberty, and mutual respect and tolerance of those with different faiths and beliefs. We also promote the universal virtues of courage, compassion, self-discipline, justice and humility. Where relevant, these values and virtues should form part of the teaching of Mathematics.
Actively promoting these values and virtues means challenging opinions or behaviours in school that are contrary to fundamental British values.

It is not necessary for staff to 'promote' teachings, beliefs or opinions that conflict with their own, but it is unacceptable for staff to promote discrimination against people or groups on the basis of their belief, opinion or background.

Monitor and review

The implementation and progress of Mathematics teaching and learning is monitored by the governing body and Maths Leader. The Mathematics Leader is given management time to monitor and evaluate the quality and standards of Mathematics throughout the school and support colleagues. The school has a named governor for Mathematics and they attend meetings with the subject leader to work together to monitor and evaluate the teaching and learning of Maths at our school. The governor nominated reports back to the governing body on a regular basis.

Additional information for Staff:

Examples of activities following the Mastery approach to teaching Maths – taken from the Maths hub.

- Spend a short time every day learning basic number facts through singing and chanting to develop factual fluency.

- The symbol **=** is an assertion of equivalence.
  If we write: **3 + 4 = 6 + 1** then we are saying that what is on the left of the = symbol is equivalent to what is on the right of the symbol. This can be explained using the idea of a balance scale. Both sides must be the same.

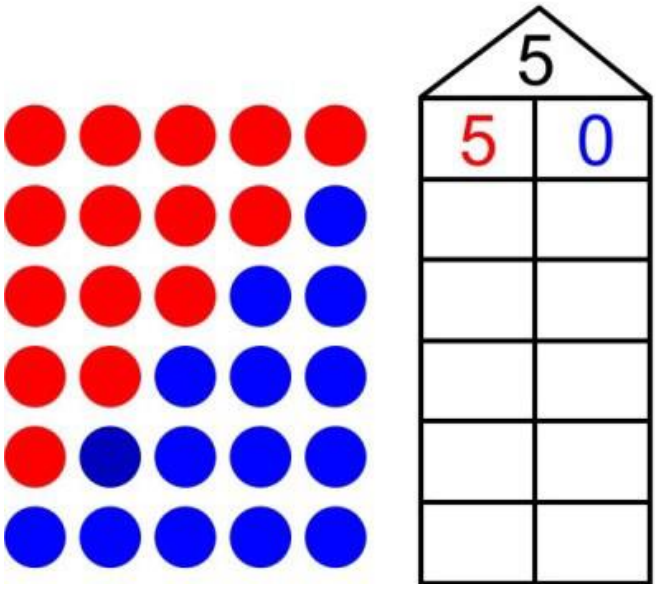
  Empty box questions help to consolidate this idea. e.g. **3 + □ = 8**

- Empty box problems are a powerful way to help children develop a strong sense of number through intelligent practice. They provide the opportunity for reasoning and finding easy ways to calculate. They enable children to practise procedures, whilst at the same time thinking about conceptual connections.
  A sequence of examples such as
  3 + □ = 8
  3 + □ = 9
  3 + □ = 10
  3 + □ = 11

- Young children benefit from being helped at an early stage to start calculating, rather than relying on 'counting on' as a way of calculating. For example, with a sum such as:
  4 + 7 =
  Rather than starting at 4 and counting on 7, children could use their knowledge and bridge to 10 to deduce that because 4 + 6 = 10, so 4 + 7 must equal 11.

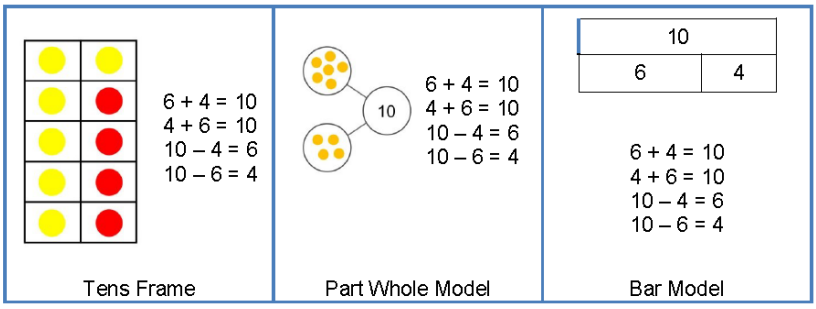
- The question "What's the same, what's different?" is used frequently to make comparisons and spot patterns. For example *"What's the same, what's different between the five times table and the ten times table?"*

- Developing instant recall alongside conceptual understanding of number bonds to 5/10 is important. This can be supported through the use of images such as the example illustrated below:



The image lends itself to seeing pattern and working systematically and children can connect one number fact to another and be certain when they have found all the bonds to 5.

Using other structured models such as tens frames, part whole models or bar models can help children to reason about mathematical relationships.



Connections between these models should be made, so that children understand the same mathematics is represented in different ways. Asking the question "What's the same what's different?" has the potential for children to draw out the connections.
Illustrating that the same structure can be applied to any numbers helps children to generalise mathematical ideas and build from the simple to more complex numbers, recognising that the structure stays the same; it is only the numbers that change. For example:

10	
6	4

6 + 4 = 10

4 + 6 = 10

10 – 6 = 4

10 – 4 = 6

- A lesson about addition and subtraction could start with this contextual story:
  "There are 11 people on a bus. At the next stop 4 people get on. At the next stop 6 people get off. How many are now on the bus?"
  This helps children develop their understanding of the concepts of addition and subtraction. But during the lesson the teacher should keep returning to the story. For example, if the children are thinking about this calculation
  14 – 8
  then the teacher should ask the children:
  "What does the 14 mean? What does the 8 mean?", expecting that children will answer:
  "There were 14 people on the bus, and 8 is the number who got off."
  Then asking the children to interpret the meaning of the terms in a sum such as 7 + 7 = 14 will give a good assessment of the depth of their conceptual understanding and their ability to link the concrete and abstract representations of mathematics

- Teachers' questions in mathematics lessons are often asked in order to find out whether children can give the right answer to a calculation or a problem. But in order to develop children's conceptual understanding and fluency there needs to be a strong and consistent focus on questioning that encourages and develops their mathematical reasoning.
  This can be done simply by asking children to explain how they worked out a calculation or solved a problem, and to compare and contrast different methods that are described. The LPS teachers have found that children quickly come to expect that they need to explain and justify their mathematical reasoning, and they soon start to do so automatically – and enthusiastically. Some calculation strategies are more efficient and the LPS teachers noted

that the Shanghai teachers scaffolded children's thinking to guide them to the most efficient methods, whilst at the same time valuing their own ideas.
Rich questioning strategies include:
"What's the same, what's different?"

23 + 10	23 + 20	23 + 30	23 + 40

Discussion of the variation in these examples can help children to identify the relationship between the calculations and hence to use the pattern to calculate the answers.

- Which is the odd one out in this list of numbers: 24, 15, 16 and 22?
  This encourages children to apply their existing conceptual understanding. Possible answers could be:
  "15 is the odd one out because it's the only odd number in the list."
  "16 is the odd one out because it's the only square number in the list."
  "22 is the odd one out because it's the only number in the list with exactly four factors."

  If children are asked to identify an 'odd one out' in this list of products:
  24 × 3 36 × 4 13 × 5 32 × 2
  they might suggest:
  "36 × 4 is the only product whose answer is greater than 100."
  "13 × 5 is the only product whose answer is an odd number."

- *"Here's the answer. What could the question have been?"*
  Children are asked to suggest possible questions that have a given answer. For example, in a lesson about addition of fractions, children could be asked to suggest possible ways to complete this sum:

$$\square + \square = \frac{3}{4}$$

- *Identify the correct question*

A 3.5m plank of wood weighs 4.2 kg
The calculation was: **3.5 ÷ 4.2**
Was the question:
a. How heavy is 1m of wood?

b. How long is 1kg of wood?

- *True or False*

Children are given a series of equations are asked whether they are true or false:

4 × 6 = 23 4 × 6 = 6 × 4 12 ÷ 2 = 24 ÷ 4 12 × 2 = 24 × 4

Children are expected to reason about the relationships within the calculations rather than calculate

- *Greater than, less than or equal to >, <, or =*

3.4 × 1.2 ○ 3.4 5.76 ○ 5.76 ÷ 0.4 4.69 × 0.1 ○ 4.69 ÷ 10

These types of questions are further examples of intelligent practice where conceptual understanding is developed alongside the development of procedural fluency. They also give pupils who are, to use Ofsted's phrase, *rapid graspers* the opportunity to apply their understanding in more complex ways.

- **Expect children to use correct mathematical terminology and to express their reasoning in complete sentences**

The quality of children's mathematical reasoning and conceptual understanding is significantly enhanced if they are consistently expected to use correct mathematical terminology (e.g. saying 'digit' rather than 'number') and to explain their mathematical thinking in complete sentences.

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 rectangle is the whole, the shaded part is 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.

Another example is where children fill in the missing parts of a sentence; varying the parts but keeping the sentence stem the same.

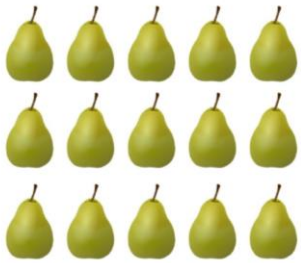
For exampl

There are 12 **stars**. $\frac{1}{3}$ of the **stars** is equal to **4 stars**

Children use the same sentence stem to express other relationships. For example:

There are 12 **stars**. $\frac{1}{4}$ of the **stars** is equal to **3 stars**

There are 12 **stars**. $\frac{1}{2}$ of the **stars** is equal to **6 stars**



There are **15 pears**. $\frac{1}{3}$ of the **pears** is equal to **5 pears**

There are **15 pears**. $\frac{1}{5}$ of the **pears** is equal to **3 pears**

When talking about fractions it is important to make reference to the whole and the part of the whole in the same sentence. The above examples help children to get into the habit of doing so.

Another example is where a mathematical generalisation or "*rule"* emerges within a lesson. For example:

When adding 10 to a number, the ones digit stays the same

This is repeated in chorus using the same sentence, which helps to embed the concept.