EARDISLEY C. E. PRIMARY SCHOOL

MATHEMATICS POLICY

Date Agreed: January 2018

Glowing brightly, sparkling too: in all that we do our values shine through

Introduction

Eardisley CE Primary School is embarking on a new rationale for the teaching of mathematics. We want to ensure that our children:

- Enjoy mathematics
- Believe that by working hard at maths they can succeed
- Achieve fluency
- Articulate mathematical reasoning
- Are able in problem-solving
- See the relevance of maths in their daily lives
- Are stimulated by learning and understanding maths

- So that they become confident and competent mathematicians.

Learning Values
We encourage all our pupils to become independent, self-motivated and self-reflective learners. Our learning values help pupils to focus on the attributes that help them to achieve this. These include:

Focus: I look and listen
Determination: I keep on trying.
Engagement: I ask and answer questions
I believe I can!
so
I love learning!

Throughout 2018/19 our school is researching and applying and evolving the use of the Mastery Maths approach. This involves all staff embarking on sustained and practical professional development supported by a learning model that involves learning with and from a national learning hub for maths.

On-going evaluation is inherent in this and we use both formative and summative assessment to ensure our children make good progress and achieve.

Key Features of our Mastery Approach

The 2014 national curriculum has been designed to raise standards, with the aim that the large majority of pupils will achieve mastery of each subject. This requires a clearer focus on lesson design, teaching and use of resources and support for pupils. The key features of our mastery approach are influenced by the National Centre for Excellence in the Teaching of Mathematics' (NCETM) features of the mastery approach.

Teaching and Learning for Mastery

A mastery approach involves all the children working together on the same topic. Challenge is provided by going deeper rather than by accelerating into new mathematical content. Pupils are encouraged to make connections between mathematical ideas. It involves knowing 'why' as well as knowing 'that' and knowing 'how'.

A mathematical concept or skill is mastered when a person can represent it in multiple ways, has the mathematical language to communicate related ideas and can independently apply the concept to new problems in unfamiliar situations.

As with all learning, children are encouraged to enjoy a positive attitude to maths alongside a 'Growth Mindset' approach that realises abilities are not fixed.

Differentiation comes through the questioning and scaffolding that individual children receive in class as they work through the problems. Children who grasp concepts more quickly are challenged through more demanding problems which deepen their knowledge of the same content -procedural or conceptual variation. Differentiation is therefore provided through procedural and conceptual variation within the lesson in order to meet children's needs.

Pupils' difficulties and misconceptions are identified through immediate formative assessment and addressed with rapid intervention, preferably on the same day.

Teaching for Mastery focuses on developing conceptual understanding but also takes account of developing basic mathematical skills, such as learning times tables, developing fluency in the use of mathematical language and procedural proficiency.

Teaching and Learning in Mastery Maths is constructed around the:

Concrete – during initial teaching of a concept, children should first experience the maths in concrete fashion, using apparatus such as diennes, Numicon, physical shapes etc.

Pictorial – once children are secure demonstrating and explaining the maths using the concrete experience, they then progress to applying and explaining their understanding using pictures, such as drawing diennes, number lines or bar modelling.

Abstract – only when secure with demonstrating understanding with both concrete and pictorial methods should children move into the use of abstract mathematics, using different representations to demonstrate their understanding, explain their logic and help solve problems.

The Development of Reasoning in Maths

Staff are increasingly incorporating the concept of progression in reasoning:

- Describing – a child describes what they did using full sentences.
- Explaining – children describe what they did/what they can see and offer some reasons. This is the beginning of inductive reasoning.
- Convincing – children are confident that their chain of reasoning is correct and can give a coherent argument.
- Justifying – children are able to reason using words such as 'because' and 'therefore' and 'this means…'
- Proving – this is deductive reasoning - a child can give a watertight argument that is mathematically sound.

Reasoning is part of basic questioning. These skills are developed through:

- Talk tasks
- Class discussions
- Modelled examples
- Sentence stems

The development of mathematical language

The development of mathematical language is a key strand in the development of mastery. Therefore, we ensure vocabulary is clearly displayed and a glossary of mathematical terminology is shared with children as teaching progresses. Clear and precise mathematical vocabulary is used in every lesson.

Children need to become proficient in using mathematical language, both orally and written, to explain concepts and their reasoning. The use of whole class repetition of precisely constructed sentences modelled verbally by the teacher form part of this learning.

The Development of Procedural Fluency

Procedural fluency is the ability to:

- Apply procedures accurately, efficiently and flexibly
- To transfer procedures to different problems and contexts
- To build or modify procedures from other procedures
- To recognise when one strategy or procedure is more appropriate to apply than another.

Fluency comes from deep understanding and practice. At the heart of this is a need for all children to know number facts, specifically number bonds to 20 and the times tables. Up to 15 minutes per day may be spent teaching and learning number facts.

Problem Solving and Reasoning

Problem Solving and Reasoning are at the heart of this approach and are a fundamental part of daily mathematics teaching.

Problem solving has 3 elements, which need to be taught and developed:

- Creating an image of the concept
- Thinking mathematically about the problem: applying/generating rules; spotting or extending patterns; sorting information; generating exapmples.
- Communicating the mathematics behind the problem and the logic and reasoning used to solve it.

Deepening Understanding

- All children should be given exposure to these approaches in each lesson so that they develop an improved ability to: solve problems of greater complexity
- Demonstrate creativity and imagination
- Independently explore and investigate mathematical contexts and structures
- Communicate results clearly and systematically
- Explain and generalise the mathematics.

Teachers use probing questions to deepen understanding:

- Questions with multiple answers
- Sometimes/always/never true
- True/false – convince me
- Show me an example of ??? no-one else will think of
- Multiple representations
- Odd one out
- What is different? What is the same?
- What do you notice?

- Continue the pattern
- Developing and answering their own questions
- Developing a set of rules/instrctions to explain their own observations
- Correcting deliberately incorrect example answers and explaining their thinking
- Testing mathematical hypotheses and ideas.

Support for slower attainers may include:

- Identification of likely tricky bits and the development of measures to address these during lesson planning
- Periods of pre-learning ahead of the rest of the class
- Use of concrete apparatus, aids and templates
- Use of partially completed questions
- Use of vocabulary mats
- Allowing verbal responses to explanations rather than written ones;
- Rapid interventions to address misconceptions to prevent children from falling behind.

How is this achieved and what does it look like in the classroom?

These 6 principles are key to effective teaching but, by its very nature, teaching is a creative profession so there is no prescribed formula for the way they are implemented in the classroom. When dealing with varied subjects it is about how these principles are best implemented to present subject and lesson specific concepts in the most effective way to pupils.

CHALLENGE

With the mastery learning model, rather than prejudging potential outcomes and stifling expectations by setting a host of differentiated learning objectives based on prior attainment, we have a single challenging learning objective and then think about what each individual pupil needs to achieve it. We consider:

- How best to engage our pupils
- How best to scaffold their learning.

Pupils may have different starting points but should aspire to the learning objective. The teacher is responsive in helping them to work towards it through, for example:

- focused questioning;
- adult/ peer help with starting their sentences;
- some may need to do a draft;
- some will need apparatus and/or pictorial aids
- some will reach the objective and need to be challenged further

It is about equity of opportunity, not all getting exactly the same to reach the objective. The aim is to keep students in the challenge zone.

EXPLANATION

We are mindful that pupils all ages need support to develop conceptual understanding. It is a ‘hands on, minds on’ approach involving:

- Concrete – manipulatives/objects to handle
- Pictorial – drawings, diagrams and images

- Abstract – such as mathematical notation

This learning route leads pupils to fluency. Alongside this we incorporate the following:

1. Plan in to schemes of learning how to **link to and build on something already known.**
2. Allow for the **limitations of the working memory** when asking students to take on board new information, giving instructions, asking them to sort key bits of information etc.
3. Where possible try to make the **abstract concrete** – ideally through establishing for each child a personal connection with the subject matter, enabling pupils to think about and plan, how to make abstract ideas make sense e.g. drawing diagrams; demonstrations in science; sharing and discussing images; taking the learning outside etc.

MODELLING

Explain the key ideas, then model how to do it / what to do with it. This falls in to two main categories:

1. **Model the creation of products/procedures**. For example: in writing a story, *show* them how to do it. Write it out on the board and discuss how/why you are doing each step as you go. Question them on what is being done. Explain, out loud, thought processes. If mistakes are made, point them out.

2. **Deconstruct expert examples and use worked examples** – have an excellent finished product and share it, discuss why it is good.

PRACTICE

Plan in time, during the lesson and over a series of lessons, for students to practice using new knowledge and skills. Consider the type of practice and its purpose:

1. Practice for fluency and long-term retention – repeating things in order to master them; coming back to things in subsequent lessons etc.
2. Deliberate 'intelligent' practice at the outer reaches of ability – allowing pupils to make connections and see patterns. Practising at the outer reaches of ability means pupils will have to layer skills and use them with agility.

FEEDBACK

Feedback is used in both verbal and written forms. Plan in how you will give feedback during/after lessons and – for this feedback to be meaningful -how you will allow students to respond this feedback.

Feedback is a two-way process and the teacher should use the pupils' feedback to inform future planning.

Teaching is adapted, based on pupil responses so that teaching is responsive. Regular and specific improvement points are used to close the learning gap so that learning is informed.

Moreover, it is our goal to nurture independent and agile learners who have the skills to be successful in an increasingly globalised and rapidly changing world. To achieve this, we must equip pupils to be critical and reflective learners in their own right by 'learning how to

learn'. Pupils need to be engaged in their own learning, be part of the creation of their 'next steps' and have the opportunity to assess their own work and that of their peers in a meaningful and useful manner.

QUESTIONING

Questions are framed using the Blooms Taxonomy with its hierarchy of challenge. Higher order questions are central to our learning and teaching approach. They are used to encourage discussion, promote explanation using appropriate and subject-specific vocabulary and clarify understanding. Some questions can be planned for but some should be responsive to what is happening in the lesson. When considering planned questions, they should be to:

1. Check for understanding – i.e. hinge questions that students should be able to answer at a certain point in the lesson, before they move on.
2. Provoke deeper thinking
3. Increase the ratio of participation and thinking of all students