



# Calculation and Bar Modelling Policy Introduction

## Introduction

This policy has been designed to teach children through the use of concrete, pictorial and abstract methods. This calculation policy should be used to support children to develop a deep understanding of number and calculation.

## National Curriculum

The aims of the national curriculum require children to:

- become fluent... through varied and frequent practice with increasingly complex problems.
- reason mathematically
- solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication.

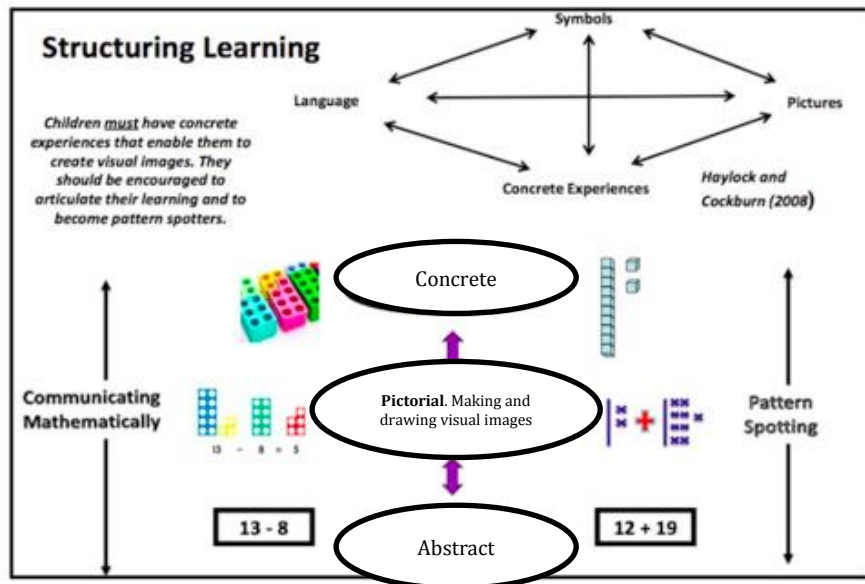
## **Using the concrete-pictorial-abstract approach:**

Children develop an understanding of a mathematical concept through the three steps (or representation) of concrete-pictorial-abstract approach.

**Concrete representation-** A pupil is first introduced to an idea or a skill by acting it out with real objects. This is a 'hands on' component using real objects and it is the foundation for conceptual understanding.

**Pictorial representation-** A pupil has sufficiently understood the hands-on-experience performed and can now relate them to representations, such as a diagram or picture of the problem.

**Abstract representation-** A pupil is now capable of representing problems by using mathematical notation, for example:  $12 \times 2 = 24$



This document aims to give guidance on how to exemplify the concrete, pictorial and abstract approach through the use of Numicon, bar modeling and written methods. As a Numicon advocate school we encourage children to explore math's using structured imagery and apparatus in order to understand and explain mathematical concepts. Alongside this guidance on bar modeling is given as an effective part of the concrete, pictorial and abstract approach to the mastery of mathematics. This is not a method for problem solving but does reveal the mathematical structure beneath the problem and mathematical relationships between its component parts. Language also plays an important role within this document and is exemplified throughout. Once children are confident within the concrete and pictorial stages then the abstract written methods are introduced.

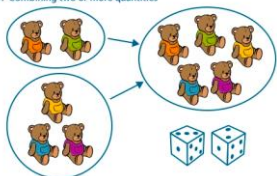
### Additive Reasoning

Additive reasoning is the relationships between the parts and the whole. Getting children to think and talk about the whole and parts using concrete manipulatives such as Numicon early on should lay the foundations for them to internalise this underlying pattern. More sophisticated additive reasoning is the understanding of the inverse relationship between addition and subtraction. Children need to fully understand that two or more parts can be equal to the whole and use this pattern to generate statements: Part + Part = Whole and that Whole – Part = Part.

### Aggregation

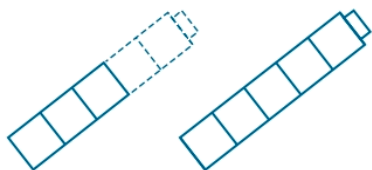
Combining of two or more quantities (How much/many altogether? What is the total?)

1. Combining two or more quantities



### Augmentation

Where a quantity is increased by an amount (increase by)



### Multiplicative Reasoning

Many children will, for example, say that to make 2 into 10 you add 8 or to make 5 into 10 you add 5. This is additive thinking. If they were thinking multiplicatively, they would multiply 2 by 5 or 5 by 2 to make 10. Purely thinking in an additive way, as research suggests, can put a ceiling on children's learning. In the national curriculum, various topics need an understanding of multiplicative reasoning, for example, multiplication, division, scaling, area, ratio and proportion. It is a useful concept to teach the children as it also helps to build mental calculation strategies and develop reasoning. Multiplicative reasoning is essentially a recognition and use of grouping in the underlying pattern and structure of our number system.

**\* This document provides guidance and examples for key objectives for each year group but is not to be followed as a complete planning aid as not all objectives are exemplified.**