

## NEP 20

### Numbers and Number Operations

- a. All children must have ample opportunities of developing the ideas of numbers and operations on numbers in their local context within and outside their syllabus. b. Numbers are the mathematical tool to count and measure. Numbers are used in many forms. Three major types of numbers are Cardinal numbers, Ordinal numbers, and Nominal numbers.

**Cardinal numbers** are used to measure and communicate the size of a group of objects, e.g., 30 students of class V went for a picnic.

• **Ordinal numbers** are used to describe the position of an object when they are arranged in a specific order, e.g., Fourth child from the left has brown hair.

• **Nominal numbers** are used as nouns/labels to identify the object in a group, e.g., Train number 2298 has just left.

The key skills that come under this category are **number sense, reading of symbols, writing words and symbols, comparison of numbers like bigger than/smaller than** etc.,

**fundamental operations** - addition, subtraction, multiplication, division, and their applications in daily life.

Problems involving operations such as addition, subtraction, multiplication, and division are not merely abstract uses of numbers. These operations have wider applications in daily life. The operations of addition and subtraction are complementary to each other. **Addition** is a combination/aggregation of distinct sets of like entities while subtraction is the exact opposite, i.e., take away or left over from a set of elements. Similarly, multiplication and division are also complimentary to each other. Multiplication is done by repeated addition while division by repeated subtraction. These operations are not just to develop computational abilities in children but to use them as tools for problem solving in daily life context. This would feed into the higher aim of mathematics as a problem-solving tool.

The problems which commonly use addition and subtraction involve an increase or decrease of some quantity, combination of two or more objects and comparison of objects. A common strategy to represent subtraction problem are “take away”/ “left over” problems. There are some informal strategies in dealing with addition and subtraction of small numbers as it helps to build a “number

sense”. These operations are useful to interpret, represent and solve simple problems in daily life context. a) By acquiring these skills, the child should be able to achieve the following- • Quantification: Counting objects in a collection (Visualization, Generalization)

Counting as a means for solving problems such as determining quantity/ comparing (Problem Solving) • Associate number concepts, vocabulary, quantities and writing numerals to communicate (Communication) • Abilities to combine, separate and name “how many” concrete objects leading to operations of addition and subtraction for small collections (Problem solving, Communication)

The following approaches can be followed to achieve these skills: - • While teaching numbers, concept of groups of tens should be used using a variety of objects like sticks, pencils etc. • Involve children in matching and sorting objects using one-to-one correspondence and ordering objects that vary in colour, size, or other parameters • Encourage children to count different groups of objects and to think about quantity and number. • Use strategies that help children learn to count accurately and efficiently such as pointing to/touching/moving each object being counted. • Draw attention to numbers and how they are used such as house addresses, prices of objects marked on packets, etc. • Use words related to estimation – more than, less than, about, nearly, approximately, and in between. • Ask children to estimate or how many by looking at a group of objects. Encourage them to test for the actual answer. • Play games that include counting and using numbers like simple board games, card, or dice games etc. • Give children problem solving situations involving combination, taking away, equal distribution of objects so that they can make the concept of addition, subtraction, multiplication, and division.

Engage students with some fun loving and learning based activities so that they can develop the concept of different operators. • Encourage children to use the vocabulary like together, take away, number of times, equal sharing.

Shapes and Spatial Understanding a. Spatial understanding: Spatial understanding is the area of mathematics that involves shape, size, space, position, direction, and movement. It helps describe and classify the world we live in. Spatial sense gives children an awareness of themselves in relation to people and objects. The key concepts include 3D shapes and solids, flat and curved surfaces of solids, 2D shapes as seen on surfaces of a solid shape e.g.,

straight lines, curved lines, shapes made up of straight lines, curved lines etc. e.g., triangles, quadrilaterals, circles etc. b. By acquiring these skills, the child should be able to achieve the following;

2D Shapes: circle, rectangle, square and triangle.

3-D Solids: like cube, cuboid, cylinder, cone, sphere.

Observe the objects in the environment and get a qualitative feel for their geometrical attributes.

- Use her own vocabulary to describe space and the shapes of various familiar objects.
- Identify various elements of an object such as edges, corners and faces while exploring and playing with them.

Explore and communicate the association between an object (3D) and its shape (2D) • Draw simple shapes on paper and trace and explore the outlines of objects on paper. • Trace her way in space by talking of direction and spatial relationships.

Since children are familiar with the shapes of objects around them, it is better to explain differences between shapes by making a connection with other objects like this is round like a ball etc. When children use their own language or common vocabulary, they can communicate what they find through their explorations. It helps them to generalize and to understand the concept better. Later, they can relate this base of understanding to the formal mathematical vocabulary. Children can be taken on exploratory walk to the nearest places and then asked to draw its map using the various landmarks they observed during the walk.

**The teachers may follow the approaches given below:**

- Encourage children to identify different shapes as they draw, look at different objects, work with puzzles, building with blocks.
- Give children many opportunities to handle objects such as blocks, boxes, containers, shape sorters and puzzles.

- Encourage children to climb in and out of boxes or large block structures, on or around outdoor equipment, and over, under, around, through, into, on top of, and out of different things to experience themselves in space.
- Encourage children to make new shapes by putting materials together and taking them apart in different arrangements. They can do this by moulding clay playing with blocks.
- Introduce spatial vocabulary, including location and position words – on/off, over/under, in/out, above/below, front/behind, top/bottom, movement words – up/down, forward/backward, toward/away from, straight/curving, distance words – near/far, close to/far from, shortest/longest etc.

**Measurement** a. Measurement in daily life situations: There are numerous situations that we encounter in our daily life which involves dealing with quantities, for example, buying clothes, constructing wooden items and buildings, cooking a meal for guests etc. Children are often involved in activities like comparing their heights, checking whether there are enough sips of water left in their water bottle, how much time is left for the lunch break, refusing to lift a heavy item, letting hot milk to cool down before consuming it, and so on. In this way children acquire an informal understanding of several physical attributes such as length, weight, volume, time, and temperature. Measurement is inherent part of human life, whether being used in the accomplishment of routine work or in an occupation. Thus, familiarity with different contexts of measurement is important for functioning effectively. This majorly contains the understanding of the following attributes of measurement

Length/distance • Weight/mass • Volume/capacity • Time • Temperature.

### **Planning learning of measurement:**

We should use the experiential learning of children, and natural context to develop and plan learning activities. Focus should be made on designing activities that have inbuilt challenge in the form of a problem which children can easily relate to and find interesting. As children start to learn the various attributes of measurement, they are introduced to vocabulary of comparison. Learning starts with comparing an attribute of objects directly (comparing length of a

pencil and a scale) and then moves to indirect comparison (comparing length and height of the blackboard). While teaching indirect comparison, we use another intermediary object for example, a string could be used to compare the length and height of the blackboard. Later, they should be introduced to non-standard units such as hand span or a stick.

### **Comparing and measuring:**

There is a big difference between comparison and measurement as measurement involves the use of number. The number describes how many matchsticks longer is a pencil, how far is my school from home, how many cups full of water will fill a jug completely, how many peas will balance a potato etc. Efforts should be made to ensure that children understand the necessity of unit of repeat in measurement, so that they will understand the importance of standard units. Later when they will be introduced to instruments used for measuring like ruler, weighing scale, clock, thermometer etc. they will not simply read the readings but know how they have been constructed and why we use them.

While comparing and measuring, children should be encouraged to make a guess or do a visual estimate first, and later to verify their guess or estimate by carrying out more systematic comparison or measurement (or by using a specific instrument). For example, let children guess whose arm is longest among them. See what all ways they suggest for comparison, and provide them with some strings, matchsticks, paper strips, etc. Let them think and select the most suitable way. Help them use it and finally reach the answer. Children can be shown two different shaped containers filled with unequal amount of water (not much difference in amount of water) and can be asked to guess which has more/less water. Observe what arguments they put up to justify their answers and have an elaborate discussion. Provide them some identical glasses and prompt them by asking, 'can we use these glasses to find out which bottle has more water?'

### **Approaches for teaching measurement.**

Thus, measurement is a skill that is inherently activity-based. There is plenty of opportunity for children to measure and to work in groups. Measurement involves

both understanding and skill. The following approaches may be followed by teachers:

- Give ample opportunities to use language of comparison - use appropriate attribute words for different situations.
- Let children figure out their own units for measurement. Children better understand standard units like metres, centimetres, grams, litres, etc when they have lots of experiences working with their own ways of measuring and comparing in non-standard units.
- Involve children in activities such as block building, cooking, crafts and other experiences that involve measurement.

Look for opportunities to help children make comparisons and measurements of volume, height, weight, length and temperature in day-to-day conversation. • Provide simple experiences that help children begin to develop an understanding of time concepts by comparing how long different activities take. Start with daily time references (after the story, before lunch) and proceed to more abstract concepts (yesterday, tomorrow, months, years, etc.)

## **Patterns**

**a. Patterns in our daily lives:** Patterns are all around us. The word pattern is used in almost every context of our daily lives such as decorative designs, figures, motifs, shapes etc. Mathematically, a pattern is an arrangement, order, sequence, or repetition. The sequence of daily activities forms a pattern in a child's life that the child can recognize. Patterns can also be seen in numbers, shapes, sounds etc. Arrangement, repetition, and order are important in many branches of Mathematics. Patterns can be identified based on color, shape, size, etc.

**Patterns in mathematics:** As patterns are all around us, it is important to develop the understanding of pattern. Identification of the pattern helps in enhancing observation and analytical skills as while identifying pattern, one observes the similarities, dissimilarities, repetition, non-repetition, growth/decay etc. Describing patterns helps in enhancing vocabulary and improving language which is one of the important aspects in mathematics learning. c. Pattern Types

Patterns can be identified based on a particular rule. For example, counting numbers have a pattern- each number is one more than the preceding number and etc.

number is one less than the succeeding number. Patterns can be of many types like sound patterns, number patterns, patterns in shapes, patterns in colours, patterns based on symmetry etc.