PDST Shape and Space Seminar 2018

Participant Booklet

Contents

PDST
Professional Development Service for Teachers | An tSeirbhís um Fhorbairt Ghairmiúil do Mhúinteoirí

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Shape and Space Strand, Strand Units and Skills

Junior and Senior Infants	1st and 2nd class
Spatial Awareness	
• explore, discuss, develop and use the vocabulary of spatial relations position	• explore, discuss, develop and use the vocabulary of spatial relations • give and follow simple directions within classroom and school settings (including directions using ½ and ¼ turns
3-D Shapes	
• sort 3-D shapes, regular and irregular (cube, cuboid, sphere and cylinder) • (combine 3-D shapes to make other shapes) • solve tasks and problems involving shape.	• describe, compare and name 3-D shapes, including cube, cuboid, cylinder and sphere (and cone) • discuss the use of 3-D shapes in the environment • solve and complete practical tasks and problems involving 2-D and 3-D shapes • explore the relationship between 2-D and 3-D shapes.
2-D Shapes	
• sort, (describe) and name 2-D shapes: square, circle, triangle, rectangle • use suitable structured materials to create pictures • solve problems involving shape (and space) • (combine/divide 2-D shapes making larger/smaller shapes) • (give simple moving and turning directions)	• sort, describe, compare and name 2-D shapes: square, rectangle, triangle, circle, semicircle (and oval) • construct and draw 2-D shapes • combine and partition 2-D shapes • identify ½'s (and ¼'s) of 2-D shapes • identify and discuss 2-D shapes in the environment
Understanding and Recalling	
• recall and understand terminology	• recall and understand terminology and facts
Implementing	
• devise and use mental strategies and procedures for carrying out mathematical tasks • use appropriate manipulatives to carry out mathematical tasks and procedures	• devise and use mental strategies and procedures for carrying out mathematical tasks • use appropriate manipulatives to carry out mathematical tasks and procedures • execute procedures efficiently
Reasoning	
• classify objects into logical categories • recognise and create sensory patterns • justify the processes or results of activities	• classify objects into logical categories • make guesses and carry out experiments to test them • recognise and create mathematical patterns and relationships • justify the processes and results of mathematical activities
Integrating and Connecting	
• connect informally acquired mathematical ideas with formal mathematical ideas • recognise mathematics in the environment • recognise the relationship between verbal, concrete, pictorial and symbolic modes of representing numbers • carry out mathematical activities that involve other areas of the curriculum	• connect informally acquired mathematical ideas with formal mathematical ideas • recognise mathematics in the environment • recognise the relationship between verbal, concrete, pictorial and symbolic modes of representing numbers • carry out cross-curricular mathematical activities • understand the mathematical ideas behind the procedures he/she uses
Communicating and Expressing	
• discuss and explain mathematical activities • record the results of mathematical activities concretely and using diagrams, pictures and numbers • discuss problems presented concretely, pictorially or orally	• discuss and explain mathematical activities • listen to and discuss other children's mathematical descriptions and explanations • **discuss and** record the results of mathematical activities using diagrams, pictures and **symbols** • discuss problems presented pictorially or orally
Applying and Problem-Solving	
• select appropriate materials and processes for mathematical tasks • select and apply appropriate strategies for completing a task or solving a problem • recognise solutions to problems	• select appropriate materials and processes for mathematical tasks **and applications** • select and apply appropriate strategies for completing a task or solving a problem • recognise solutions to problems • apply concepts and processes in a variety of contexts

Shape and Space Strand, Strand Units and Skills (contd.)

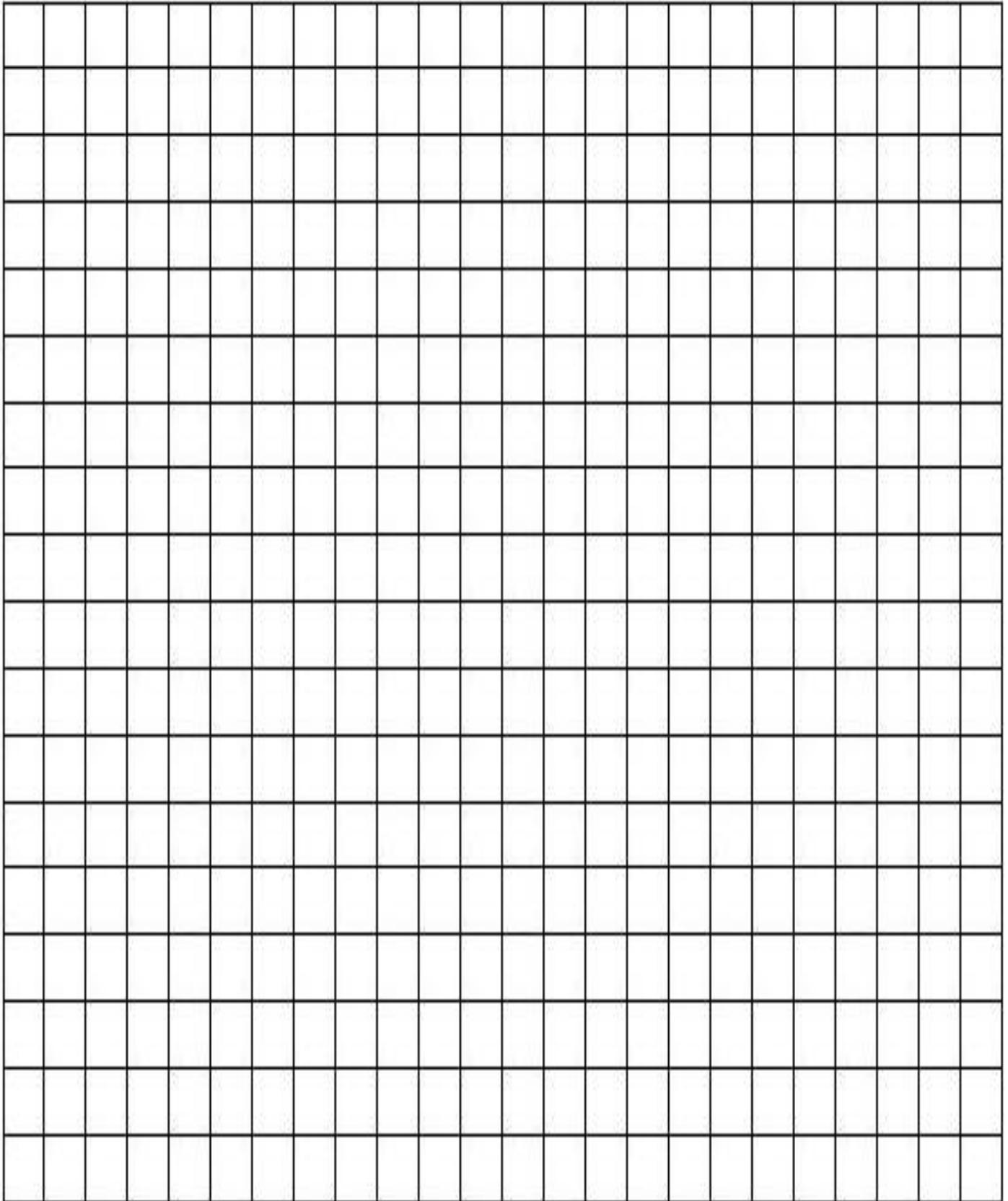| 3rd and 4th class	5th and 6th class
Symmetry (3rd and 4th class only)	
• identify line symmetry in the environment • identify (lines of symmetry as horizontal, vertical or diagonal) and draw lines of symmetry in 2-D shapes • (use understanding of line symmetry to complete missing half of a shape, picture or pattern)	
3-D Shapes	
• identify, describe and classify 3-D shapes, including cube, cuboid, cylinder, cone, sphere, triangular prism, pyramid • explore, describe and compare properties of 3-D shapes • explore and describe the relationship of 3-D with 2-D shapes • construct 3-D shapes • solve and complete tasks and problems with 2-D and 3-D • (recognise that prisms sliced have faces equal in shape and size)	• identify and examine 3-D shapes and explore relationships, including tetrahedron (and octahedron), examining faces, edges and vertices • draw the nets of simple 3-D shapes and construct the shapes
2-D Shapes	
• identify, describe and classify 2-D shapes: □, ▯, Δ, ◆, ○, ◖, oval and irregular shapes (equilateral, isosceles & scalene triangle, parallelogram, rhombus, pentagon, octagon) • explore, describe and compare the properties (sides, angles, parallel and non-parallel lines) of 2-D shapes • construct and draw 2-D shapes • combine, tessellate and make patterns with 2-D shapes • identify the use of 2-D shapes in the environment • solve and complete practical tasks and problems	• make informal deductions about 2-D shapes and properties • classify and describe triangles & quadrilaterals lines & properties • identify the properties of the circle • construct a circle of given radius or diameter • tessellate combinations of 2-D shapes • classify 2-D shapes according to their lines of symmetry • use 2-D shapes and properties to solve problems • (plot simple co-ordinates and apply where appropriate) • (construct triangles from given sides or angles)
Lines and Angles	
• identify, describe, (draw) and classify vertical, horizontal and parallel (oblique, perpendicular, intersecting) lines (and angles) • recognise an angle in terms of a rotation • classify angles as < > or = to a right angle • solve problems involving lines and angles.	• recognise, classify, describe and relate angles to shapes in the environment • recognise angles in terms of a rotation • estimate, measure and construct angles in degrees • explore the sum of the angles in a triangle (and quadrilateral)
Understanding and Recalling	
• recall and understand terminology, facts and definitions	• recall and understand facts, definitions and formulae
Implementing	
• devise and use mental strategies and procedures • use appropriate manipulatives for maths procedures • execute standard procedures efficiently with varied tools	• devise and use mental strategies and procedures • use appropriate manipulatives for maths procedures • execute standard procedures efficiently with varied tools
Reasoning	
• make hypotheses and carry out experiments to test them • make informal deductions involving a number of steps • explore and investigate maths patterns and relationships • reason systematically in a mathematical context • justify processes and results, problems and projects	• make hypotheses and carry out experiments to test them • make informal deductions • search for and investigate maths patterns & relationships • reason systematically in a mathematical context • justify processes and results, problems and projects
Integrating and Connecting	
• connect informal and formal ideas and processes • understand connections between procedures and concepts • recognise mathematics in the environment • represent ideas and processes: oral, pictorial, diagram, and symbolic • recognise and apply maths ideas and processes cross curricular	• connect informal and formal ideas and processes • recognise mathematics in the environment • represent ideas and processes: oral, pictorial, diagram, and symbolic • understand the connections between procedures & concepts • recognise and apply maths ideas and processes cross curricular
Communicating and Expressing	
• discuss and explain, processes and results of tasks • listen to and discuss other descriptions and explanations • discuss and record processes and results using varied methods • discuss and analyse verbal or diagrammatic problems	• discuss and explain, processes and results of tasks • listen to and discuss other descriptions and explanations • discuss and record processes and results using varied methods • discuss problems and carry out analyses
Applying and Problem-Solving	
• select materials, concepts and processes for tasks • apply concepts and processes in a variety of context • analyse problems and plan an approach to solving them • select and apply varied strategies to tasks, projects and problems • evaluate solutions to problems	• select materials, concepts and processes for tasks • apply concepts and processes in a variety of contexts • analyse problems and plan an approach to solving them • select and apply varied strategies to tasks, projects and problems • reflect upon and evaluate solutions to problems

Square Corners
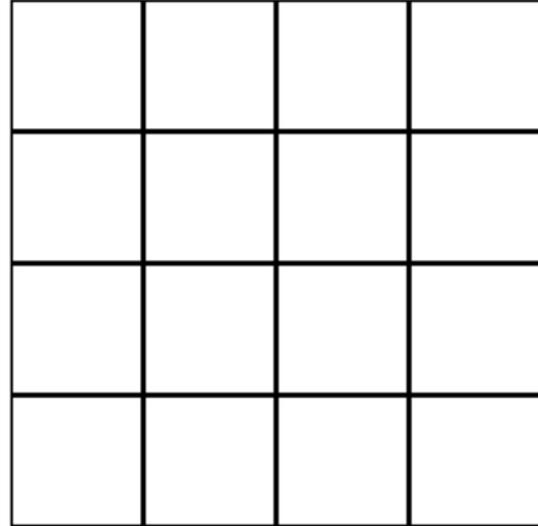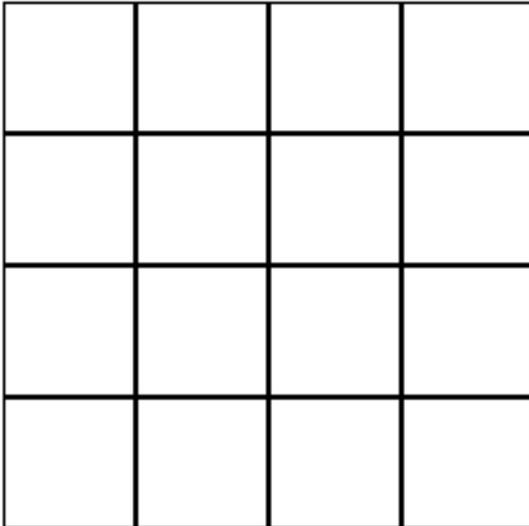
Levels in the Developmental Progression for the Composition of Shapes

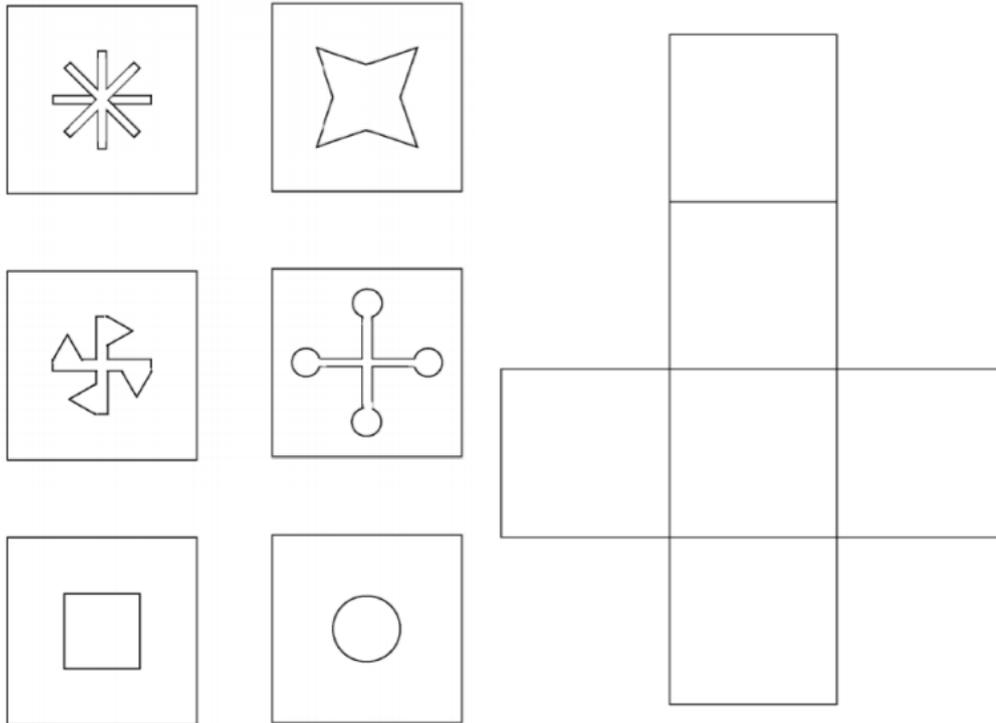|	
Precomposer	Children manipulate shapes as individuals, but are unable to combine them to compose a larger shape.
Piece Assembler	Children at this level are similar to Precomposers, but they place shapes *contiguously* (near or next to but may not actually be touching).
Picture Maker	Children can *concatenate* (link shapes together in a chain or series) shapes contiguously to form pictures in which several shapes play a single role.
Shape Composer	Children combine shapes to make new shapes or fill puzzles, with growing intentionality and anticipation. Shapes are chosen using angles as well as side lengths.
Substitution Composer	Children deliberately form composite units of shapes and recognise and use substitution relations among these shapes (e.g. 2 trapezoids can make a hexagon)
Shape Composite Iterater	Children construct and operate on composite units (units of units) intentionally. They can continue a pattern of shapes that leads to a 'good covering' but without coordinating units of units.
Shape Composer with Superordinate Units	Children build, iterate and operate on units of units of units.

(Adapted from: Young Children's Composition of Geometric Figures: A Learning Trajectory, Clements, Wilson and Sarama, 2014)
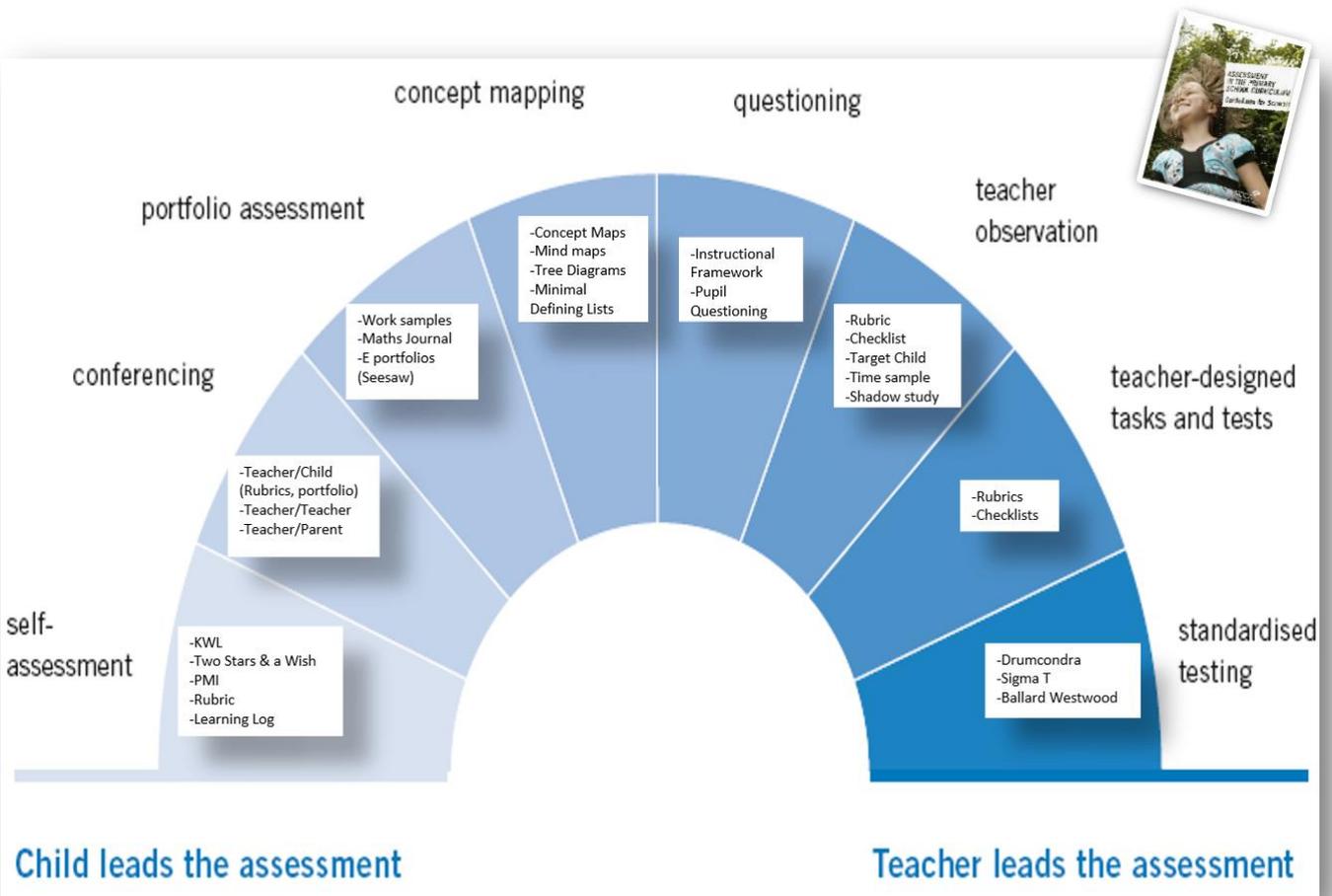
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A Puzzling Cube

https://nrich.maths.org/1140

Continuum of Assessment

concept mapping

questioning

portfolio assessment

teacher observation

-Concept Maps
-Mind maps
-Tree Diagrams
-Minimal Defining Lists

-Instructional Framework
-Pupil Questioning

-Rubric
-Checklist
-Target Child
-Time sample
-Shadow study

-Work samples
-Maths Journal
-E portfolios (Seesaw)

conferencing

teacher-designed tasks and tests

-Teacher/Child (Rubrics, portfolio)
-Teacher/Teacher
-Teacher/Parent

-Rubrics
-Checklists

self-assessment

standardised testing

-KWL
-Two Stars & a Wish
-PMI
-Rubric
-Learning Log

-Drumcondra
-Sigma T
-Ballard Westwood

Child leads the assessment

Teacher leads the assessment

Child-Led Assessment

Concept Mapping

Concept mapping makes spatial representations of ideas and the relationships between these ideas. Concept maps are similar to graphs containing ideas and lines describing the relationships between them. The maps help show what and how a child thinks about an idea. They can be especially useful for children with reading and writing difficulties. Using evidence of children's learning from concept maps, the teacher can identify teaching strategies, activities and experiences to modify their learning where misunderstanding exists, and/or further develop their thinking. At the beginning of a unit of work concept maps give information about children's current level of understanding or misunderstanding. This enables the teacher to use concept mapping for AfL and identify immediate learning needs. During or at the end of learning, children can revisit their maps and adjust them or draw new maps based on the same concept as AoL, enabling the teacher to evaluate the effectiveness of his/her teaching in supporting learning.

Portfolio Assessment

A portfolio is a collection of the child's work, reflecting his/her learning over a period. Portfolios provide opportunities for collaborative assessment whereby the teacher and child together talk about the child's work, identifying positives and points for improvement. Portfolios can exist in hard copy and/or electronically. The teacher decides on the purpose(s) of the portfolio before beginning to use it e.g. to show improvement, to show a range of work, to show strengths and interests, etc. The portfolio can represent both AfL and AoL. The teacher/child (or both) periodically select a piece of work for inclusion. The child attaches a short statement explaining why this piece was selected, emphasising what he/she has learned.

Conferencing

Conferencing is an opportunity to share information to increase understanding for the teacher and child about the child's learning. The teacher talks to the child about his/her strengths and achievements and suggests where and how learning can be improved. Through conferencing the teacher listens to the child's ideas and encourages openness in the child. This is an example of AfL; the outcome of the conference will inform the teacher's planning for next steps in the child's learning, and will help the child to see how to improve. The conference is more likely to succeed in a classroom climate that respects children's opinions and encourages them to express them. Children need to know they are not under examination in a conference with the teacher, and are free to say what they feel about their own performance.

Self-Assessment

Self-assessment is an essential part of AfL enabling children to take greater responsibility for their own learning. Self-assessment involves metacognition—the process of being aware of and reflecting on one's own learning. The skills of self-assessment need to be learned over time. This involves a long-term, continuing process that is planned at class and school level. Self-assessment skills include effective questioning, reflection, problem-solving, comparative analysis, and the ability to share thoughts in a variety of ways. These skills can be taught/modelled by the teacher. Self-assessment can be used by children of all ability levels and in all areas of learning. A learning log can be used to document the child's self-assessment and reflection on his/her work. Self-assessment contributes to a positive classroom climate in which making mistakes is considered central to the learning process.

Developing and Assessing Skills through Shape and Space

Consider the following with your group
Record your answers on the flipchart provided

First Task:

Skills Targeted	Class Organisation
Knowledge Base	**Maths Language**
Assessment Tool	**Questions for Pupils**

Circle, Square, Triangle

What is still going around in your head?

What is squared away?

What 3 activities will you use in your classroom?

A Suggested Framework for Integrating Skills Development

Theme:

Mathematics	Science	Other
Strand(s):	**Strand(s):**	
Strand Unit(s):	**Strand Unit(s):**	*Other curriculum links such as visual arts, oral language development, debates, use of ICT to record, interpret and present data, team building skills etc. could be considered here.*
Curriculum Objectives:	**Curriculum Objectives:**	

Mathematical Skills:

☐ Implementing

☐ Understanding and Recalling

☐ Applying and Problem-Solving

☐ Communicating and Expressing

☐ Integrating and Connecting

☐ Reasoning

Science Skills:

Working Scientifically

☐ Questioning   ☐ Investigating and experimenting

☐ Observing   ☐ Estimating and measuring

☐ Predicting

Analysing:

☐ Sorting and classifying   ☐ Interpreting

☐ Recognising patterns   ☐ Recording and communicating

Designing & Making

☐ Exploring   ☐ Making

☐ Planning   ☐ Evaluating

Getting Started (Early engagement with a problem)

Setting the scene in context:	Let's conjecture and consider:	Facilitating exploration:

Working on the problem through investigation

Questioning to elicit:	Have we a prediction?
Let's investigate:	**Making sense of our work:**

Digging Deeper to discover more and consider proof

Apply what I learned to…	Integrate and Connect with…	I learn best when…

(Adapted from Discover Primary Science Inquiry Framework)