

Open Up to Outdoor Mathematics!

Supporting children's developing problem solving reasoning and numeracy skills through good use of natural and man made materials in the outdoor environment.



Learning through Landscapes

Learning through Landscapes (LTL) is the UK's national school grounds charity. The charity works with schools and early years settings, helping them to maximise the potential of their outdoor spaces for learning, play and well-being. Members can access help, advice and written materials to help them improve and develop the use of outdoors.

Learning through Landscapes believes that *knowledgeable and enthusiastic adults are crucial to unlocking the potential of outdoors**, and aims to foster children's mathematical thinking through outdoor experiences that are imaginative and enjoyable. This booklet has been developed as part of the 'Open Up to Outdoor Mathematics' project. It incorporates ideas for making good use of natural resources and made materials and includes illustrative photographs. All the ideas can be implemented easily and with little expense.

Acknowledgements

Learning through Landscapes is grateful for the involvement of the following people:

UBS Bank for continuing their long established history of support for children in Hackney by providing the original funding and ongoing support for the project.

Sebright Primary School, particularly the staff and children within the Nursery and Foundation Stage classes who rose to the challenge and worked enthusiastically throughout the project.

Leaview Community Nursery, particularly Leticia, Avis and the children whose enthusiasm for working with cameras provided such inspiration for the project.

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*One of three Vision Statements for high quality outdoor play. More information from www.ltl.org.uk

Sebright Primary School Foundation Stage Class



Sebright Nursery



Leaview Community Nursery

Introduction

In the past, teaching of mathematics within the early years sector often over relied on indoor paper based activities to develop children's mathematical skills. Anecdotal feedback from practitioners and the early years advisors who support settings around the country indicates that some practitioners are not particularly confident with this aspect of curriculum, or their own role as outdoor educators. The Curriculum Guidance for the Foundation Stage (2000) recognised this ongoing issue:

"Many adults are less confident about mathematics than any other area of learning. Some adults think of mathematics as 'doing sums' and are not aware that it involves much more than that."

Curriculum Guidance for the Foundation Stage, p. 73

The Curriculum Guidance also states that effective teaching within this area of learning

"Requires practitioners who help children to see themselves as mathematicians, and develop positive attitudes and dispositions towards their learning. Children have a natural interest in numbers, measuring and shapes, aroused by interaction with their environment and with other people."

Curriculum Guidance for the Foundation Stage, p. 71

Learning through Landscapes recognised that a project focusing on nurturing mathematical experiences in the natural and made environment outdoors would support staff and enrich children's learning experiences. In particular the project would promote two key tenets that underpin the requirements of the Foundation Stage for children's mathematical development:

"Effective teaching requires practitioners who understand that mathematical development does not depend on specific resources."

"It is important to provide a rich environment outdoors as well as indoors, in which children are provided with interesting materials to sort, count, talk about, compare, use for making models and so on ... everyday objects and materials will interest children."

Curriculum Guidance for the Foundation Stage, p. 72



Early Years Foundation Stage

The Early Years Foundation Stage (EYFS) Consultation document published in May 2006 has guided the content and format of this booklet.

The EYFS will take the place of the current Curriculum Guidance for the Foundation Stage and will be introduced in September 2008. It will contain updated guidance and materials for early years practitioners in all areas of learning. Mathematical Development will be renamed as Problem solving, reasoning and numeracy.

It is anticipated that the idea and suggestion will remain relevant and useful to practitioners delivering the new EYFS framework from September 2008.

Problem solving, reasoning & numeracy

Source: *The Early Years Foundation Stage Consultation Document (May 2006)*

Practitioners must support children in developing their understanding of problem solving, reasoning and numeracy in a broad range of contexts in which they can explore, enjoy, learn, practise and talk about their developing understanding. Practitioners must offer opportunities for these skills to be practised, in order to give children confidence and competence in their use.

What problem solving, reasoning and numeracy means for children

This Area of Learning and Development includes seeking patterns, making connections, recognising relationships, working with numbers, shapes, space and measures, and counting, sorting and matching. Children use their knowledge and skills in these areas to solve problems, generate new questions and make connections across other Areas of Learning and Development.

How settings can effectively implement this Area of Learning and Development

Mathematical understanding should be developed through stories, songs, games and imaginative play. To give all children the best opportunities for effective mathematical development, practitioners should give particular attention to:

- many different activities, some of which will focus on mathematical development and some of which will draw out the mathematical learning in other activities, including observing numbers and patterns in the environment and in daily routines.
- practical activities underpinned by children's developing communication skills.
- activities that are imaginative and enjoyable.
- real-life problems, for example: 'How many spoons do we need for everyone in this group to have one?'.
- modelling mathematical vocabulary during the daily routines and throughout practitioner-led activities.
- giving children sufficient time, space and encouragement to use 'new' words and mathematical ideas, concepts and language during child-initiated activities in their own play.

- encouraging children to explore problems, to make patterns and to count and match together.
- the balance between learning and teaching indoors and outdoors (e.g. having read a story about washing clothes, there might be laundrette play indoors and washing line play outdoors; streets of clothes shops built out of recyclables; bikes and other wheeled vehicles being used as delivery vans; numbered (and lettered) parking spaces. The staff would spend time in both environments and the level of child-initiated and practitioner-led activity would be monitored and divided more or less equally across both environments. Displays would include examples from both environments).
- help for those children who use a means of communication other than spoken English in developing and understanding specific mathematical language.
- opportunities to observe, assess and plan the next stage in children's learning.
- relevant training to improve practitioners' knowledge, skills and understanding.

NB: The overview for this area of learning is taken from the consultation version of EYFS – following the public consultation period this document is to be amended, however the emphasis on the effective use of outdoors remains a priority within the final guidance materials.



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Each mathematical idea includes support for practitioners under the following headings:

Look, listen and note:

This information includes pointers for staff observation so that they can begin to plan what to offer next for children's mathematical experiences.

Planning and Resourcing:

These notes are not a prescriptive list, however they do highlight some suggestions which may act as a catalyst for staff planning discussions. It is important to develop plans and use resources that meet the needs and interests of the children within the setting at the time.

Effective Practice:

This information suggests ways of interacting with children to support their play, thinking and mathematical learning.

Development Matters:

Within Problem solving, reasoning and numeracy this section highlights the stepping stones and Early Learning Goals that each idea is most strongly supporting. However, since much of children's play and learning is cross-curricular other stepping stones and early learning goals may also be relevant, despite not being included.

Case Study:

This gives an illustrative example from one of two settings involved the project.

Good Idea!

This section highlights other good ideas for enriching children's mathematical experiences

*The '**Maths on the Move**' section has been included to support settings and childminders who use Hackney parks and other public spaces to enrich their children's outdoor experiences..

Numbers for Labels and for Counting

Number hunt

Look, listen and note: When children begin to use the names for number accurately. The strategies that children use for matching number and quantity.

Planning and resourcing: Prepare laminated photographs of features that can be 'hunted' for and counted, for example 1 door, 2 gates, 3 fence posts, 4 airbricks. Hunt for examples of a specific number outdoors, such as 3 drainpipes, 3 windows, 3 manhole covers. Give children a way of recording their discoveries, for example using cameras, or clipboards and pencils. *See the materials and resources list at the back of this booklet for examples of common items and features that can be counted outdoors.*

Effective practice: Introduce and use number language, for example 'one' 'two' 'three', 'lots'. Model and encourage use of mathematical language, for example by asking children 'how many paving slabs?' Show children how counting is used to find out how many items are in a set.

Development matters: Sometimes match number and quantity correctly. Recognise some numerals of personal significance. Count up to three or four objects by saying one number name for each item. Recognise numerals 1 to 5. Know that numbers identify how many objects there are in a set. Early Learning Goal: Say and use number names in order in familiar contexts. Count reliably up to 10 everyday objects. Recognise numerals 1-9.

Case Study:

At Leaview Community Nursery children collected leaves then counted and recorded their total.



Number Match

Look, listen and note: When children begin to use the names for number accurately. The strategies that children use for matching number and quantity.

Planning and resourcing: Prepare collections of interesting things found outdoors that children can sort, order, count and label. Provide number cards or large wooden numbers that children can use when counting objects outdoors. *See the resources and materials list at the back of this booklet for examples of common items that can be found outdoors.*

Effective practice: Introduce and use number language, for example 'one' 'two' 'three', 'lots'. Model and encourage use of mathematical language, for example by asking children 'how many pebbles will fit in the flowerpot?'

Development matters: Sometimes match number and quantity correctly. Recognise some numerals of personal significance. Count up to three or four objects by saying one number name for each item. Recognise numerals 1 to 5. Know that numbers identify how many objects there are in a set. Early Learning Goal: Say and use number names in order in familiar contexts. Count reliably up to 10 everyday objects. Recognise numerals 1-9.

Case Study: Children at Leaview Community Nursery collected a specific number of pebbles and found the corresponding number.



Calculating

Comparing and Problem solving

Look, listen and note: The strategies used that show children are working out whether a group of object is the same or different. How children use fingers or counting to work out a solution to a simple problem. How children find the sum or total of two numbers.

Planning and resourcing: Collect together items that can be used for counting, comparing and problem solving, for example pebbles, acorns, sticks, fir cones. Provide children with wooden numbers and containers that can be used when they are counting outdoors. Encourage children to record what they have done, for example by drawing, tallying or photographs. *See the resources and materials list at the back of this booklet for more examples of common items that can be found outdoors.*

Effective practice: Help children to organise their ideas by talking to them about what they are doing. Demonstrate use of language, such as 'same as', 'fewer', 'less'. Show an interest in how children solve problems and value their different solutions. Make sure children are secure about the order of numbers before asking what comes after or before each number.

Development matters: Compare two groups of objects saying when they have the same number. Show an interest in number problems. Find the total number of items in two groups by counting all of them. Use own methods to work through a problem. Early Learning Goals: In practical activities and discussion, begin to use the vocabulary involved in adding and subtracting. Begin to relate addition to combining two groups of objects and subtraction to 'taking away'.

Case Study:

Children at Leaview Community Nursery sorted a range of materials into different bowls and worked out which contained the most items.



Good idea!

Why not enrich childrens' play by adding seasonal materials such as conkers and chestnuts.



Case study: Children at Sebright Primary School recorded how many gold 'nuggets' they had found in the sandpit by marking them down on a tally sheet. The 'nuggets' were created by spraying butterbeans with gold paint.



Shape, Space and Measures

Sorting Materials

Look, listen and note: How children apply their understanding of the properties of items. How children match and categorise different objects. The observations made by children relating to the properties of objects and the arrangements or patterns they make.

Planning and resourcing: See the resources and materials list at the back of this booklet for examples of common items that can be found outdoors. Use whatever materials are available in your outdoor space –twigs, stones, leaves, flowers, gravel. To provide variety and extra interest supplement these everyday materials with seasonal items, such as conkers, acorns, and sycamore seeds. Provide containers and large trays to enable children to separate different items.

Effective practice: Support children's interest in the items and objects that they find outdoors. Discuss similarities and differences, for example between a conker and a chestnut. Discuss alternative ways of sorting the same items. Value children's arrangements of objects by displaying them or taking photographs.

Development matters: Show an interest in shape and space by playing with shapes or making arrangements with objects. Show curiosity and observation by talking about shapes, how they are the same or why some are different. Sort objects, making choices and justifying decisions. Sort familiar objects to identify their similarities and differences. Early Learning Goal: Use developing mathematical ideas and methods to solve practical problems.

Good idea!

Why not have a designated area outdoors where children can explore collections of objects which contained the most items.



Case Study:

The Nursery children at Sebright Primary School sorted and categorised a wide range of natural materials, including pebbles, pine cones, wood and shells.

Shape, Space and Measures

Shape Search

Look, listen and note: How children apply their understanding of shapes. How children recognise shapes. The circumstances when children begin to use the mathematical names for shapes. How children show curiosity and observation by talking about shapes, how they are the same or why some are different.

Planning and resourcing: Plan opportunities for children to describe and compare shapes. Provide ways for children to record the shapes they find and identify – for example by providing cameras and making books about the shapes that are in the outdoor environment.

Effective practice: Demonstrate the language for shape in conversations with children. Encourage children to talk about the shapes they see around them. Provide opportunities for children to match shapes that they see outdoors. Support children to record the shapes that they can see and identify around them outdoors.

Development matters: Show an awareness of similarities of shapes in the environment. Match some shapes by recognising similarities and orientation. Show curiosity and observation by talking about shapes. Begin to use mathematical names for shapes. Early Learning Goal: Use language such as 'circle'... to describe the shape.... of solids and flat shapes

Good Idea!

Why not create laminated pictures of the shaped objects and features that are in your outdoor space and encourage children search for them.



Case Study:

At Leaview Community Nursery children hunted for different shaped features in their outdoor space and photographed the shapes they identified.

Shape, Space and Measures

Making Trails

Look, listen and note: How children decide which way they should go.
How children apply their understanding of position or direction
How children choose the materials to create their trail

Planning and resourcing: See the resources and materials list at the back of this booklet for examples of common items that can be found outdoors. Use whatever materials are available in your outdoor space –twigs, stones, flowers, gravel, conkers, acorns.

Effective practice: Create a trail with children; introduce key words to describe the route of the trail. Support children to follow the trail. Encourage children to create their own trails. Can the same place be reached by a different route? Where else could a trail lead to?

Development matters: Observe and use positional language. Find items from positional/directional clues. Early Learning Goal: Use everyday words to describe position. Use developing mathematical ideas and methods to solve practical problems.

Good Idea!

Share stories such as Rosie's Walk (by Pat Hutchins) and We are going on a Bear Hunt (by Michael Rosen) to act as a catalyst for children's play, to stimulate further discussion, or to reinforce children's understanding of position and direction.

Case Study:

At Sebright Primary School staff introduced the language of direction and position by creating a trail that led children to a Teddy Bears Picnic. Later children worked together to create their own trails around the school grounds.



Maths on the Move

Number hunt

Look, listen and note: When children begin to use the names for number accurately. The strategies that children use for matching number and quantity.

Planning and resourcing: Prepare laminated photographs or a scrapbook of features in the park or the street that can be 'hunted' for and counted, for example 1 door, 2 gates, 3 fence posts, 4 trees. Hunt for examples of a specific number outdoors, such as 3 drainpipes, 3 windows, 3 manhole covers. Give children a way of recording their discoveries, for example using cameras, or clipboards and pencils. *See the resources and materials list at the back of this booklet for examples of common items and features that can be counted outdoors.*

Effective practice: Introduce and use number language, for example 'one' 'two' 'three', 'lots'. Model and encourage use of mathematical language, for example by asking children 'how many benches?' Show children how counting is used to find out how many items are in a set.

Development matters: Sometimes match number and quantity correctly. Recognise some numerals of personal significance. Count up to three or four objects by saying one number name for each item. Recognise numerals 1 to 5. Know that numbers identify how many objects there are in a set. Early Learning Goal: Say and use number names in order in familiar contexts. Count reliably up to 10 everyday objects. Recognise numerals 1-9.

Good Idea!

Visit your local park and help children to count how many bollards or benches they can see. Roll a dice or give children a wooden number or a number card and encourage them to find a corresponding number of things, for example park signs.



Shape Search

Look, listen and note: How children apply their understanding of shapes. How children recognise shapes. The circumstances when children begin to use the mathematical names for shapes. How children show curiosity and observation by talking about shapes, how they are the same or why some are different.

Planning and resourcing: Plan opportunities for children to describe and compare shapes. Provide ways for children to record the shapes they find and identify –for example by providing cameras and making books about the shapes that are in their outdoor environment, for example in the local park, or on the way to the shops.

Effective practice: Demonstrate the language for shape in conversations with children. Encourage children to talk about the shapes they see around them. Provide opportunities for children to match shapes that they see outdoors. Support children to record the shapes that they can see and identify around them.

Development matters: Show an awareness of similarities of shapes in the environment. Match some shapes by recognising similarities and orientation. Show curiosity and observation by talking about shapes. Begin to use mathematical names for shapes. Early Learning Goal: Use language such as 'circle'... to describe the shape.... of solids and flat shapes.

Good Idea!

Create a scrapbook of photographs or laminate a set of photographs of park features, for example benches or lamppost bases, and encourage children locate and name the shape.



More Good ideas!

Using Leaves

Leaves are free and available all year round!
Why not collect some and try out the ideas below.



Using Bricks

Brick buildings are all around us! Why not support children to incorporate some of the ideas below into their play?



More Good ideas!

Numbers as labels

Help children to spot the numbers that see around them. Give children ways of recording the numbers that they find. For example, they could use pencils, paper and clipboards, or put the same wooden number into a bag, or take a photograph of each number.



Patterns and Symmetry

The outdoor environment is full of patterns. Help children to spot them and give them cameras to record the patterns they find.



Resources and Materials

The outdoor environment includes many materials, both natural and made, that can be used to nurture children's developing mathematical skills. The combination of urban and natural elements in the borough of Hackney provides settings with an interesting range of resources to draw upon. The lists below are intended to be a starting point for thinking about your own space. The man made features will vary from setting to setting and around your locality. Natural materials may be in abundance or fairly scarce. Some settings bring in sackfuls of leaves in Autumn so that their children can 'scuffle' through leaves in an otherwise barren yard. Some natural materials, such as flowers will have a very short life span. However, even a very basic collection can be enhanced by being added to in different seasons. Look carefully at what is in your space already and consider what else could be sensitively introduced to enrich children's experiences.

Natural Materials

Gravel	Sycamore seeds
Pebbles	Acorns
Earth	Flowers
Sticks	Grass
Logs	Chestnuts
Leaves	Conkers
Pine Cones	Water/Puddles



Made Resources

Fences
Manhole covers
Windows
Doors
Brick walls
Drainpipes
Paving slabs
Painted markings
Seating

Additional items to support children's mathematical play and learning

***Large wooden numbers**

***Large dice with spots and numbers**

Balance scales

Tuff-Spot' builder's tray

***A selection of containers for collecting and sorting**

Scoops and Tongs

***Recording equipment**

- paper and pencils
- cameras
- tape recorder

***Tallying equipment**

- lollipop sticks
- counters
- pencils and paper

Good Idea!

The items marked with * are particularly useful for 'Maths on the Move'. Why not collect and store them in a rucksack that can go out to the park with you?

Books and stories to support Problem solving reasoning and numeracy outdoors

Maths Outdoors

Carole Skinner
Publisher BEAM
www.beam.co.uk

Mathematics Through Play in the Early Years

Activities and Ideas
Kate Tucker
Publisher Paul Chapman
ISBN 1 4129 0394 7
www.paulchapmanpublishing.co.uk

Children's Mathematics

Making Marks, Making Meaning
Elizabeth Carruthers & Maulfry Worthington
Publisher Paul Chapman
ISBN 1 4129 2283 6
www.paulchapmanpublishing.co.uk

More Than Numbers

Children developing mathematical thinking
Carole Skinner
Publisher BAECE
ISBN 0 904187 23 3
www.early-education.org.uk

Rosie's Walk

Pat Hutchins
Publisher: Simon & Schuster
ISBN 0 02 043750 1

We're going on a Bear Hunt

Michael Rosen & Helen Oxenbury
Publisher: Simon & Schuster
ISBN 0 689 81581 6

One, Two, Skip a Few First Number Rhymes

(includes Five Little Leaves)
Roberta Arenson (Illustrator)
Publisher: Barefoot Paperbacks
ISBN: 0 439 08277 3

Ten Wiggly Wiggly Caterpillars

Debbie Tarbett
Publisher: Little Tiger Press
ISBN: 1 845 06027 X

The Rescue Party

Nick Butterworth
Publisher: Picture Lions
ISBN: 0007155166

The Secret Path

Nick Butterworth
Publisher: Picture Lions
ISBN: 0007155182

Organisations

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BEAM

BEAM (BE A Mathematician) has been actively involved in mathematics education since 1987. They supply resources, training and consultancy in the UK and internationally. www.beam.co.uk

DfES

The DfES Standards website has information about the Primary Framework for mathematics, including information about the Foundation Stage. The website states that the renewal of the Primary Framework for (literacy and) mathematics offers everyone involved in teaching children aged from 3 to 11 an opportunity to continue the progress made in raising standards by embedding into practice the principles of both Every child matters: change for children (2004) and Excellence and enjoyment: learning and teaching in the primary years (Ref: 0518-2004). www.standards.dfes.gov.uk

Early Years Experience

The Early Years Experience website is intended to provide free help and ideas to all those involved with young children, including parents and educators in Playgroups, Nurseries or Schools. It includes lots of information including reviews of story books that relate to all aspects of mathematical development. www.BigEyedOwl.co.uk

The Association of Teachers of Mathematics

The Association of Teachers of Mathematics aims to support the teaching and learning of mathematics by:

- encouraging increased understanding and enjoyment of mathematics
- encouraging increased understanding of how people learn mathematics
- encouraging the sharing and evaluation of teaching and learning strategies and practices
- promoting the exploration of new ideas and possibilities
- initiating and contributing to discussion of and developments in mathematics education at all levels

Early Childhood Mathematics Group is a working sub-group of the ATM
Further details from www.atm.org.uk

Early Years Advice and Information for registered providers in Hackney
Children's Information Service **Tel.** 020 8820 7590/7583 **Email:** cis@learningtrust.co.uk



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