

Developing Early Maths Skills Outdoors

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Introduction



About the series

This series is intended for early years students and practitioners working with children aged two to five years. It aims to demonstrate how outdoor provision is just as important as the indoor classroom and to highlight the wealth of opportunities the outdoor environment provides for teaching basic skills and concepts in maths, science and literacy.

In her review of the Early Years Foundation Stage (EYFS) in England, Dame Tickell (2011) recommended a focus on 'how children learn rather than what they learn'. She identified three characteristics of effective learning; playing and exploring, active learning and creating and thinking critically. The books in this series outline the basic concepts and skills that underpin maths, science and literacy and show

how the outdoor environment promotes an active, social and exploratory pedagogical approach to early learning.

Dame Tickell also singled out three 'prime' areas of learning; communication and language, personal, social and emotional development, and physical development. She identified these as fundamentally important for laying secure foundations in preparation for more formal education.

Therefore, these books promote early years practice that:

- Involves active practical activities that prompt lively debate and conversation, enabling children to develop the communication and language skills they need to find out about the world and make sense of new information, as well as discuss, extend and evaluate ideas;

- Gives children the chance to practise large and fine motor control, which is not only essential for cognitive development, but important in terms of gaining the strength and co-ordination needed for future writing and recording;
- Fosters physical and playful activity, promoting healthy personal, social and emotional development by reducing stress, improving mood and boosting motivation and learning.

The books contain a wealth of ideas for enhancing continuous outdoor provision, as well as planning focussed maths, science and literacy activities that exploit the unique qualities of the outdoor environment. They also provide advice on planning and assessment, where to find resources and recommendations for further reading. Throughout each book there are links to all four British early years curricula.

Developing Maths Outdoors

It is through active social early years experiences that children eventually become capable of logical, creative and critical thought. The outdoor environment facilitates active and physical exploration of the world, where children learn and use language to make sense of what they encounter. They do this in an unrestricted space that allows for vocal discussion and argument, which extends their knowledge and helps them to form new thinking and ideas.

Early years pioneers Jerome Bruner (1966) and Jean Piaget (1952) advocate physical exploration that helps children to develop understanding of basic concepts. They believe children internalise the knowledge they gain through hands-on experience and this later leads to more complex abstract thought. This theory is supported by the hugely influential *Researching Effective Pedagogy in the Early Years* (REPEY) and *Effective Provision of Pre-school Education* (EPPE) research projects, which advocate planning practical experiences for children to 'actively construct conceptual knowledge' (Siraj-Blatchford et al., 2002) through a balance of taught and 'freely chosen yet potentially instructive child-initiated activities' (Siraj-Blatchford et al., 2004).

Children develop mathematical sense by trying things out and playing with ideas. The outdoor environment is the ideal arena for planning maths activities that would otherwise be impractical, unattractive or impossible indoors. When outside children develop a sense of number by talking together, collecting natural objects and playing games; they explore size, shape and space while building on a large scale and tackling physical challenges; and they learn about capacity by digging holes in sand pits and filling buckets with water from hoses.

Lev Vygotsky (1986) further highlights the role of social interaction in learning. It is his contention that children extend and develop their thinking through discussion with more

knowledgeable others. This is again supported by the REPEY and EPPE research, which identify the need for good quality verbal interactions that extend and develop thinking. All four British early years curricula place much emphasis on the importance of mathematical conversation, introducing key vocabulary and teaching children the language they need to talk and think about their developing mathematical ideas.

When outside children are less restricted and have the freedom to sing, talk and shout, making it possible to engage in lively play, conversation and debate. Outside children have the space to recite and act out counting rhymes; they encounter large-scale mathematical problems, for example how many spades they need so everyone can help dig a large hole; they discuss and test mathematical ideas, such as how tall to build a ramp so that a toy car travels a certain distance; and they extend each others' learning by challenging one another's ideas, for instance when keeping score during team games.

The outdoor environment promotes active social learning, which is essential for acquiring early maths skills and developing an understanding of mathematical concepts. It is the ideal arena for children to voice their opinions, discuss problems, verbalise thoughts, argue with each other, test their theories against others and develop ever more accurate ideas. There is no need to be quiet outside in the open, where noise is carried away on the breeze.

Laying the Foundations for a successful future

The Effective Pre-school, Primary and Secondary Education (EPPSE 3-16) project report outlines how crucial the REPEY and EPPE research findings are. The report summarises the findings of the entire longitudinal study, which followed nearly 2,600 children from their early years through to the age of 16 and aimed 'to explore the most important influences on developmental pathways that lead to GCSE achievement, mental well-being, social behaviours and aspirations for the future'.

EPPSE reports that children who attended pre-school achieved 'higher total GCSE scores and higher grades in GCSE English and maths'. What's more, attending a high quality setting, where children are exposed to active, social learning experiences, was most beneficial and 'significantly predicted total GCSE scores as well as English and maths grades'. This was also a determining factor in terms of following an academic route into A levels, showing 'that the benefits of pre-school in shaping long term outcomes remain across all phases of schooling and last into young adulthood' (Sylva et al., 2014).

Comparing quantities



Being able to compare quantities by looking at sets of objects and deciding which is larger or smaller, is the precursor to calculating. When children add more items to increase a quantity they are adding. When they look at the difference between sets of objects they are learning about subtraction. When they share objects out and look at who has got more or less they are playing with division. What's more, when they double the number of skittles in a game they are using multiplication.

Comparing quantities involves the following skills and concepts:

- Understanding and being able to use language such as 'same', 'more' and 'less' to describe and compare quantities
- Understanding that adding more and multiplying increases a quantity

- Understanding that taking away and dividing decreases a quantity
- Being able to recognise larger/smaller amounts
- Being able to count accurately.

Children learn to compare quantities through play and practical activities that involve sorting, comparing and counting. Practitioners help by engaging children in conversation and introducing mathematical vocabulary that will help them to verbalise their own thinking.

As well as making use of the plentiful natural resources that can be found all around us outside, the following activities also take advantage of the outdoor space where children can play messy games and compare quantities on a larger scale.

Activity 1: Dump it

Type of activity: Adult-initiated, during independent play.

Resources: Toy dumper trucks, pebbles, large stones.

What to do: Set up a small world building site with a range of toy dumper trucks, stones and pebbles. Join in the children's play. Load up a dumper truck with pebbles and talk about how many you can fit in the back. Fill a different sized truck. Compare the two, talking about which truck can carry the most/least pebbles. Ask the children if they think their trucks could carry more or less than yours.

Key vocabulary: More, less, most, least.

Extension ideas: Extend the conversation. Ask the children if they can fit even more pebbles in their trucks. Ask them to dump some pebbles so that they have less. Count out the pebbles to check which truck holds the most/least.



Who can collect the most natural objects?

HOME LINKS

Ask parents to help their children compare quantities by involving them in outdoor activities. Give examples such as counting out how many snails there are munching the beans compared to the lettuce, how many tomatoes there are on one plant compared to another and how many windows there are on the back of the house compared to the front.

Activity 3: Blowing bubbles

Type of activity: Adult-led, small groups.

Resources: Wide open space, pots of bubble mix.

What to do: Take the children to a wide open space and get them to take turns blowing bubbles. Each time a child has a turn, encourage everyone to talk about how many bubbles they have blown. Did this child blow more or less bubbles than the last? Who managed to blow the most bubbles in one go? Who blew the least?

Key vocabulary: How many? more, less, most, least.

Extension ideas: Allow the children to have another go. Take the first turn, then challenge a child to blow more bubbles than you. Continue, challenging each child to blow more bubbles than the child before them. Each time discuss whether each child managed to blow more bubbles or if they blew less.

Activity 2: Who can find the most...?

Type of activity: Adult-led, small groups.

Resources: Small hand-held baskets, timer.

What to do: This activity is best done in a park or woodland area where there is scope to find plenty of items. Challenge the children to go and find a particular natural object in a set amount of time. When the time is up bring the children together to compare how many they have found. Look at the quantities and encourage the children to make a judgement about who has found the most/least. Count out the objects to check. Repeat the activity but this time send them in search of something different.

Key vocabulary: How many? most, least, more, less, same.

Extension ideas: Set up a score chart to record who brings back the most each time. Then at the end look at who scored the most/least points. Ask the children to share out their items so that everyone has the same.

Try...

...playing sorting games with the children. Sort them by gender, hair colour or clothing, for example, and compare the numbers in each group.