

PLAY MATTERS

Playful learning birth to 5:
Supplementary guide for
mathematics



EARLY  
CHILDHOOD
MATHS GROUP

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About this Supplementary Guide

This Play Matters: Playful Learning Birth to 5 - Supplementary Guide for Mathematics has been written by the Early Childhood Mathematics Group. The group brings together Early Childhood educators, researchers, and practitioners with a shared commitment to promoting mathematical thinking through play. Their collective expertise supports the development of resources that help practitioners embed playful, meaningful mathematics within everyday Early Childhood practice. This guide aims to inspire confidence, curiosity, and creativity in how children explore early mathematical ideas in their own unique and playful ways.

Find out more about Early Childhood mathematics by visiting the dedicated Early Childhood Maths Group website:

<https://earlymaths.org>



Introduction

This supplementary guide to Play Matters highlights the pivotal role of play and playful learning in supporting very young children's mathematical learning and development. Research is clear that there are foundational mathematical concepts and attitudes that are essential for children's healthy mathematical development. It is an issue of social justice that less advantaged children do not miss out on these. It is thus vital these are approached playfully in early childhood settings, with skilful, informed and sensitive adults drawing on a wide repertoire of strategies.

Mathematics is all around us. From the patterns children notice in the world, to the ways they share fruit at snack time, build towers with blocks, or count the steps to the garden, mathematical learning begins from birth and grows through everyday experiences. Yet too often, mathematics is seen as something abstract, difficult, or disconnected from children's lives. This supplementary guide aims to change that narrative, by showing how play and playfulness provide the richest opportunities for children to develop mathematical confidence, curiosity, and joy.

At the heart of this guide are the principles of Play Matters. Play is the foundation of childhood, shaping the way children learn, grow, and connect with others. The Play Matters project is dedicated to ensuring that the early years sector recognises and values both play and the child, equipping parents, practitioners, and caregivers with practical ways to embed playful learning into daily routines. A play-rich environment is not just about having fun, it is a vital space where children build essential social, emotional, and cognitive skills. Through play, they form relationships, develop trust, and navigate the world with curiosity and resilience.

Mathematical play, in particular, opens doors to problem-solving, pattern-finding, spatial awareness, and early number sense. When practitioners and caregivers notice, nurture, and extend children's mathematical ideas during play, they help children develop a positive attitude towards mathematics, one that can last a lifetime. As research shows, early mathematics is a strong predictor of later achievement (Duncan et al., 2007; Sutton Trust, 2024), making these playful beginnings essential to future success and flourishing.

This guide sits within the wider Play Matters project, which seeks to:

- Advocate for the value of play in all aspects of children's lives, and for an Early Childhood sector that places the child at the centre.
- Equip parents, early childhood professionals, and caregivers with practical resources to integrate play into everyday learning.
- Influence policies and practices so that play is prioritised as a foundation for children's wellbeing and development.
- Foster communities where every child experiences the joy, creativity, and learning that flow from play.

In the pages that follow, you will find practical strategies, real-life examples, and insights into how mathematical learning unfolds through play. Whether indoors with puzzles and picture books, or outdoors with water, sand, and movement, mathematics is everywhere children play. By embracing playfulness and nurturing children's natural curiosity, we can ensure that every child grows up mathematically capable, confident, and full of wonder.

The Importance of Mathematical Play

“

Mathematics could be like roller-skating, but usually it is like being told to stop roller skating and come in and tidy your room.

This is not a superficial matter

(Winter 1992, p99)



Example 1

Anna (4 years 4 months, to friend) “Can you count how many spots are on my dress?”

Friend “Lots”

Practitioner “I think there are millions!”

Anna “No! A hundred - I expect it’s a hundred. Until my birthday we’d be counting!”

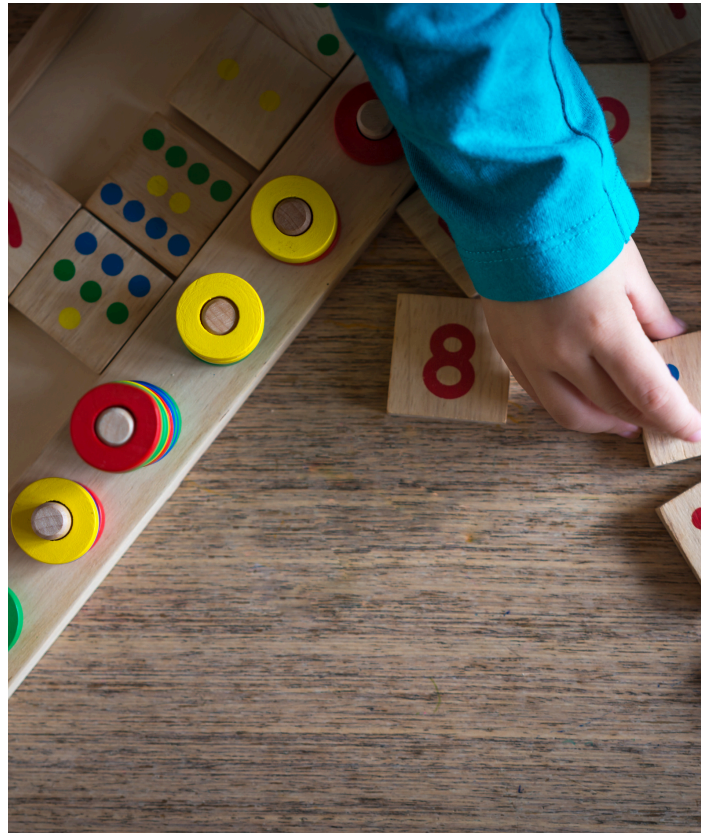


Example 2

A practitioner is with a group of 3- and 4-year-olds by an empty water tray. The practitioner holds up a teaspoon and suggests filling it up using this. The children laugh and grab buckets.

Children's play involves a range of mathematical ideas, concepts and behaviours. Through play, children represent their mathematical experiences, exploring the mathematics that they have learned and found interest in from exploring their world. Children's mathematical play can be overlooked or dismissed in favour of adult-planned mathematics instruction, which is often narrower, more abstract and less rich. Such adult-planned activities have their place, but it is essential that practitioners are attuned to children's mathematical play, noticing how the children are mathematical as well as what mathematics they explore and in order seize these opportunities. This can be challenging, but as we learn more about a child's mathematical development, we can become more confident in building upon these moments. Practitioners have playful approaches in their repertoire but are often nervous about teaching mathematics in this way and integrating mathematical interactions in play situations.

In examples 1 and 2, the adults are confident to deliberately provoke mathematical discussion. They use their knowledge of the children to make playfully ludicrous suggestions that prompt the children to think mathematically and come up with much better ideas. This is a powerful and effective strategy to use, trusting the children with the mathematics and feeling confident to be humorous and playful with mathematics.



Research is clear about the importance of early mathematical development. Children are mathematical from the earliest stages of life. Early mathematics is a priority because mathematics competence at the start of school determines children's later success in mathematics – positively or negatively – so supporting all young children to have foundational underpinnings in mathematics, before the start of school, is a priority (Duncan et al. 2007, Byrd Hornburg et al. 2018, Cahoon et al. 2021, Sutton Trust 2024). The Education Intervention Foundation concluded that:

'... the ages of three to five are therefore considered an ideal time to rectify income-related learning gaps in children's understanding of numbers' (Asmussen et al. 2018, page 10).

We want our children to grow up mathematically confident, capable and curious, but there is a problem. It is not unusual for adults to say how underconfident they are mathematically, indeed, boast about how bad they are at maths and how much they disliked maths as a school subject. As educators of our youngest children, it is crucial we change this narrative of 'maths is hard' and 'maths is not for me' and instead display a positive and curious attitude towards the mathematics we present to our children. We do this by:

- being interested in, and knowledgeable about, the development of our children's early mathematics,

and

- being playful in how we approach mathematics with our children.

This means we need to broaden our view of mathematics. Whilst it is often portrayed as a formal subject, studied at desks and consisting of number crunching with symbols and formulae, this is not mathematics. Mathematics is creative and involves active engagement in solving problems and imagining approaches or solutions. It can be quite dynamic, physical and joyful and there is mathematics in many of the everyday activities that young children engage in.



Example 3

Two children are sitting with a practitioner at a table with 11 slices of apple. Their challenge is to share the fruit out fairly.

The practitioner has observed other children tackling this task and each has had a different way of solving the problem. This pair shares out the apple, one slice at a time, and then gives the spare slice to the adult, saying: "It's one too more many". Others have taken a handful of apple slices each and then justified the amount ("I am hungry"), others have left the spare apple slice on the plate.

In example 3, the adult has deliberately laid out 11 slices to share between two, rather than an equal number, to provoke different solutions to the problem of 'fair shares'. Fair shares is a mathematical situation that makes perfect sense to very young children and one that can be introduced into all sorts of everyday scenarios.

It is possible to support the mathematical development of our youngest children through our focus on the all-important three Prime Areas of the EYFS (DfE 2025): Communication and Language, Physical Development and Personal, Social and Emotional Development. Large-scale, outdoor, physical mathematics games and activities, such as an obstacle course, enhances children's physical development. Routinely giving children the time and space to communicate what they notice mathematically, such as talking about the patterns on a leaf or a fence, enriches their ability to communicate. Children's motivation and emotional response to a turn-taking maths game or concentrating to complete a jigsaw puzzle forms part of their personal, social and emotional development. It is therefore important not to treat mathematics as different or separate from other areas of learning. Play matters for all aspects of children's holistic development, including maths!

As practitioners, we have a crucial role to play in how our youngest children feel about mathematics. Research by Dowker and colleagues (2018) into 5- and 6-year-old children's view of mathematics suggests that their attitudes to mathematics are associated with the success they experience. We can influence children's attitudes by modelling a positive and curious approach to mathematics whilst playing with children. For example, we might wonder aloud: "I wonder what will happen if ... ", we can welcome discussion and encourage differing responses and ideas, "So Isaac, you think we could try steeper slope to make the car go faster, and Luna, you think we should try a longer one?", By modelling being puzzled, "I don't know; this is tricky", we can support children when things get challenging and avoid those feelings of failure which create negative attitudes to mathematics.



The adult role in children's mathematical play



Understanding mathematical development: Becoming more knowledgeable about the development of our children's early mathematics so we can support their mathematical play

Early Childhood practitioners are, by definition, interested in young children's development. However, more professional development may be needed to provide sufficient understanding of the development of early mathematics in order to support children's play creatively and with confidence. Research-based developmental progressions are useful for helping us to see the broad journey that our children are on, and the key milestones we want them to reach in each aspect of mathematical understanding (Frye et al. 2013). The mathematics section of Birth to 5 Matters (Early Childhood Coalition, 2021) separates out aspects of number, spatial awareness, shape, pattern, and measurement so the progressions in each are easier to see. There is also an overview of the developmental progressions for mathematics in the UK EYPDP programme (Early Years Professional Development Programme) and detailed ones in the US Learning Trajectories which map the earlier to later stages of development in each area of mathematics.

Developmental progressions are different to schemes of work, 'stepping stones', or lists sequencing curriculum activities. Rather than breaking objectives into smaller chunks and scheduling which to teach first, developmental progressions set out how children's understanding tends to build, with later stages building upon earlier ones. They are useful to consult to understand children's mathematical play and support it more effectively. They are not for slotting children into or for ticking off what they do, but instead they help us understand children's past, current and next developmental steps. They enable us to get to know children mathematically, to understand their varied mathematical progress and to perceive children's competencies by focussing positively on what they can do. A research-based developmental progression satisfies two of the four overarching principles of the EYFS (DfE 2025). They allow for the fact that:

- every child is a unique child and that every child is a competent mathematics learner from birth and can be resilient, capable, confident, and self-assured,

And,

- children develop and learn and develop in different ways and at different rates. Practitioners need to provide a range of experiences to support each child's unique journey.

The further two overarching principles of the EYFS framework (DfE 2025), Positive Relationships and Enabling Environments, we explore in relation to mathematics in this next section.

Positive relationships: Being playful in how we approach mathematics with our children

Play and playfulness is the most effective way to teach early mathematics. It is unhelpful to discriminate between mathematical play that is adult initiated and that which is child initiated. It is more helpful to ensure that, whoever initiates the task, child or adult, space and time is included for the child to direct what happens (such as in example 4). That we make sure we listen to children's mathematical ideas, making time to observe what they are interested in and curious about. Research bears out the importance of child agency in all mathematical activity and identified the intersection of play and guidance as a powerful vehicle for early mathematics learning. Play researchers, who termed this intersection as 'guided play', identified it as having three fundamental characteristics:

- The adult being clear about the purpose of the activity,
- The child should have choice and agency, whoever initiates the task, at some point the child should have some freedom and choice over their own actions and play behaviour,

and

- The adult is flexible with their guidance.

(Skene et al. 2022, Weisberg et al. 2016)

Example 4: Case Study

The adults have prepared a large cloth on the floor and emptied onto this a pile of small loose parts: nuts, bolts and 1p coins. Also available are small pots with lids, and open, sectioned trays. The intention is to stimulate some counting and comparing of amounts with children filling and emptying their chosen containers. The containers and small parts have been selected carefully in order that up to approximately 20 items fit inside the lidded containers.

Children arrive and begin to handle the objects and fit them into the trays or pots. An adult plays alongside with the materials, modelling and copying what the children are doing. They begin to narrate what they notice and what they themselves are doing: "I see you are fitting in as many as possible and squeezing the lid on – you must have hundreds in there!"
"I am going to choose all these bolts and put one in every space".
One child says, "I have the mostest! I have most than you!"

This is the adult's opportunity to invite the children to explore how many they have and to compare amounts. If the child had not said this, the adult could have done so.

TOPIC: MATHEMATICAL PLAY

The people who have the power to make a difference to children's life chances are Early Childhood practitioners, through developing children's mathematical confidence and positive attitude to the subject. This should be done playfully. How we introduce new activities and interact with the children during their play is as important as the learning we intend they will gain. Effective Early Childhood pedagogy applies to mathematics as well as to every other area of learning, and at the heart of this are the Positive Relationships built between adults and children whilst engaging in mathematics. Sustained mathematical conversations, sustained shared thinking (Siraj-Blatchford et al. 2012) – between adults and children (and between children) foster the positive relationships that we want to help our children build with and around mathematics.

Enabling Environments: ensuring provision is rich in mathematical play possibilities.

The early childhood environment needs to be mathematically rich. It needs to contain numerals to see, talk about and play with, including calculators, number tracks and 100 squares as well as construction, role-play, small world play, collections, malleable materials, jigsaws, games, loose parts, water, sand, mud, vehicles and picture books which all present opportunities to pose maths contexts and play with mathematical ideas. Engaging, mathematically-rich picture books provide the 'warm and fuzzy' moments that children enjoy with adults and opportunities to recreate or role-play stories (Gifford, Gripton & Williams 2025).

It is important for children to experience the full breadth of early mathematics in their play. Research (such as Rittle Johnson et al. 2019) shows that it is crucial to provide experiences that develop children's spatial reasoning and pattern awareness. This means that it is a good idea to include resources in provision that encourage children to play with patterns. A pattern area can include loose parts with mats, frames or strips for children to arrange or line up to create spatial or repeating patterns, for example.

An environment with a range of jigsaws, small world toys and good quality wooden blocks helps promote spatial play, as well as plenty of outdoor play where children can move around the physical space in different ways. Ofsted (2023) are clear about the importance of developing spatial reasoning and the Spatial reasoning toolkit (Gifford et al. 2022) provides detailed guidance on how practitioners can provide an environment which is conducive spatial play. The toolkit includes list of picture books which could provide starting points for spatial explorations such as "A Lion in the Night" by Pamela Allen which involves a chase using directional vocabulary that children might enjoy recreating. The Early Childhood Mathematics Group offer guidance on establishing an environment that is 'maths friendly'. This extends the more common 'maths area' to capitalise on mathematical opportunities that exist across all areas of provision including outdoors, in imaginative play, continuous provision and construction.



Being mathematical: Supporting children to be mathematical in their play

The statutory EYFS Characteristics of Effective Teaching and Learning (DfE 2025) are particularly useful in supporting the development of young children's mathematical problem solving and solving problems lies at the heart of all mathematics.

- Playing and exploring is about mathematical engagement: children playing with something familiar to them and being willing to 'have a go'. For example, making choices about what and how to measure or count something.
- Active learning involves being actively involved in the task, mentally as well as physically. We need to celebrate perseverance in solving problems and completing puzzles. We might say, "That is tricky to fit that shape into that space, and you keep trying!", and encourage children to enjoy achieving what they set out to do, "You counted all those buttons, you should be proud of your counting!".
- Creating and thinking critically is the essence of thinking mathematically. It involves children having their own ideas, testing these and finding their own ways to do things, including solving problems that interest them, "What do you notice happening?" (e.g. the taller the slope the faster the cars go down it), "Why not try the longer one and see" (e.g. when building a house with a doorway), "How can we make sure they all have the same amount now?" (e.g. when sharing out apple slices between friends). It also involves children being given time and opportunities to make links with what they already know and to notice similarities, differences and patterns, and to make predictions based on these observations. All of these are possible in play. Children can also check how well their activities are going, changing strategy as needed and reviewing how well their approach has worked. Practitioners can support this checking with prompts such as, "Do you think this this might work?", "Do we need to start again?", "Has it worked? How do you know?", and "How could we have done it differently?"



Mathematics is not only a list of content, but also a way of thinking and behaving. Through play, we can support children to think and behave mathematically, such as experimenting (e.g. with the height of a slope to race cars down), imagining (e.g. saying they need two slices each before sharing out the apple slices) and organising (e.g. finding all the same type of block to build a wall). These are all observable in young children's mathematical play when they have access to resources that invite mathematical curiosity (considering fundamental questions of how big?, how many?, how can I ... ?) and children are given plenty of time to explore these, alongside opportunities for sustained interactions with sensitive adults as they count, build, construct and invent.

Key points

The key points regarding playful mathematics learning from birth to 5 are that the practitioner needs to:

- have a repertoire of playful strategies, including making ludicrous suggestions and deliberate mistakes in mathematics.
- to enjoy mathematical activities themselves, such as outdoor games, picture books, puzzles, practical problem-solving at snacktime.
- to become familiar with the range of aspects of mathematics which provide foundational understanding for later learning, including number, pattern, measurement, and spatial reasoning.
- to research and understand how these typically develop and interconnect, and how children might show their understanding including in play (developmental progressions).
- to be able to plan the environment and experiences which help all young children access mathematical learning playfully.

In their research review, [Gripton & Williams \(2022\)](#) identified the key principles for appropriate pedagogy in early mathematics according to research. They concluded that young children learn mathematics through play and that this principle should underpin early mathematics pedagogy. Early mathematics is too important to be left to chance. Mathematical play can be engaging, creative and joyful for children and adults alike.



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