EARLY CHILDHOOD MATHS GROUP

Outdoor Maths Matters

Sue Gifford

& Sam Goldsworthy

Why early maths matters:

Those who start behind stay behind - and the gap widens in primary school.

Education Endowment Foundation (2020)

Mathematical achievement is consistently found to be the strongest predictor of children's overall school achievement and their success in entering the workforce.

Early Intervention Foundation (2018)

What research tells us:
Mathematical predictors

- parents' education and home learning EIF, 2018
- self-belief OECD, 2012
- mathematical reasoning Nunes & Bryant, 2012

- **number sense** Nunes & Bryant, 2009; EIF, 2018
- **patterning** Rittle-Johnson et al., 2016
- **spatial reasoning** Hawes & Ansari, 2020

Simon Lewis

EYFS Statutory Mathematics Educational Programme

Developing a strong grounding in number is essential so that all children develop the necessary building blocks to excel mathematically. Children should be able to count confidently, develop ***a deep understanding of the numbers to 10, the relationships between them and the patterns within those numbers****. By providing frequent and varied opportunities to build and apply this understanding - such as using manipulatives, including small pebbles and tens frames for organising counting - children will develop a secure base of knowledge and vocabulary from which mastery of mathematics is built.*

In addition, it is important that the curriculum includes rich opportunities for children to develop their ***spatial reasoning skills*** *across all areas of mathematics including shape, space and measures. It is important that children* ***develop positive attitudes and interests*** *in mathematics,* ***look for patterns*** *and relationships, spot connections, 'have a go', talk to adults and peers about what they notice and not be afraid to make mistakes.*

EYFS Statutory Framework 2021

Give me 9

Number predictors for 5 year olds

- **counting out** a number from a larger group
- **understanding cardinal numerals** (ie. a number of things)
- **understanding the order of numerals**

When might children learn each of these?

How do young children learn number sense?

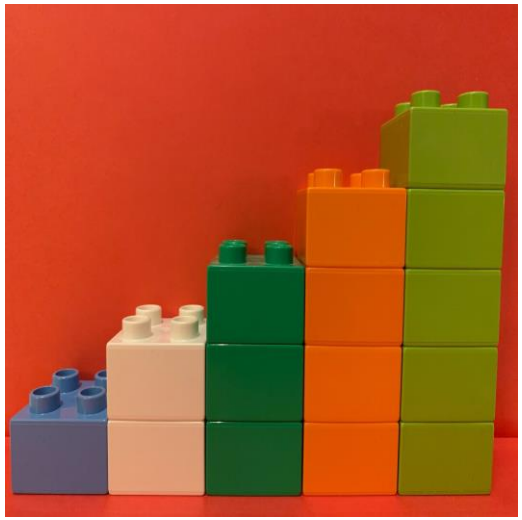
- **routines** – snack time, tidying up, visual time table
- **number rhymes and picture books**
- **games** – collecting, tracks, targets
- **problem solving** eg sharing
- **adult playfulness**- eg deliberate mistakes
- **‘sustained shared thinking’** (REPEY, 2002)

The beginnings of pattern awareness

What makes it pattern?

Which bits are the same?

Reflecting and rotating



Growing patterns

Can you spot the mistake?

The importance of early patterning

We found that early patterning..knowledge was a unique predictor of later mathematics achievement, over and above other mathematics and non-math skills.

Rittle-Johnson et al. (2016, 2019)

Image: Eastwood Forest School

Abstracting patterns is the basis of structural knowledge,

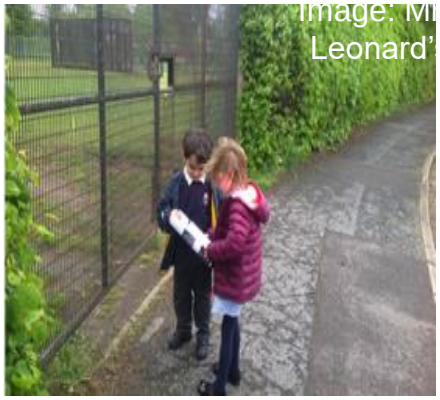
the goal of mathematics learning.

Warren (2005)

Identifying the unit of repeat: beyond AB patterns

Spatial reasoning involves

fitting things in



navigation

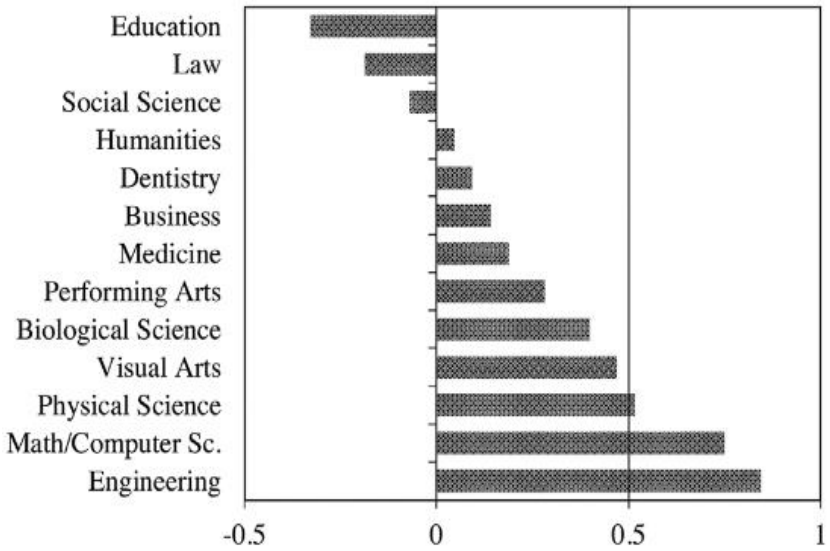
understanding diagrams

construction and design

classification & identification

performing arts

The importance of spatial reasoning



People who are good at maths tend to be good at visualising

Hawes & Ansari (2020)

Teaching spatial thinking may be an underutilized route to improving mathematics achievement.

Verdine et al. (2017)

Girls and other underrepresented groups are harmed in their progression in mathematics due to lack of attention to spatial skills. Sarama & Clements (2009)

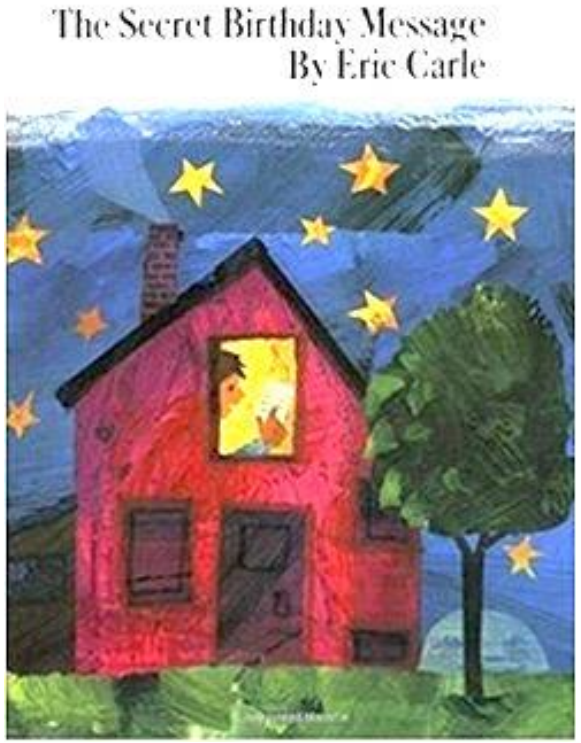
Image: Community Playthings

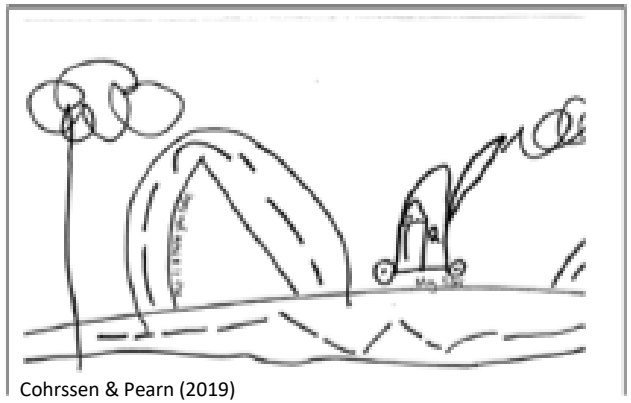
Spatial relations

Where is it?
Which way?

Mulligan et al 2020

- obstacle courses
- small world play
- route finding
- robots
- treasure hunts
- picture books
- models & maps





Cohrssen & Pearn (2019)

The characteristics of effective teaching and learning

In planning and guiding what children learn, practitioners must reflect on the different rates at which children are developing and adjust their practice appropriately. Three characteristics of effective teaching and learning are:

- **playing and exploring –** children investigate and experience things, and 'have a go'
- **active learning –** children concentrate and keep on trying if they encounter difficulties, and enjoy achievements
- **creating and thinking critically –** children have and develop their own ideas, make links between ideas, and develop strategies for doing things

Statutory framework for the EYFS

More than ever before, living and working in the 21st century requires the "four Cs" – creativity, critical thinking, communication and collaboration OECD 2016

Maths Outdoors

- Puddle Jumping- counting/ size/ depth/ patterns

Maths Outdoors

- Stones Stacks- ordering/ counting/ weights/space

Maths Outdoors

- Leaf Patterns- ABAB/ size/ shapes

Maths Outdoors

- Stick Collecting- size/subitising/ordering/shapes/ measuring

Maths Outdoors

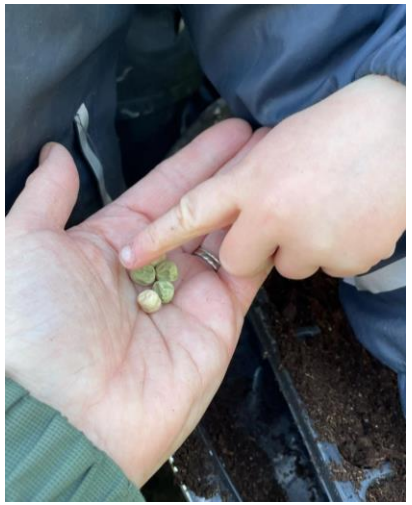
- Water/Potion Play- capacity/ more or less/ language

Maths Outdoors

- Loose Parts- counting/cardinality/subitizing /number matching/ordering/ estimating

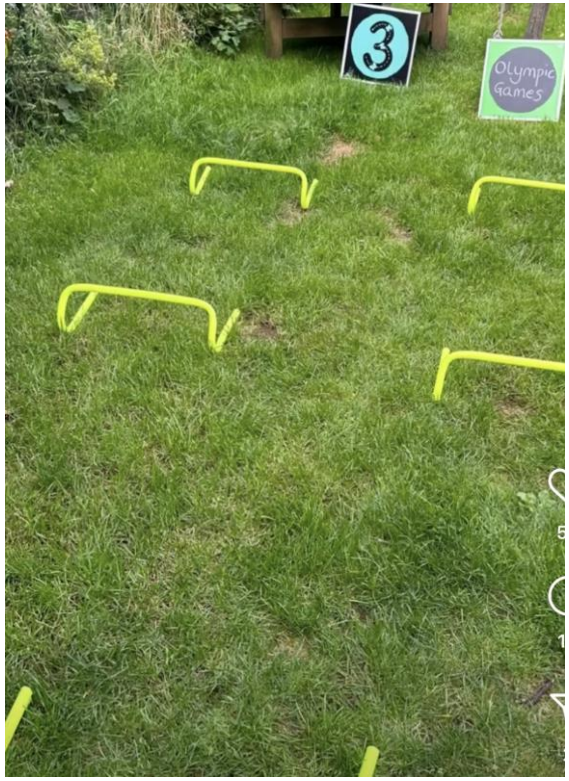
Maths Outdoors

- Planting- counting/ estimating/ measuring/ size



Maths Outdoors

- Obstacle Course- positional/ directional language / route planning/sequence



Maths Outdoors

- Bug Hunting- counting/ positional/ directional l

language/ size/ longer

shorter/ bigger

smaller/ massive

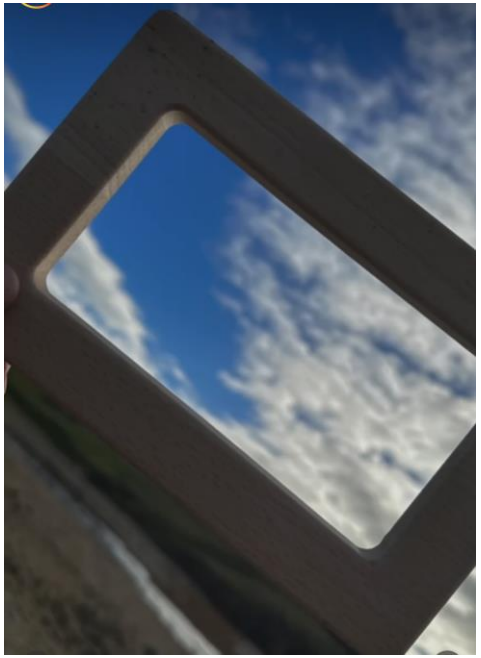
tiny

Maths Outdoors

- Mud Kitchen- weight/ measure/ more or less/ count/ sort/ comparison/ money/ capacity/ language

Maths Outdoors

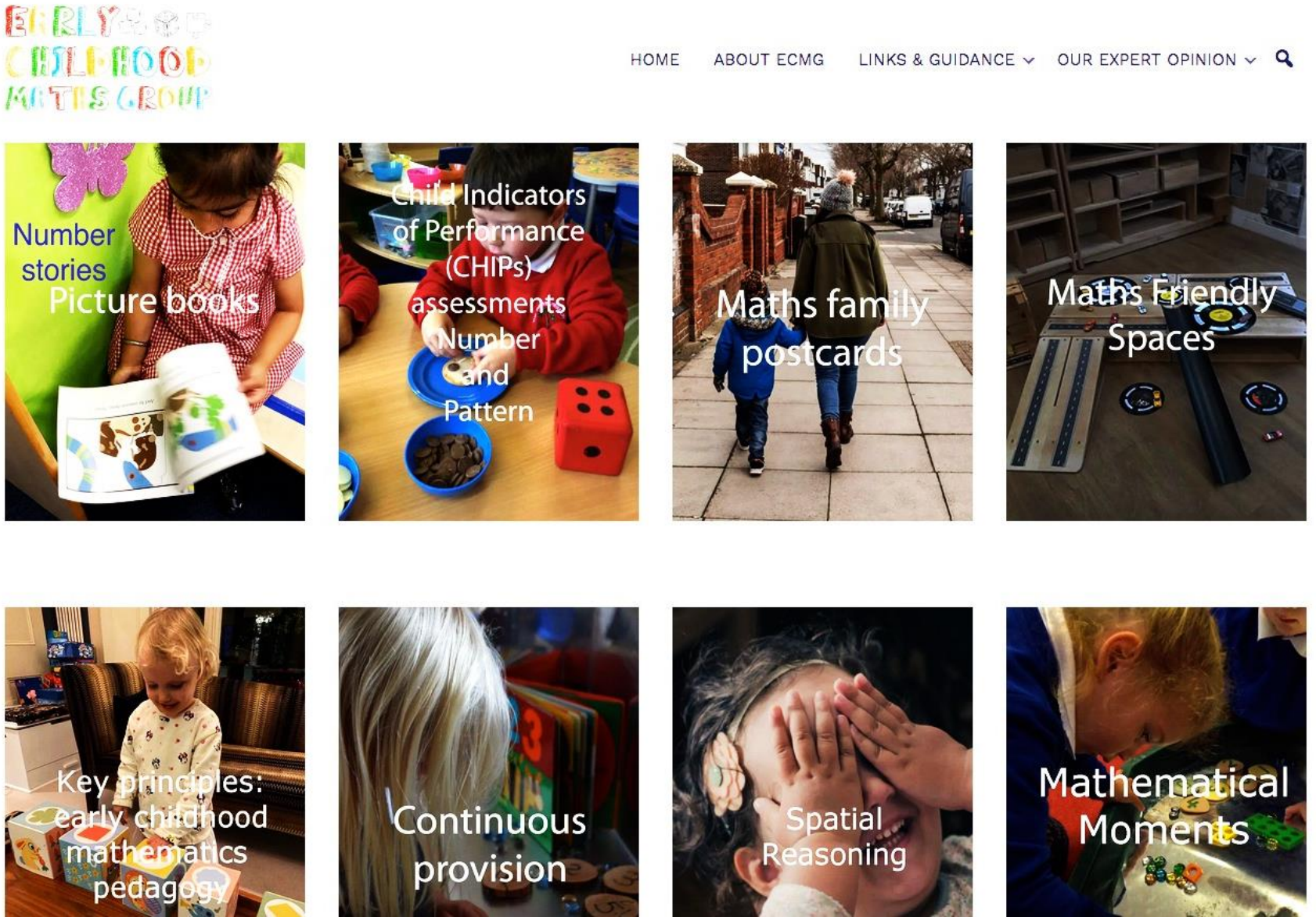
- Hopscotch with chalk- number recognition/ ordinal numbers/ matching quantity to number




35
30
25
20
15
10
5


can you make a pattern?

earlymaths.org: guidance and resources



Practice guidance for different age groups

EARLY CHILDHOOD MATHS GROUP

HOME ABOUT ECMG RECOMMENDED LINKS OUR EXPERT OPINION

Building firm foundations in mathematics

The Early Childhood Mathematics Group would like to offer some support and encouragement to all adults in helping children to become confident young mathematicians. We all know that maths is very important for young children's lives and their future life options. If we can help them build firm mathematical foundations, we will have given them a really good start. It is also important that families and practitioners work together to support children's mathematical learning.

Everyday experiences and routines, rhymes and games provide excellent mathematical learning opportunities for children under seven. Opportunities for mathematical learning can happen anywhere and should be practical wherever possible. What matters is building young children's confidence and their willingness to have a go, whether at counting, construction or shape puzzles. Since supportive relationships are so important, it is imperative to find activities that not only children enjoy, but that adults can enjoy too. Recognising the maths in everyday activities helps to develop children's mathematical learning even further. When playing and in everyday routines, such as having a snack, children can learn lots of maths.

Download the guidance

Babies to 2 year olds guidance Download

3, 4 & 5 year olds guidance Download

5, 6 & 7 year olds guidance Download

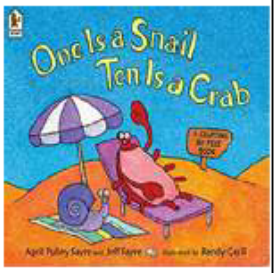
earlymaths.org

Spatial Reasoning Toolkit: trajectories, posters and key rings

Maths family postcards in 10 languages – so far

The collection of all the postcards or print.

Picture book lists

	***Mouse count*** Ellen Stoll Walsh 3 to 5 https://www.youtube.com/watch?v=oA5QeZhDJEs Also available in Spanish	A hungry snake collects sleepy mice into a jar, adding on each time, but the mice trick him and escape, 'uncounting' themselves.	**Counting and cardinal number values to 10** **Ordinality - number order: counting back** **Adding by counting on** The snake demonstrates adding by counting on. Children can use this strategy by adding their own numbers of toy mice or pebbles into a jar and count back as they remove numbers of 'mice'. This video from the Erikson website shows two ways of developing the story, large scale and small scale: https://earlymath.erikson.edu/mouse-collections-preschool-storytime-game/
	***One is a snail, ten is a crab*** April & Jeff Sayre 3 to 7 https://www.youtube.com/watch?v=zDjp7rTXtsk	A counting by feet book: a snail has one foot, a person has 2, a dog has 4, crabs have 10… So 40 can be made with 4 crabs or 10 dogs.	**Counting and cardinal number values to 100** **Adding combinations of 2s, 4s, 10s etc** **Counting in 10s** **Composition** **Problem solving** Children can make numbers to 20 with say, snails people and dogs - or make other numbers with other creatures. You could provide animal pictures or toys and invite children to make numbers in different ways using the animals e.g. *How many ways can you show eight feet?* Children could record their combinations in their own ways. Very young children also enjoy the book: see Mathematical Moment *One is a snail*

Positive relationships and maths

"Most of us probably have a good idea what it takes to get our young children to love reading. Snuggling up with a favourite book at bedtime, for example, sends a clear message about the value of reading.

But what about a love of math?"

Brownell (2021)
https://earlymath.erikson.edu

Image: Crown Copyright (2009)