

Building firm foundations in mathematics ...with 3, 4 & 5 year olds

Developing children's mathematical well-being for future learning

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 practitioners and families work together to support children's learning.



DCSF (2009)

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 engaging in everyday activities, such as eating a snack, children can learn lots of maths.

Important mathematical learning for birth to seven years includes:

- counting by just saying number words
- counting objects; making and comparing small numbers of things
- comparing sizes and dimensions, capacities and weights
- exploring properties of shapes by fitting them together and building models
- exploring spatially, describing where to find things and giving directions
- spotting and discussing different patterns
- finding different ways to solve problems practically

Learning and enjoying being mathematical

Time for independent exploration

Very young children need plenty of time to freely explore the mathematical resources and activities on offer; to pursue their own interests and to make sense of what they see, hear and are taught. They need to do this independently as well as with other children. Adult engagement is essential in order to deepen their understanding and help them develop the confidence to play with and extend their ideas. With unrestricted time, children's independent play can often surpass adult expectations and demonstrate the [Characteristics of Effective Learning](#) (para 1.9), which are relevant for learning mathematics at all ages.

Working together

It is important that practitioners, carers and families work together to support mathematical learning, exchanging ideas and observations of children's interests and responses. In early years settings, it helps if a little time is regularly set aside for these exchanges, so families and practitioners have regular conversations about how the child is being mathematical both at home and in the setting.



STA (2014)

Games

Simple games can provide children with repeated opportunities to develop early maths skills. Playing alongside an adult or older child provides opportunities for a younger child to observe the various maths skills involved, and once the game is familiar, young children can begin to play by themselves. As they get older, children will take turns and organise games.

Rhymes, books and apps

Books and rhymes provide many valuable and meaningful contexts for young children's mathematical learning. Picture books are particularly powerful at this age, containing rich and varied images of quantities and patterns for children to enjoy sharing with adults. Rhymes often consist of learning and repeating early number sequences alongside finger and body movements. The best apps combine aspects of direct instruction with play, they can be motivational and enjoyable whilst productively supporting learning. However, too many of the commercially available apps can be classified as 'edutainment' and fall short in terms of the learning approach and the mathematics content. Apps can support the mathematical learning of 3-5 years olds but these need to be high-quality, used for a limited amount of time per day and ideally supported by an adult to help children understand the mathematics and make sense of what they are experiencing.

Three and four year olds

Three and four year olds

At this age children often enjoy ...

- Counting out loud as far as they can
- Recognising two, three or four things without counting and showing 'finger numbers'
- Giving two, three or four things when asked
- Recognising number symbols to 5, and those related to their lives, e.g. bus or door numbers and ages of siblings
- Checking whether small amounts have been shared fairly
- Creating and building towers and enclosures
- Collecting things that are alike (or different!)
- Lining up or arranging objects in a pattern
- Doing things for themselves



[Community Playthings](#)

Activities, games, rhymes, books and apps

Activities

- Count small collections of objects, indoors and out.
- Number hunts involving finding seven leaves, getting three apples or one for each family member.
- Talk about large numbers of things you can see (e.g. *There must be at least 100 cars in this car park!*)
- Home play and tea parties for toys involving counting out the number of plates, spoons and food items; posing sharing problems in order that everyone has the same amount.
- Snack-time fruit: help to cut this up, count and share it out fairly.
- Cooking: weighing, counting and mixing ingredients, using recipes with numbers of cupfuls and spoonfuls.
- A mud kitchen, with old saucepans, jugs and balance scales, as well as ladles and spoons.
- Play with dolls' houses, farms, road mats and train tracks, talk about *inside*, *between*, *in front of*, *through*, *behind*, *round*, *over*, etc.
- Excursions: talk about routes and directions as well as important landmarks and remember the order of things seen. Take photographs of things from different viewpoints.
- Jigsaw puzzles: model strategies for tackling puzzles of increasing difficulty, discussing pieces to fit particular shaped holes.
- Make models with old boxes, posing challenges to make beds for toys, or houses with doors, large den-making outside with sheets and pegs.
- Getting dressed and talking about the sequence and way around that clothes are put on including using words such as: *first*, *next*, *inside out* and *upside down*.
- Discuss the order of daily activities and events in the future (e.g. *how many 'sleeps' until your birthday?*).

Three and four year olds

Games

Number games

- Throw 5 beanbags into a tyre or box, 'How many can you get in? How many are out?'
- Dice and track games, for example chalking stepping stones outside, rolling a dice and jumping along that many stepping stones until you reach the end.
- Spinner or dice outdoors: call actions to be counted (e.g. star jumps, twirls, hops).

Shape and space game

- Take it in turns to throw a dice, choose that many blocks and build the tallest tower you can. Others can then make suggestions for making it taller.

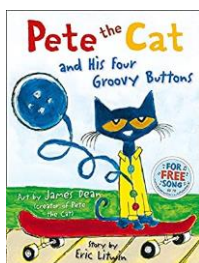


Songs & Rhymes

- 5 little ducks: subtracting by counting back - show the numeral and fingers for the number left
- 5 speckled frogs: try, two jump off the log - how many on the log and in the pool now? Show using fingers.
- 1,2 buckle my shoe: a counting-out rhyme to 20 , or make up your own rhymes to 10
- *Hickety tickety*: an adaptable number bond song. Prepare your fingers to show the combinations:

*'Hickety tickety rumpa rickety hornicup:
How many fingers do I hold up?
Two: one for me and one for you!
Three: two on the ground and one in the tree
Four: three in the room and one out the door
Five: four buzzing around and one in the hive'*

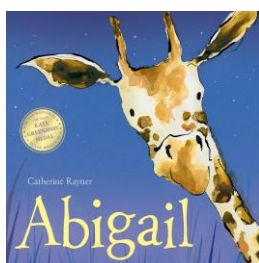
Books



Pete the Cat and his Four Groovy Buttons

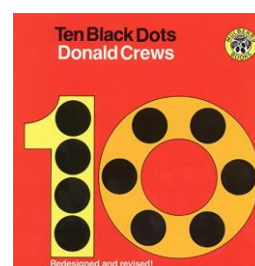
Eric Litwin

Subtracting from 4 with a song



Abigail

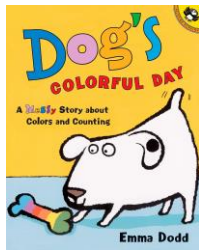
Catherine Rayner
Counting sequence
with mistakes



Ten Black Dots

Donald Crews
Arranged in different ways
including a staircase pattern

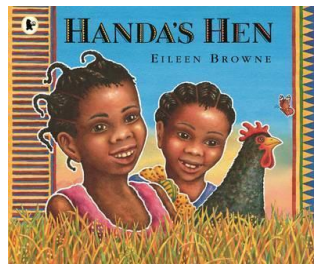
Three and four year olds



[Dog's Colourful Day](#)

Emma Dodd

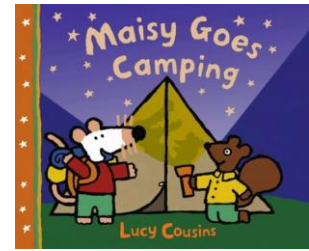
Dog collects spots to 10



[Handa's Hen](#)

Eileen Browne

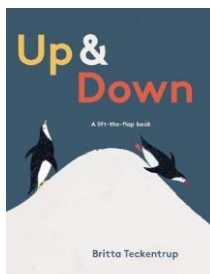
Numbers to 10



[Maisy Goes Camping](#)

Lucy Cousins

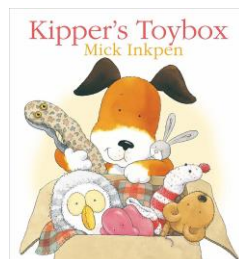
Five toys try to squeeze into the tent



[Up and Down](#)

Britta Teckentrup

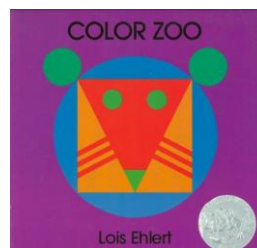
Directions and opposites



[Kipper's Toybox](#)

Mick Inkpen

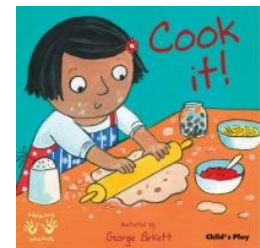
Instead of 6 toys there sometimes seem to be 7 or 5



[Colour Zoo](#)

Lois Ehlert

Shapes within shapes making animal faces



[Cook it!](#)

Georgie Birkett

Stages in cooking, including shopping and washing up

Apps (free)

- [Monster Music Factory](#)

Interactive storybook focusing on different methods for figuring out the number of objects in a collection (with suggestions for adults to encourage mathematical thinking).



- [Monster Birthday Surprise](#)

Interactive storybook focussing on how numbers can be expressed in many ways such as objects, dots, and symbols.



- [Touch Counts](#)

A number exploration environment to support children with number naming; counting and skip-counting; number order, number and number meaning (how many); even/odd; less than, greater than and equal to relationships; subitising; addition, subtraction, and the beginnings of division and multiplication. Website and youtube channel offers ideas for parents and teachers.



Three and four year olds

- [123 section of Khan Academy Kids](#)

Open-ended activities for mathematics and problem-solving (2-7 years). Can be adapted for individual learning paths and teachers can set up a class account

Apps (paid)

- [Math Shelf](#)

Math Shelf supports geometry, place value, arithmetic, fractions, money, measurement and time. Can be adapted for individual learning paths.

- [Maths 3-5 \(One Billion\)](#)

A free section with two paid sections. Sorting and matching, counting to 3 (then 6 then 10), lines, patterns, shapes, comparison, addition and subtraction.



Four and five year olds

Four and five year olds

As they get older, children often enjoy...

- Counting aloud to high numbers
- Spotting large numbers, e.g. on calculators, car milometers, microwaves
- Counting backwards from different places
- Finding and giving up to ten objects accurately
- Collecting large numbers of objects to organise and count
- Playing turn-taking games, especially outdoors
- Building constructions and solving jigsaw and pattern puzzles of greater complexity
- Ordering and arranging things
- Spotting and creating patterns
- Playing a range of card and board games

Activities, games, rhymes, books and apps

Activities

- Count fingers, actions and large collections of objects, counting *as high as you can*.
- Hiding numbers of things to find (e.g. 10 toy cars around the room, 5 dinosaurs in the sand).
- Share food items and playdough by counting and cutting, talk about *same* quantities.
- Help to measure out, make and bake favourite foods.
- Mix potions with specific numbers of petals and leaves as well as amounts of soil and water.
- Make more complex shape pictures and constructions, fitting shapes into outlines and building models from pictures, giving directions to a friend to make a model that they can't see.
- Treasure hunts with directions and clues.
- Playing 'robots', giving instructions to move (e.g. *6 steps forwards* or *'back one step and turn right'*).
- Discuss times of the day using a clock and counting down to events on a calendar.
- Copy and make repeating patterns (AB, AABB, ABB, ABCC) with varied objects and actions, e.g. an ABB pattern of ...teddy, car, car, teddy, car, car... or ...nod, clap, clap, nod, clap, clap,...
- Play and invent games outdoors (e.g. tracks, hopscotch, dice, spinners, beanbags, skittles).

Four and five year olds

Games

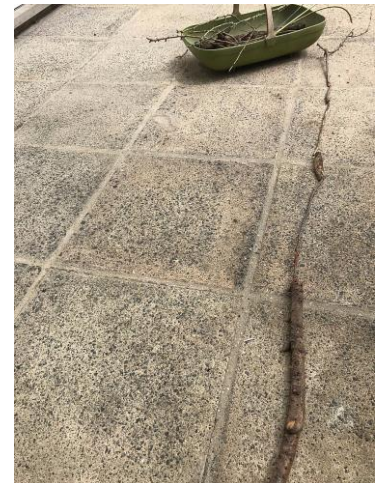
Number games

- 'Ten nice things': players start with 10 nice objects each. They take turns to roll a numeral dice and give that many of their nice things to the person on their right, who then rolls the dice. The winner is the first person to give all of their nice things away. Encourage children to predict numbers: 'You're getting 6 more - what a lot you'll have!'
- Hide five things under a pot or in your hand, then take some out. *How many are still hidden inside?*
- [More number game ideas](#)



Shape, space and measures games

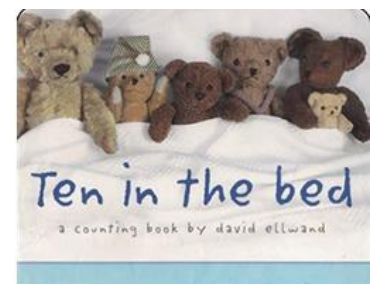
- Stick Race: use sticks of all different lengths and a start and finish line marked on the ground. Take it in turns to lay down a stick to form a line. The winner is the person who lays the stick nearest to the finish line. 'How many sticks did it take to reach from start to finish?' 'How are you choosing your sticks each time?', 'What if you don't have to lay a straight line?'
- [More shape, space and measures games](#) and [even more](#)



Songs & Rhymes

- [10 little men in a flying saucer](#): subtracting from 10
- [Ten green bottles](#): 'What if 2 should fall at once?'
- [Five currant buns](#): spot the increasing number of pennies as the number of buns decreases
- [Ten in the Bed](#): the numbers in bed and on the floor show patterns of bonds to 10
- *Hickety tickety rumpa rickety hornicup*: bonds to 10 - or pairs of children can make up combinations

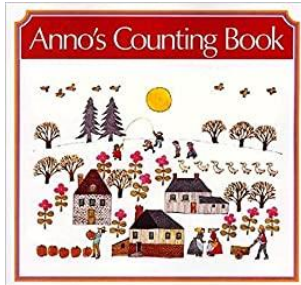
*'Hickety tickety rumpa rickety hornicup
How many fingers do I hold up?
Six: three by the window and three on the bricks
Seven: five in the bed and two in heaven
Eight: five go in and three must wait
Nine: five in the air and four down the mine
Ten: five in the field and five in the pen'*



Ten in the bed: a counting book by David Ellwand

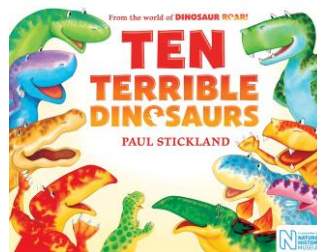
Four and five year olds

Books



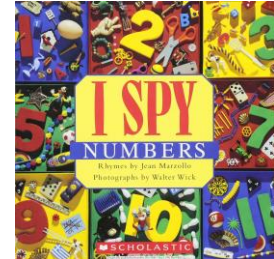
Anno's Counting Book

Mitsumasa Anno
Numbers of varied things to spot, in different combinations



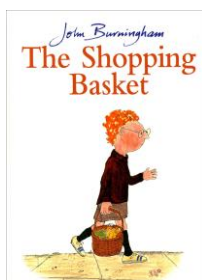
Ten Terrible Dinosaurs

Paul Stickland
Subtracting dinosaurs with a staircase pattern



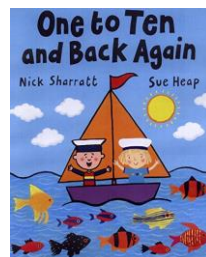
I Spy Numbers

Jean Marzollo & Walter Wick
Collections of things with a 3-ness (or 6-ness) about them



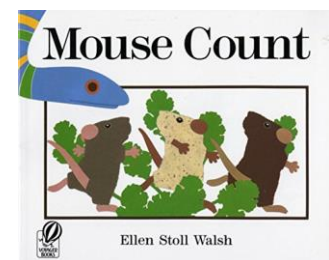
The Shopping Basket

John Burningham
Subtracting one from numbers to 10 with a triangular pattern for 21



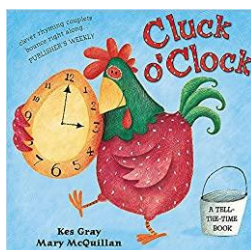
One to Ten and Back Again

Nick Sharratt & Sue Heap
Counting items to ten - match with numerals



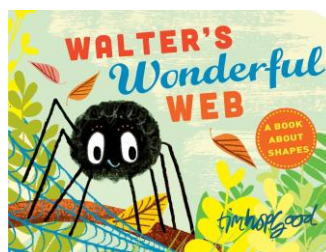
Mouse Count

Ellen Stoll Walsh
Adding by counting on
Activities at [Erikson EMC](#)



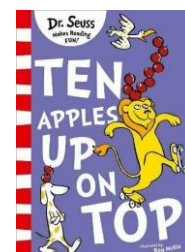
Cluck O'Clock

Kes Gray & Mary McQuillan
The hens' day with times



Walter's Wonderful Webb

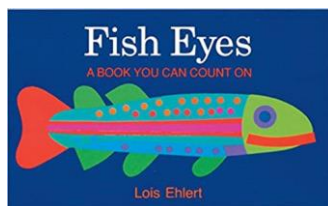
Tim Hopgood
About the properties of shapes



Ten Apples up on Top

Dr. Seuss
Counting and rhyming

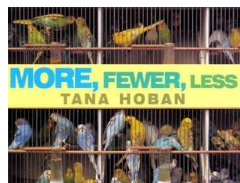
Four and five year olds



[Fish Eyes](#)

Lois Ehlert

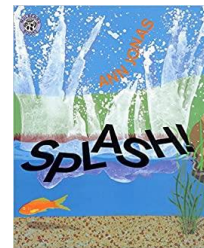
Counting fish and adding one more



[More, Fewer, Less](#)

Tana Hoban

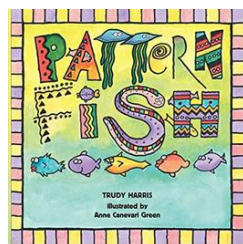
Estimating whether there are more or fewer things



[Splash](#)

Ann Jonas

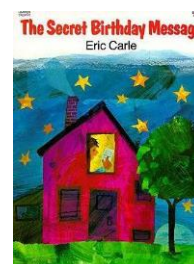
One more/less animals in the pond



[Pattern Fish](#)

Trudy Harris

Repeating patterns from AB to ABCD in words, actions and colours



[The Secret Birthday Message](#)

Eric Carle

Clues with directions to find a birthday present

Apps (free)

- [Monster Music Factory](#)

Interactive storybook focusing on different methods for figuring out the number of objects in a collection (with suggestions for adults to encourage mathematical thinking).



- [Monster Birthday Surprise](#)

Interactive storybook focussing on how numbers can be expressed in many ways such as objects, dots, and symbols.



- [Monster Frog Pond](#)

Interactive storybook focusing on addition and subtraction (with suggestions for adults to encourage mathematical thinking), 4-6 years.



- [123 section of Khan Academy Kids](#)

Open-ended activities for mathematics and problem-solving (2-7 years). Can be adapted for individual learning paths and teachers can set up a class account.



Four and five year olds

Apps (paid)

- [Meet the Numberblocks](#)

Each Numberblock has its number of Numberblobs for the child to tap to count. Tapping on the Numberblock moves them into a different arrangement (shape).



- [Finger Numbers](#)

Four games to develop number sense using fingers (counting, subitising, sets and calculation) (demonstration video is in German).



- [Numberblocks Card Fun](#)

Numbers 1 to 10 and activities to match, add and subtract with increasing complexity.



- [Numberblocks Hide and Seek](#)

This app focuses on addition and number bonds.



- [Dragonbox Numbers](#)

This app contains 4 different game activities to explore. Good for adults and children to use together to begin with.



- [Maths 3-5 \(One Billion\)](#)

A free section with two paid sections. Sorting and matching, counting to 3 (then 6 then 10), lines, patterns, shapes, comparison, addition and subtraction.



- [Math Shelf](#)

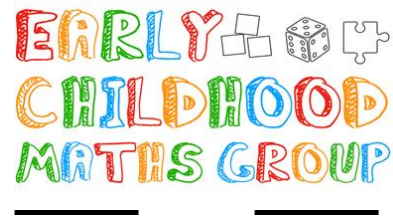
Math Shelf supports geometry, place value, arithmetic, fractions, money, measurement and time. Can be adapted for individual learning paths.



Three, four and five year olds

Adults can help 3, 4 and 5 year olds learn by:

- **building on their interests** e.g. finding hidden toys, putting objects inside each other, building towers, jumping up and down, counting favourite toys, counting steps
- **sometimes playing alongside and silently offering choices, watching what the child does** e.g. passing them two different shaped blocks and watching how they decide which to use
- **talking about numbers** e.g. *I wonder how many there are? I wonder if there are more trains or cars? I can see 1, 2, 3 cups.*
- **using maths words to talk about what you notice and what you are doing** e.g. *straight, curved, on top of, between, more, longer, further*
- **being enthusiastic and encouraging, showing interest in how they think** e.g. *you are so good at counting, Why did you choose that one? and how did you know that there are 5?*
- **being playfully wrong** e.g. counting incorrectly or making silly suggestions, like trying to fit a huge block into a tiny hole or suggesting they wear twelve shoes today
- **providing easy, then harder, puzzles and challenges, sometimes teaching helpful strategies or directing attention to key features** e.g. *I am finding the straight edges first to help me or that piece has four bumps, what hole will it fit?*
- **discussing options** e.g. wondering *whether..?* or *what if?* and trying more than one way



Acknowledgments

Community Playthings <https://www.communityplaythings.co.uk>

Department for Children, Schools and Families (2009) *Children thinking mathematically*
<https://webarchive.nationalarchives.gov.uk/20110202143550/http://nationalstrategies.standards.dcsf.gov.uk/node/257449>

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The Early Childhood Mathematics Group (ECMG) is a UK based group of early years mathematics enthusiasts and experts that includes teachers, researchers and teacher educators. We work together to promote early childhood mathematics.

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