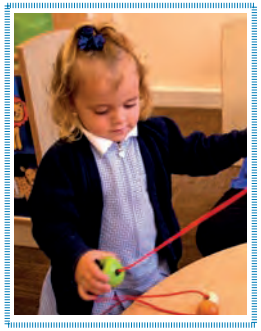


The Number Journey

Bolton Council

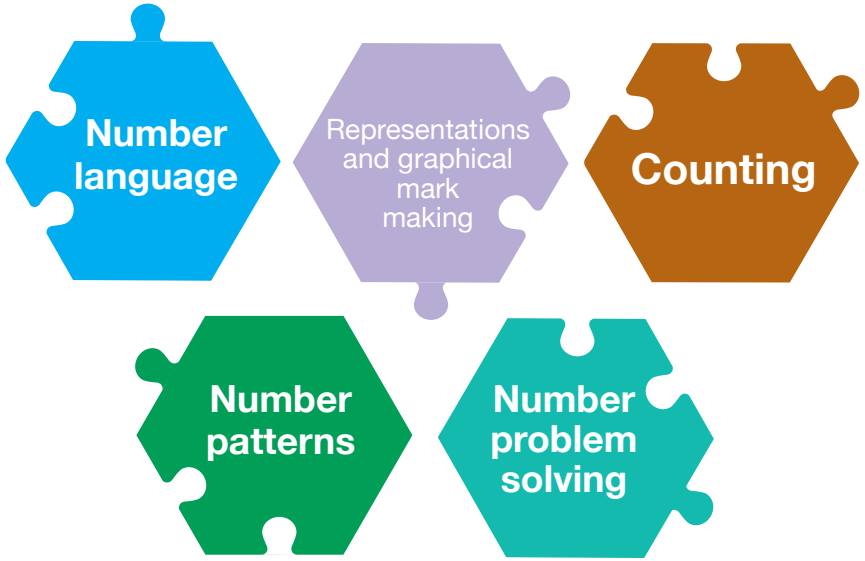
Introduction

by Bolton Early Years and Childcare Team

During the early years, children develop firm foundations in early mathematical skills, knowledge, understanding and an appreciation for maths. The first few years of a child's life is a prime time to nurture a child's natural instincts to use and apply mathematical thinking. It is therefore, crucial to provide quality, rich mathematical experiences to support young children to develop number awareness and key number concepts.

This guidance is designed to support young children from birth to 60 months to develop a sense of what number means, how they can use and apply number skills and concepts in their every day life.

The key skills and concepts needed to support children's number sense are:



These skills and concepts cannot be developed in isolation and therefore, this guidance recognises that young children will play, explore, actively learn, create and think critically across all areas of learning. It also acknowledges that young children's learning is nurtured through a reflective and supportive learning community both in the setting, at home and in the wider environment.

This document offers practical guidance to help practitioners to observe and assess young children's number development to inform next steps in planning. It offers ideas to support children's number development on a day-to-day basis through routines, continuous provision and quality interactions both indoors and outdoors.

Contents

How to use this guidance

The Number Journey contains three sections:

Section 1

This section defines each of the five number sense concepts. An illustration has been included to express how each of the concepts interlink and should therefore be taught through a holistic approach in line with the EYFS principles and practice.

Section 2

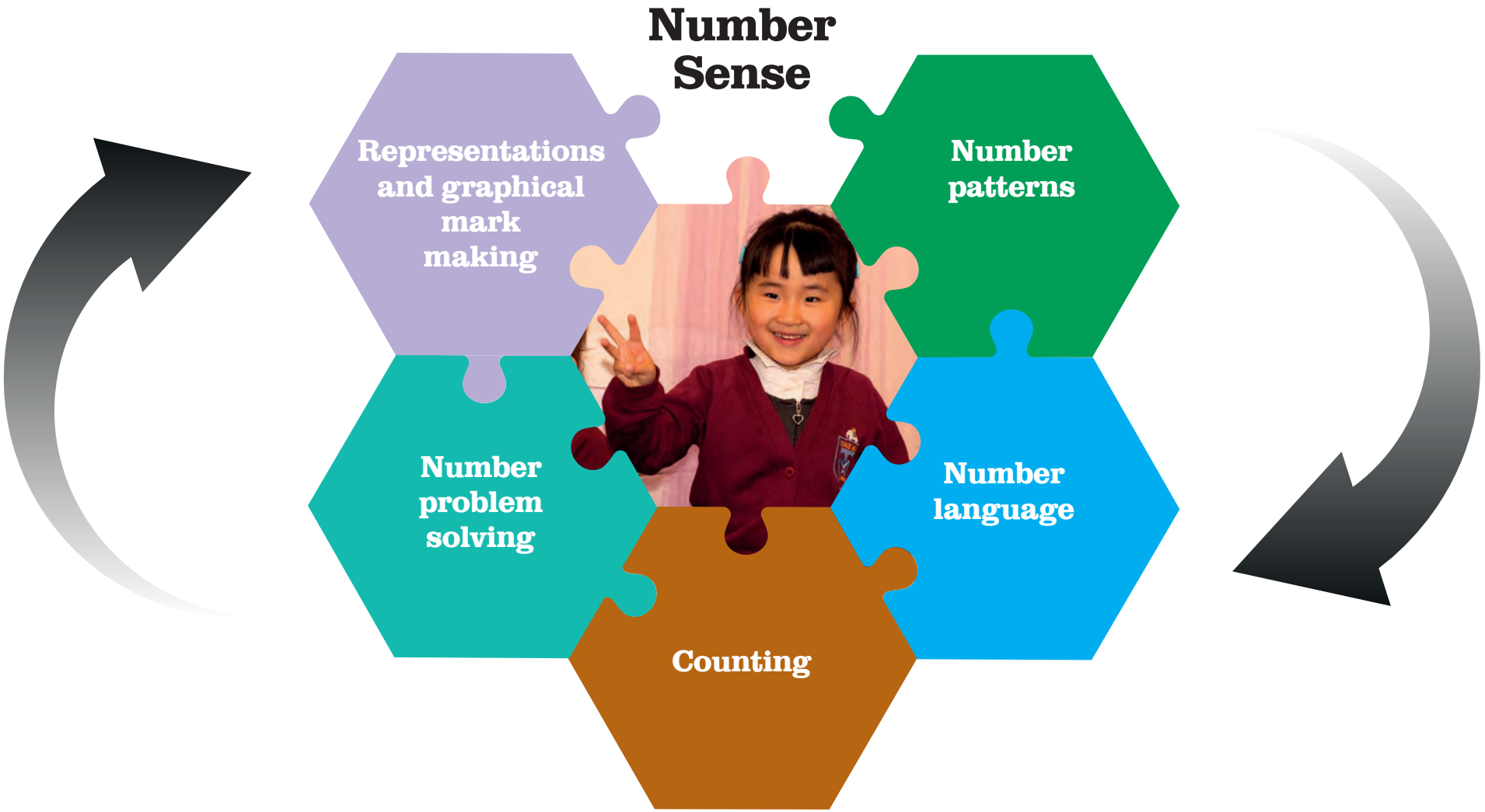
Refer to this section if you want to read about each of the five concepts in more detail. Each of the number sense concepts are colour coded and follows the same format:

- An outline of the development process for each of the number sense concepts
- Top tips to support your planning and playful interactions
- Examples of effective child-initiated opportunities, guided sessions, routines and the role of the adult. Every example of effective practice is linked specifically to appropriate age bands and the corresponding significant milestones

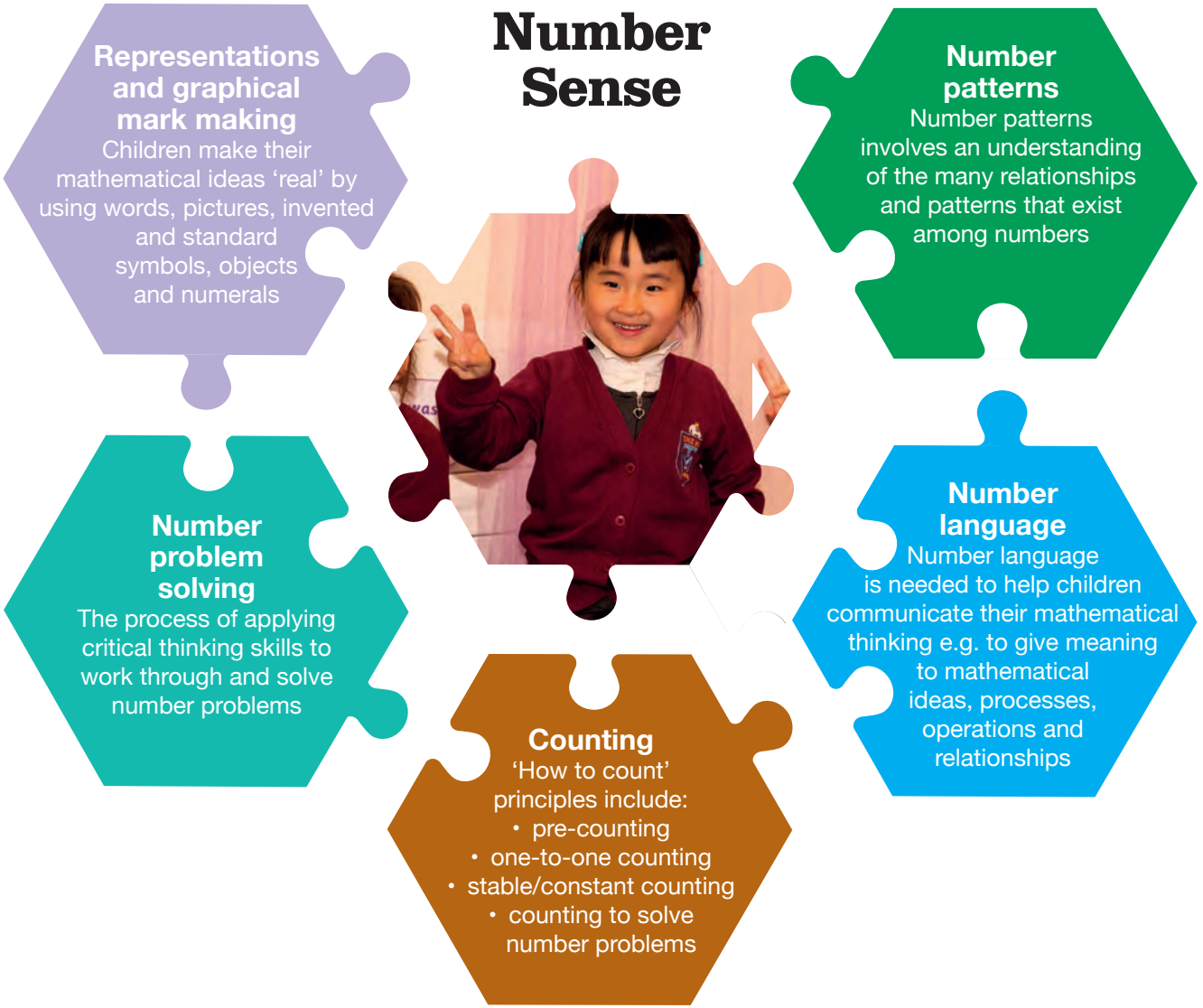
Section 3

The development matters statements in the EYFS in relation to number, along with child development research has been used to outline specific number concepts. Milestone pages can be used to help you track progress for each of these concepts in line with the corresponding Early Years Outcomes. Within these milestones; look, listen, consider and characteristics of effective number sense pages provide useful 'I Can' statements to support your on-going monitoring and observations.

Number sense concepts and skills overview



Number sense concepts and skills overview



The number language development process

- **Identify new vocabulary**
- **Plan when and how to introduce**
- **Clear definitions**
- **Visual representations and practical exploration**
- **Making personal links and connections**

Examples of effective practice...

Identify creative ways to extend or clarify children's number language

Plan to introduce number vocabulary in timely and meaningful context

Teach clear and accurate definitions

Provide a wealth of opportunities for children to hear, rehearse and apply new words in a range of practical situations

Number language top tips

Model how and when to use number terminology in several contexts. Clearly pronounce the beginning and ending of numbers

Number language can be used for informal meaning e.g. "I like lots of sweets" or formal expression linked to mathematical terminology e.g. add, estimate, predict, first, etc.

Number language is needed to help children communicate their mathematical thinking (to give meaning to their mathematical ideas, processes and operations)

Children need to hear new words several times before they can actually say them

Children learn language/s at an amazing rate. However, number language does not develop in the same way as everyday spoken language. It should be taught in a fun, systematic, stage appropriate and meaningful way

Practitioners need to be highly skilled in teaching and understanding number vocabulary:

- technical terms specific to mathematics (e.g. probability)
- specialist use of more general terms (e.g. factor)
- mathematical terms that are used and in some cases confused with unrelated everyday phrases (e.g. difference)

Record and monitor individual children's number language development

Have high expectations for children to use the correct number terminology

Plan practical activities for children to apply and use their new vocabulary with their peers and to wider audiences

Use age and stage appropriate questions to check children's understanding, carefully challenging and remodelling misunderstandings

Number language

Age band	Significant milestones
Birth to 11 months	Makes sounds with their voice during social interaction
8 to 20 months	Develops an awareness of number names through their development of action rhymes and songs that relate to their experiences of numbers

Examples of effective practice to support number language development

Create opportunities to introduce age appropriate number sequencing and number language vocabulary in meaningful context.

Routines:
Opportunities to introduce babies to number name sequencing e.g. “One, two, three, peek-a-boo!” Wiggling and counting each toe during nappy changing time or snack time “1, 2 , 3 all gone!”

Creating an enabling environment:
- Number rhymes props - help toddlers to choose their favourite rhymes
- Practice number rhymes with resources on display e.g. mobiles
- Record and replay children making sounds to number rhymes
- Heuristic play opportunities to model new number language linked to purposeful exploration

Guided sessions:
- Carefully plan to use a series of number rhymes books that introduce, repeat and embed number names
- Nursery rhymes sung with actions could be used to introduce, rehearse and reinforce new number language for counting, adding, subtracting, identifying number patterning and solving problems

Adult role: Introduce, repeat and rehearse specific number concepts vocabulary
- Find ways to introduce and rehearse phrases e.g. if adults uses the phrase “More, more” whilst tickling, babies will anticipate and invite you to tickle again and again
- Introduce and rehearse the phrase more as the opposite to less
- Toddlers will watch and lift a cloth as you cover toys saying “One more”
- Watching and listening to the first, second and third beat of a drum that they hear

Modelling how to use numbers: e.g. counting how long toddlers can stand upright, or how many foot steps they can take

Age band	Significant milestones	Examples of effective practice to support number language development
 16 to 26 months	Says some counting words randomly, for example 1, 3, 5	**Routines:** • Model sentences that include number sequences e.g. select fruit one, two, three slices of fruit • Demonstrate how to introduce new key phrases e.g. "You had three slices of banana 1, 2, 3, all gone, zero, all gone" **Creating a rich number language environment:** • Numbers displayed in areas of the provision such as numbers on buckets in the sand area, number wall friezes • Number rhymes bag/box with props (i.e. a duck for five little ducks) can be used to emphasise and rehearse counting vocabulary forwards and backwards **Guided sessions and adult role:** • **How many?** Model how to answer, allow time for thinking, recast answers etc. • **Make connections** for children "You have two legs, one, two legs. I have two legs one, two" • **Make links** to other concepts e.g. "You have… same as me" • **Demonstrating** how to use language e.g. during block play-building and taking down towers as an adult counts. Filling and emptying containers with water, sand, cereal, rice and lentils, adults use counting words whilst child scoops/digs
 22 to 36 months	Uses some language of quantities such as more and a lot Recites number names in sequence Can predict a missing word in number rhymes, number songs, etc.	**Routines:** • Pointing out and linking numbers around the room e.g. tell me how many children can play here? **Creating a rich number language environment:** • Adults props for planned number language • Display clear examples of specific words: more, after, backwards in workshop areas. Wear keyrings with "This week's new number language" **Guided sessions and Adult role:** • Adults model words many: a lot, no more, same, next, number sequences • High expectations for children to use number language whenever possible, e.g. "We have lots of apples" "One more bucket" "No more boxes" • Playing with interactive number displays "Now it's the same" • Whilst baking "One more stir"

Age band	Significant milestones
30 to 50 months	Uses some number names and number language spontaneously Uses some number names accurately in play Recites numbers in order to 10 Using ordinal and narrative language e.g. first/beginning etc.

Examples of effective practice to support number language development

Create a rich enabling environment for children to see, hear and use new/familiar number language:

- Create a rich bank of number language books, catalogues, albums
- Photo displays of children and adults using number language in a range of contexts
- Use talking pegs to record adults using new number vocabulary in practical contexts
- Role play areas – add key questions linked to how many items there are in themed areas e.g. props with numbers such as telephones, tills, etc.
- ICT such as Purple Mash, beebots and remote controlled cars can be useful ways for children to hear electronic use of new number vocabulary
- Outdoors – areas with number language attached to large scale resources such as logs with numbers on, counting mats and playground markings
- Mud kitchen with challenges to use recipe resources such as numbered pans, spoons, etc. Actively seek to use wider application of number by linking number language to practical exploration, visual image and movement

Plan guided sessions:

- Introduce new words/phrase of the week e.g. altogether, fewest, etc.
- Read stories such as Goldilocks and the Three Bears rich with number names and number language, model language such as “How many?” and “Count”
- Celebrate when you hear children using new number words

Adult role: Plan to use/model number language when:

- Playing games, e.g. “I have two cars, how many have you got?”
- Baking, encourage the children to discuss adding more, “How many spoons have we added?”
- Opportunities for introducing and reinforcing number vocabulary in role play and small world areas e.g. support children to use new vocabulary in sentences - use words to quantify e.g. “Look I can see three rockets.” or using words to explain number problems e.g. “I have too many now.”

Challenge children to use and practice new words or questions e.g. Interactive displays – include captions

- “What number comes next?”
- “What does that number tell us?”

Age band	Significant milestones
40 to 60+ months	Begins to use vocabulary involved in addition and subtraction. Uses language of more or fewer Says the number that is one more than a given number. Can explain their graphical marks Counts forwards and backwards within the number sequence 1 to 10 Can count reliably from 0-20 say which number is one more or one less than a given number May be able to explain the strategies used to solve problems Uses ordinal language e.g. first, second, third

Examples of effective practice to support number language development

Create a rich enabling environment for children to see, hear and use new/familiar number language:

- Ensure that new language is shared with parents/ carers in home diaries
- Display new words with class definitions e.g. 'double and half'
- Record children explaining and demonstrating new number language. This can be sent home on disc or via a Vlog
- Help children to display number language and appropriate pictures around the classroom. Help them to set each other challenge questions "How did you use our new number word today?"

Plan guided sessions:

- Observe, look and carefully plan when and how to introduce new number vocabulary to support gaps in learning
- Ensure children understand and have clear definitions. Find creative links to children's interests with visual images or practical exploration of the new terminology
- Create opportunities for children to rehearse and apply new vocabulary in pairs and independently
- Use literacy aids to support number language development - have familiar number stories and rhymes displayed for children to act them out and extend number language with friends
- Display the new number words and reward children for using them
- Incorporate number rhymes with velcro numbers, symbols, pictures and have new number language available for children to use independently
- Guide children to use number language in full sentences e.g. three teddies having a picnic and two more came along. Turn this into a number sentence and then write the number sentence and symbols
- Guide children to use number language to read and write labels and captions for a purpose on displays, following instructions
- Support children to explain their problem solving ideas by using specific number terms and phrases

Adult role:

- Model number language at every opportunity

Challenge children to display when and how they have used new number language: through child voice templates, showing their labels and discussing the ideas with a wider audience, e.g. in a show and tell situation

The counting process

Pre-counting

One-to-one counting

Understanding cardinality

Understanding stable/constant counting

Counting to solve number problems

Examples of effective practice...

Exploring without counting

Number labelling activities e.g. match each spoken number with one and only one object.

Ordinal number games

Linking nursery rhymes, songs and stories with the numeral.

Children see everyday numerals with cardinal meanings

Activities that support children to understand the last number counted tells the size of that set

Opportunities to solve problems by counting forwards or backwards to solve number problems. E.g. five and three can be added by counting on from three to five

Children to find solutions to daily maths challenges. "I have two leaves, can you help me find nine altogether?"

Counting top tips

We often take it for granted that children can count when we hear children refer to quantities during play or when we hear them chant numbers that they have heard. However, in order for children to count reliably they need to be taught how to master the following counting principles: pre-counting, one-to-one correspondence, understanding of cardinality and stable constant count. Once these principles have been achieved they can be supported to apply their counting principles to solve number problems.

Pre-counting

Toddlers develop pre-counting skills by exploring and investigating an understanding of the terms lots, few and the same. They begin to understand how these concepts are related through playful interactions. At this early stage understanding of pre-counting develops in line with a child's ability to make comparisons. At this stage no counting is involved

Counting on to solve number problems

Once children understand cardinality and the forward and backward number sequences they can count on or back to solve number problems. For example 5 and 3 can be added by counting on from the largest number: "5…..6,7,8"

Understanding cardinality and stable constant count

Once children know number names in order and coordinate a touch of one item saying one number, they can then develop children's understanding of cardinality

This means that children understand when you count the items in a set, the last number counted tells the size of that set

They also need to understand that the number in a set will remain constant as long as no items are added to the set, or taken from the set

One-to-one counting

The key focus of one-to-one counting is developing children's ability to count

Two skills are needed:

- ability to say the standard list of counting words in order (ordinal numbers) e.g. counting to 10
- ability to match each spoken number with one and only one object

Counting

Pre-counting

Age band	Significant milestones	Examples of effective practice to support counting
Birth to 11 months	**Developing counting awareness/pre-counting** Developing pre-counting skills by noticing the differences in quantities (up to three items) through touch, movement, listening, responding and vocalisation. (No counting is involved)	**Routines:** • Model counting – e.g. nap time. Slowly count backwards (from 10 to 0) pretend to close eyes and snore • Counting the number of buttons to open whilst getting changes forwards 1, 2, 3 and 4 and backwards 4, 3, 2 and 1 • Demonstrate when to use counting during feeding time e.g. use counting whilst making snacks or feeding. One spoon, two spoons, etc. **Plan guided sessions:** • Use number rhymes songs and stories to emphasise counting sequences e.g. raising and lowering voice when saying different numbers • Babies look carefully for changes - Play light tracking games. Shine a torch across the room. Now shine the torch twice saying "1, 2." Shine the torch again say "1", wait and say "Zero it's gone". Repeat this and babies will track the light. Once the game is understood now only shine the torch once - watch how the baby looks and waits for the other light. This can be extended to sounds e.g. shake rattle, bang drum once, twice. Babies will anticipate sounds and notice if you make one less sound • Provide a wealth of natural objects to manipulate - model counting as babies move each item
8 to 20 months	**Developing counting awareness/pre-counting** Developing pre-counting skills by comparing and discriminating between preferred quantities based on more or less during playful interactions	**Routines:** • The routine is a key opportunity to introduce counting for a purpose e.g. preparing for sensory play or nappy fun time, counting the numbers of treasure bags to use, counting number of items of clothes to remove for the session and counting them back on • Counting items spotted whilst walking in the garden **Plan guided sessions:** • Carefully choose number rhymes and action songs to count one more. Find songs and stories alongside props to demonstrate counting backwards • Create exploration sessions for toddlers to search for items - encourage toddlers to watch as you count up to four items into a bag/box. Count each item out of the bag. Repeat and now watch as toddlers look for the exact number of items to pull out of the bag. Encourage them to keep searching by counting as they retrieve each item • Using puppets to help play tickle and counting games e.g. "Two tickles, one tickle, two tickles" • Plan time and space for toddlers to explore and choose different quantities of items – choice between bowls of fruit, baskets of toys, handful of stacking rings **During independent play:** create a counting rich environment and model how and when to count e.g. sing counting songs whilst playing with stacking blocks

Pre-counting

Age band	Significant milestones	Examples of effective practice to support counting

16 to 26 months

Developing counting awareness/pre-counting

Early understanding of the concept lots and few. Early awareness that items can be the same or not the same

Children at this stage develop these concepts by comparison and practical opportunities to select objects using one-to-one correspondence in practical situations

This is important because these concepts lay the foundation for children to later develop an understanding of the many ways that numbers are related to each other

Routines:

- Create a counting rich environment
- Plan opportunities to use resources for a purpose
- Display personalised numbers in the environment e.g. one child's face, two children's faces, etc.
- Talk about how many children you can see today
- Have personalised counting books available refer to these throughout the day
- Counting steps, clapping hands and making beats as you count to and from spaces
- Counting at lunch time… count whilst waiting for food, serving of food "We need 3 bowls 1, 2, 3.." "I like peas 1, 2, 3, 4 spoonfuls for me"

Plan guided sessions:

- Carefully plan sessions to demonstrate more, less and the same
- Use blocks to build towers together. Count each block. "Look they're the same". Repeat activity by collecting items e.g. on plates/shopping baskets make comments "Lots"
- Extend the activity by encouraging the child to look carefully at items and change the number of items available. Puppets can be used to take items away etc
- Play games where toddlers can increase the quantity of items in sequences/putting piles of objects in lines. One carrot, two carrots, three carrots. Help toddlers to notice that the piles are increasing in quantity
- Create opportunities for toddlers to explore counting boxes - boxes with different amounts inside. Or counting books pulling out items from the book

During independent play - model how and when to count. Use quality interaction techniques to support child initiated counting e.g. time for children to add and use number words, repeat and expand on what they say.

Counting

Age band	Significant milestones	Examples of effective practice to support counting

22 to 36 months

One-to-one counting
This is the ability to count using one-to-one correspondence

Two skills are needed:

1. Ability to say the standard list of counting words in order. At this early stage, children are encouraged to recite some number names in sequence, whilst playing or singing number rhymes etc.

2. Ability to match each spoken number with one and only one object. At this early stage, children may select a small number of objects from a group when asked, e.g. "please give me one", "please give me two". Beginning to show an awareness of the empty set e.g. 'All gone'

Children at this stage of development need to be supported to recognise numbers and become confident in collecting and answering questions about a specific set of objects.

Routines:

- Daily opportunities to hear and practice counting sequences in practical contexts, hello and goodbye counting songs
- Actively modelling how and when to count "I can see Molly, Zac, Noah, Haider and Dola" (holding up a finger each time a name is said… I can see 1, 2, 3, 4, 5 children today
- Daily opportunities to sing and listen to number songs and number rhymes placing each item on a washing line, or in a special box as you sing each item

Create rich independent learning experiences:

- Interactive displays of familiar number rhymes
- A range of interesting containers to inspire children to count objects
- Find creative ways for children to touch each item e.g. post a set number of items into a character's mouth
- Poke six pieces of spaghetti into six holes of a colander
- Make special flap book pockets and lift a set number of flaps. Velcro/stick items e.g. stick nine images on a poster
- Submerge items e.g. push four fish under the water
- Pull and roll e.g. pull eight playdough balls to place over items on a playdough template/mats etc.
- Encourage children to hear themselves count - set up a counting puppet show. Children take the lead to be a counting puppet
- Carefully plan ways to support children to match items e.g. laying the table, find missing items i.e. gloves, shoe and counting items individually e.g. come and explore stations. Placing one item in separate compartments e.g. individual magnifying containers, egg boxes, ice cube trays. Encourage children to count and touch items as they show their friends

Guided sessions:

- Active maths sessions are perfect opportunities for children to explore counting through their senses
- Singing actions songs to touch and move body parts "one finger one thumb keep moving"
- Respond to a beat of an instrument by emphasing the steady beat by responding with a clap, jump, stamp, growing taller etc.
- Spotting items all around. "I see 1, 2, 3 worms, 5 daisies let me check 1, 2, 3, 4 and 5. Yes 5 daisies"
- Go on a specific number hunt - hunt for items of five. Take photos of each item and display these in special number books
- Following instructions: run and pat two trees

Counting

Age band	Significant milestones	Examples of effective practice to support counting

30 to 50 months

Embedding one-to-one counting ability to say the standard list of counting words in order e.g. recites numbers in order to 10

Cardinality and stable/constant count
Children understand cardinality. I.e. know that the last number counted tells the size of that set. Know that the numbers in a set will remain constant as long as no items are added or taken away from the set

Know that numbers identify how many objects are in a set e.g. separates a group of objects of three or four objects in different ways beginning to recognise the total is the same. Sometimes matching numerals and quantity correctly

Use zero and the numeral to represent the empty set e.g. 0

Realise not only objects but anything can be counted. Cardinality is important because it allows numbers to be used to describe and compare sets. This allows sets of items to be combined (addition) and separated (subtraction)

Children at this stage of development need to be supported to use and apply their one-to-one correspondence to count, check and recheck that they are counting accurately.

Routines:

- Daily opportunities to hear and practice counting sequences in practical contexts – children will take the lead in selecting a counter and dropping this in a box to represent each child in that morning
- Self-registration – I am here displays "I was first in today… I was second… third"
- Counting pieces of fruit at snack time
- Children help to make snacks by following recipes – recipe cards showing the visual image i.e. (four slices of toast, cut into 16 squares). Use safety knives for the children to cut and count. How many have we now/how many have we eaten/how many are left until they are all gone
- Celebrate a friends fourth birthday – counting and turning on the LED candles
- Encourage children to become 'counting helpers'. Counting helpers help to collect items for friends – "My turn to collect three coats for my friends."
- Encourage them to touch each item as they collect them and hand them to their friend (repeat this with different items around the provision)

Create rich independent learning experiences:

- Opportunities to count selections of objects and rearrange and count again
- Hunting for baskets of natural resources to make up sets; once collected counting items again by sticking them on sheets of paper
- Opportunities for counting and using vocabulary in role play and small world areas. Introduce the concept of zero with a physical action e.g. both hands make a big circle shouting zero
- Provide lots of opportunities for meaningful counting – Redecorating the house. Make a decorating guide for the items needed. Six new cushions, setting the table in the home corner for two people, hanging up the correct number of aprons
- Role play areas – Display key questions linked to how many items there are. Add props with numbers such as telephones, tills, ask children to count each item one by one as we put them into the shopping basket
- Introduce counting stations around the room – Introducing numbered resources such as stringed number logs and variety of resources to count and compare quantities into zip bags, small pouches, or number frames
- Provide ICT software packages, Apps, MP3, Talking pegs, recording pens for children to listen and record their voice as they play with counting resources

Counting

Age band	Significant milestones	Examples of effective practice to support counting

30 to 50 months

Embedding one-to-one counting ability to say the standard list of counting words in order e.g. recites numbers in order to 10

Cardinality and stable/constant count
Children understand cardinality. I.e. know that the last number counted tells the size of that set. Know that the numbers in a set will remain constant as long as no items are added or taken away from the set

Know that numbers identify how many objects are in a set e.g. separates a group of objects of three or four objects in different ways beginning to recognise the total is the same. Sometimes matching numerals and quantity correctly

Use zero and the numeral to represent the empty set e.g. 0

Realise not only objects but anything can be counted. Cardinality is important because it allows numbers to be used to describe and compare sets. This allows sets of items to be combined (addition) and separated (subtraction)

Guided sessions:

- Active maths sessions are physically active ways to support children to count everything and anything for fun. Focus on the final number in the count
- Counting fingers to accompany number rhymes or stories – modelling how to stop and check the count so far and matching the final count to specific numerals. Use careful questioning – "How many are left?", "How many do we have now?". "Can you come and check?"
- Holding up numerals and corresponding dots for children responding with actions e.g. counting forwards with corresponding spins, bottom shuffle forwards, pats on friends backs, tapping head etc. Introduce how to count backwards with corresponding actions. Number rhymes and rocket games are good e.g. children can count 5, 4, 3, 2, 1, blast off
- Turn down the lights and give children illuminous wrist bands, wave wrists and count
- Dice games – rolling the dice collecting items e.g. flowers for flower pots, spots for ladybirds, etc.
- Play ordinal number games – racing cars awarding 1st, 2nd, 3rd and 4th prizes
- Making up ordinal stories based on familiar number rhymes – the first little men in the flying saucer had a red space ship, etc.
- Support children to learn some counting checking skills – model how to arrange objects easily (in a line), an action for the final count e.g. slide check, enclose and round or a clap

Counting

Age band	Significant milestones	Examples of effective practice to support counting

40 to 60+ months

Embedding cardinality and stable/constant count
Accurately counts actions or objects which cannot be moved. Count irregular arrangements of objects beyond 10

Counts out up to six objects from a large group.

Use counting skills to partition and recombine small groups of objects

Count from one to solve number problems - counts a first set starting from 1 e.g. 1, 2, 3 and adding this number to a new set of objects to solve addition problems (up to two single digit numbers)

Counts a first set starting from 1 e.g. 1, 2, 3, 4 and removing this away from a larger amount to solve subtraction problems. (up to two single digit numbers)

Counts on or back to solve number problems e.g. starts counting the largest set first then adding or subtracting this from the smaller set

Children at this stage of development need to be supported to use and apply their one-to-one correspondence to count, check and recheck that they are counting accurately.

Routines:

- Daily opportunities to hear and practice counting sequences in practical contexts. Model how to use the calendar to check the date and work out how many days remain in that week. Model how to use counting to help work out how many absences over two days. Tidy up time – Label shelves with dots and numerals to encourage children to find corresponding items. Combine sets of missing items to be replenished. Children find different ways to share items into snack box containers for their friends

Create rich independent learning experiences:

- Jointly play and then leave games and activities in the learning provision to encourage children to count a set of numbers, then count on from a given number independently e.g. Magic box – Number on the box to say how many are in the box, then count on from that number. Similar activities using stories, e.g. Mrs Wobble has five buns under her cloth and then another customer orders three more. How many on the tray now? Display children's own adding and subtraction stories

- Display pictures of children's cardinal numbers. Provide ten frames and numicon shapes and encourage children to count out small objects from large sets of objects to fit into each frame or numicon hole

Counting

Age band	Significant milestones	Examples of effective practice to support counting

40 to 60+ months

Embedding cardinality and stable/constant count
Accurately counts actions or objects which cannot be moved. Counts irregular arrangements of objects to 10, and begins to count beyond 10

Counts out up to 6 objects from a large group.

Use counting skills to partition and recombine small groups of objects

Counts from one to solve number problems - counts a first set starting from 1 e.g. 1, 2, 3 and adding this number to a new set of objects to solve addition problems (up to two single digit numbers)

Counts a first set starting from 1 e.g. 1, 2, 3, 4 and removing this away from a larger amount to solve subtraction problems. (up to two single digit numbers)

Counts on or back to solve number problems e.g. starts counting the largest set first then adding or subtracting this from the smaller set

Guided sessions:
Active maths sessions hold up number cards – Encourage children to run to the middle, select counters from a large pile of counters, hold up fingers or respond with an action e.g. cheers, giving high fives to a set number of friends.

Dice games – Roll two dice. The first dice is the starting point – all children run to this number and then roll the second dice children count the spots together and either jumps forward or back.

The dice fitness game – Sit the children in a circle. One child rolls a die, counts the dots and sets a physical challenge for the group e.g. jump four times.

Use music to encourage counting – Tap out a 12 tap rhythm fast, slow, fast, slow. Children repeat the taps and count. Extend this by combining rhythm. Tap 1 pause and tap 3 more times. Children tap how many you tapped altogether.

Children play pass the ball count games. Use Numicon/ number cards, dice to show the starting number e.g. 8 pass the ball to each child and count 1, 2, 3,…8 choose another Numicon/number card, roll the dice e.g. 6 count the ball to the corresponding number e.g. 8, 7, 6, 5, 4, 3, 2.

Play number line games – Play ‘count me in’. Jump puppets up and down the number line starting at different numbers.

In order for children to ‘count on’ they need to keep track of their counting – Support children to remember the last count to and from 10 then counting 10. Then counting 10 in two parts e.g. silently counting 1, 2, 3, stop counting and picturing the number 3 then continue to count to 10. Various skills can be achieved by repeating this with different actions e.g. slow wiggles to a chosen number then big wiggles and a loud count to 20. Extend this by pretending to be computers tap a given number a head whilst using fingers to count on.

Card and imaginary activities – Interactive wipe board games are a great way to observe and take note of each child’s counting skills.

Large flash cards are a good way for children to remember an image of a number then choose another card to help count forward or back.

Show two Numicom templates, say the number that the first Numicom template represents and then count on using the number represented by the second Numicom template.

Play ‘count me in’. Jumping puppets on the number line starting at different numbers.

Encourage children to notice what’s the same and different with the numbers or quantities they have. Explore and count how many each child has, how many more they need and explain how they can check. Encourage children to use counting and checking skills independently and with a partner. (see page 36 for Counting to solve number problems opportunities).

The number pattern process

Numbers define quantity that can be compared
e.g. more, less or the same

Numbers relate to each other
e.g. two is one more than the number one and one less than the number three

Numbers can be partitioned and composed in meaningful ways
e.g. five can be thought of as one and four, five can be thought of as one and four, two and three etc.

Numbers have repetitive patterns
e.g. 5, 6, 7, 8, 9 or 15, 16, 17, 18, 19

Examples of effective practice...

Comparison and estimation activities

More/less and number track games

Opportunities to explore quantities, finger count and play subitising games

Point out number patterns in the environment e.g. displays, door numbers

Number patterns top tips

Number patterns involve an understanding of the many relationships and patterns that exist amongst numbers. In order to help children understand that numbers can be used in meaningful ways, they must first understand that:

Numbers define a quantity that can be compared

It is important to create a wealth of practical opportunities for children to notice how numbers are similar and different.

Through playful exploration children can be taught how to understand and master the art of comparing quantities. Reinforce and embed children's innate understanding of more. Once the concept of more is secure, introduce the concept of less/fewer than by teaching the relationship between more and less e.g. "Are there more/fewer leaves on the grass or on trees?".

Numbers relate to each other

Children need to be taught how numbers relate to each other in meaningful ways.

Once a child understands how to compare quantity, they can begin to identify how their pile of objects (e.g. toys) are changed by including and removing one or two more. Children need to physically experience adding one more and taking away one:

- Manipulate objects by posting, hiding, finding, eating whilst hearing practitioners comment "You have fewer than me I will eat one more"
- Playing action games, clapping, jumping, shouting, blinking, one more time. Repeat with fewer actions e.g. one less spin than before
- Children move themselves and objects along to land one before and one after a given number. This is an important skill for later number comparisons and counting e.g. four is one more than three and three is one less than four

Numbers can be partitioned and composed in meaningful ways

Children benefit by developing their natural ability to recognise a quantity/a whole amount without counting. Known as subitising. Encourage children to recognise subgroups/sets of number patterns e.g. three dots and another four dots when looking at seven dots.

Games that encourage children to visualise, instantly recognise dots and sets of images which supports these skills.

These skills can be further extended by teaching children to actively separate a whole set of objects by manipulating objects or if appropriate, using their fingers. E.g. for children to rehearse and fully understand how to split objects to five.

Numbers have repetitive patterns

Finding ways to immerse children in activities that reinforce a solid understanding and confidence in knowing what ten looks and feels likes (the ten ness of ten).

Time is needed to explore visual tools and to manipulate numbers to 10 e.g. one to nine increases by one as you count forward and decreases as you count down.

Once this is firmly understood this same number pattern can be applied to understand the position of number sequences (tens -19, 20, 21, 22 or hundreds -100, 200, 300) as the quantity increases.

Number patterns

Age band	Significant milestones	Examples of effective practice to support number patterns
Birth to 11 months	Discovering how others respond to needs Makes vocalisation to repeated interactions	**Number patterns help young children to learn how numbers are interconnected and how numbers can be used in meaningful ways.** **Routines:** • Daily opportunities for babies to explore patterns around them e.g. nurturing the pattern of speech taking turns in nurturing the pattern of speech whilst taking turns in conversations • Engrossing babies in patterns all around them - mobiles above nappy changing area. Black, white and red displays on the walls **Guided sessions:** Number patterning can be supported by encouraging babies to: • Identify and predict distinct patterns through rhythm e.g. rocking with a baby while singing and patting gently on his/her back so that he/she can simultaneously hear and feel the patterns in the music • A basic understanding of number patterns can be planned by supporting babies to explore quantities using every day objects e.g. independent exploration of a range of objects e.g. treasure baskets, heuristic play, mystery boxes with various quantities
8 to 20 months	Beginning to identify patterns in everyday routines	**Routines:** • Daily routines support babies to become familiar with real life predictable patterns. Use facial gestures and sounds to show excitement. This encourages babies/ toddlers to think about what happens next **Guided sessions:** • Number relationships can be nurtured by encouraging toddlers to identify similarities and differences. This skill is the foundation for recognising how numbers compare e.g. encourage toddlers to explore and compare objects with different and similar textures, shapes, patterns, smell and taste • Toddlers can play instruments at a specific part of a simple song such as Twinkle, Twinkle, Little Star, whilst you play the rest of the tune. Repeat until they become familiar with the pattern • Stacking bricks or nests of baskets etc. encourage babies to see that whole objects can be taken apart and reconnected

Age band	Significant milestones	Examples of effective practice to support number patterns
16 to 26 months	Identifies patterns in routine and behaviour (needed for logical reasoning, predictions and problem solving)	**It is important to emphasise number patterns with young children to help them learn how numbers are interconnected and how numbers can be used in meaningful ways.** **Routine:** • Encourage discussion about the routine of the day. This helps to form awareness of the patterns throughout the day and to link and compare e.g. "Story time then mummy time" **Create an enabling environment:** • Active exploration and sensory experiences with different quantities provide a basis for further understanding of quantities and comparisons e.g. threading activities on a large scale • Pouring out bags of different objects e.g. sensory pebbles. Finding all of the pine cones and tea spoons hidden in custard • Heuristic play items such as pine cones, bottle tops, pegs, jigsaws etc. **Guided sessions:** • Plan exploration of patterns in music by playing along to number rhyme songs e.g. hitting a drum when singing 1, 2, 3, 4, 5 once I caught a fish alive • Model and talk about connecting toys e.g. stacking blocks, Russian dolls, jigsaws enables children to recognise that whole objects/numbers are made up of smaller parts that can fit together
22 to 36 months	Recognises and anticipates patterns in routine and behaviour (needed for logical reasoning, predictions and problem solving) Identifying and anticipating what comes next, in events that have personal significance and beginning to identify links and connections to symbols, images and some of the numbers that they know Developing a concept of more, less or the same **Subitising number** Instantly recognising the number of 1, 2, 3 objects without counting. This is crucial for later number partitioning skills	**Routines:** • Explore and identify the daily routine e.g. photo albums of the day, velcro photos of the day on a timeline etc. demonstrates children's ability to anticipate daily patterns • Extend this by using bricks, coloured balls or counters and encourage children to copy, then to predict what comes next. Make the connections to number rhymes talk/act out what number comes next • Snack time - commentary has more, less and the same amount of breadsticks **Guided sessions:** • Make hungry monster posting box – feed the monster more • Opportunities to compare amounts – "Lily has more carrots than Harry". Number rhymes such as 'Five Currant Buns' using props and actions • Exploring books with themes, more or less • Link book theme explore items i.e. more in a bird's nest • www.teachpreschool.org/2012/04/exploring-more-or-less-in-a-bird-nest/ Encouraging children to identify and make simple patterns, e.g. with fruit, matching socks, shape printing are essential skills that enable children to recognise and identify number patterns and relationships.

Age band	Significant milestones
30 to 50 months	Identifies and anticipates what more than, less than will look like Developed an understanding of one more than one less Begins to see a pattern of numbers as they use fingers whilst reciting number orders to 10. E.g. relationship of numbers 1-4 to 5 and 6-9 to 10

Examples of effective practice to support number patterns

Routines:

- Key person time – Make statements about the number of children you have in, "We had fewer children in yesterday than today"
- Use books with number patterns and relationships at story time

Creating an enabling environment:

- Display number lines with photos of children's fingers. Refer to these whilst playing alongside children and encourage children to copy
- Numbers on the bikes with corresponding parking bays for children to see where to park bikes at tidy up time
- Number lines and hundred boards available indoors and outdoors for children to touch and refer to during their play
- When taking washing off the line ask children to put the socks into pairs, reinforce that a pair is two things that go together
- Providing children with a reason to count e.g. dice, cubes, natural resources, money
- Introduce props linked to stories in the reading areas
- Snack area – Questioning children about the number of items needed and opportunities to separate into equal and unequal groups. Outdoors – looking for natural patterns, sorting and organising objects into categories such as large shells, small shells, big bikes, small bikes. Opportunities to count objects and rearrange them and count again. Ask them to tell you what they can see, horses, cows, sheep in the fields, how many?
- Playdough/malleable – making and counting cakes, comparing more and less than

Guided sessions:

- Plan number rhymes activities, using fingers to represent each number
- Look at different ways to represent each number, i.e. thumb and little finger to represent two, or spider man arrangement for three. Provide simple board games that involve moving a counter forwards and backwards round the board, i.e. one more, one less
- Opportunities to recite numbers in sequence and represent numbers using fingers
- Play silly puppet games – Puppet messes up groups of objects and counting to check if the total is the same. More, less and the same

More and less activities:

- Plan independent activities to support children to match objects and recognise the concept more, less and the same using cards that say more on one side and less on the other
- Place ten beans in a cup. Children throw the beans onto a mat. They count each colour to see how many beans landed on the red side and how many landed on the blue side. They compare to see which colours have the most, least, or same amount
- Build towers to point out which tower has the least amount of bricks

Estimating activities:

- Activities that encourage children to find a number that is close enough to the right answer
- Support children to guess how many conkers can you fit in Peppa Pig's handbag. How many bananas can fit in the Minion box
- Introduce estimation jar. Give examples of correct containers and then an example where children are encouraged to estimate

Number track activities:

- Guided sessions created to support children to roll dice and jump along a number track
- Using small world characters to move along the number track
- Extra large number track for large group track games
- Washing line games including hunting the missing number, pinning items next to numerals

Age band	Significant milestones
30 to 50 months	**Subitising** Instantly recognises the number of up to four objects without counting. This is crucial for them to be able to separate a group of three objects in different ways and begins to recognise that the total is still the same
40 to 60+ months	**Subitising** The skill of recognising up to five objects is now used to help count, group and recognise objects mentally. This is needed for partitioning e.g. the ability to move around, or partition and regroup and combine small groups of up to four objects and recognises that the total is still the same. Make reasonable estimates for small quantities

Examples of effective practice to support number patterns

Subitising activities:

What is subitising?

There are two components of subitisng; perceptual and conceptual. Perceptual subitising is the instant visual recognition of pattern without counting. E.g dots on a dice represent a number. Conceptual subitisng is recognising smaller groups and organising these patterns in to easily recognisable subgroups e.g. six dots can be seen as four dots and another two dots.

Subitising will help children:

Count on from a known patterned set and combine numbers from sets.

Routines:

Help children to link groups during daily activities e.g. paints in paint pots, aprons on the correct hooks, signs that indicate how many children in each area.

Guided sessions:

Create practical opportunities for children to manipulate small group of everyday objects.

- **Pairs** – Socks, shoes, two cups, two wheels on a bike, gloves
- **Sets of three** – Linked to nursery rhymes e.g. props Goldilocks and the three bears, three billy goats gruff, lucky glover, three goals in a hat trick, three blind mice, three strikes and you're out. A triangle, traffic lights
- **Sets of four** – Car wheels, animal legs, a set of chairs
- **Help children to quickly look and recognise** the number in each set. Up to five
- **Introduce games with visual images** – Introduce five frames and then 10 frames. For children to become familiar with the visual pattern
- **Make visual pattern books** with children
- **Encourage children to make up stories** with sets of story props
- **Cards, dice and dominoes games** encourage children to quickly recognise dots and link it with a physical action e.g. one ten forward, matching card memory games, putting visual image cards on a washing line
- **Once children can confidently subitise numbers 1-5** they can use their imagery skills to group two sets of images e.g. first set of two with another set of five

Age band	Significant milestones
40 to 60+ months	Embeds patterns of numbers as they use fingers whilst reciting number orders to 10. E.g. relationship of numbers 1-4 to 5 and 6-9 to 10 Recognising the relationship 0-10 and significant stopping points i.e. 5 can be used to count on to 10. 8 is 2 away from 10. 10 is a significant point to count on to 20 Begins to become aware of patterns for 1 to 9. This provides a guide to counting larger 2 digit number sequences Begins to recognise the patterns of pairs whist using fingers to count and object sort

Examples of effective practice to support number patterns

Routines:

- Use calendars to count down days
- Create opportunities for estimating throughout the day "How many planes will we see flying by?" extend this to other items

Guided sessions:

Plan more/less activities:

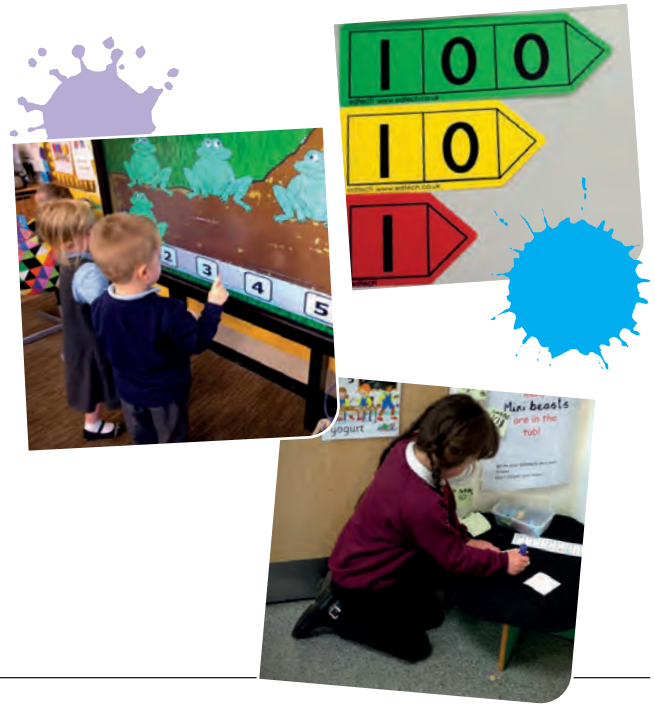
- Two puppets grabs a handful of counters – The winning puppet is the one with either more or less counters
- Throw two dice, then point to the dice that has the fewer dots
- Children get in pairs and have 10 unifix cubes each. Practitioner has a note card with '**more**' written on one side and '**less**' written on the other
- Practitioners instructs the children to hold any amount of cubes in their hands. "Look and to see if your partner has more or less than you. If I hold up the card that says '**more**' the person that has more wins. If I hold up the card that says '**less**' the person that has less wins."

Plan estimate activities:

- Estimate how many sheets of wrapping paper we will need to wrap the teddy
- Play visual estimating games on the smart board or using flash cards
- Create and model how to use estimating at the Estimation Station
- Time to see a range of objects. Time to estimate, time to check (link this to mark making opportunities when and if appropriate)

Plan decomposition activities: e.g.

- Opportunities for children to explore and understand that a whole group can be separated in different ways
- Two pirates dig up eight coins, find different ways to share the treasure can into two parts: 0 and 8, 2 and 6, 5 and 3, and so on
- Using two different colours to make a tower for Spiderman to climb
- In the role play area find different ways to sort the brown and white eggs in to the eggs box
- Using stories to act out the different ways the seven characters can be placed in two different scenes e.g. grass and the mud



Age band	Significant milestones
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Examples of effective practice to support number patterns

Plan number track and number line activities

Number tracks encourage children to read numerals and locate numbers in order from one to a set number. Number lines enable children to recognise the division of numbers rather than a set numbered space.

Number lines start at 0.

- Use number tracks to find the missing number. “I start on two I take two steps forward what number do I land on?”
- “Can you make the frog jump two steps back?”
- Games that support children or puppets to count in 2’s, 5’s and 10’s. Show the numbers on a number line or a number square. Jump puppets along the number line. Use Numicon to show place value e.g. 2 ten templates to represent 20 jumps
- Numbered stepping stones for children to put in order
- Number lines in each area. Games available that involve number tracks. Numbered stepping stones for children to put in order etc.

The number problem solving process

Stage 1

Getting started
identifying how to engage with the problem

Stage 2

Combining skills/ experience
such as trial and improvement, adding, subtracting, doubling, halving

Stage 3

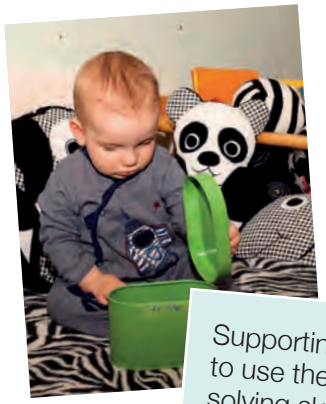
Proving and applying findings

Stage 4

Making conclusions and explaining findings
written, verbally and non-verbally

Examples of effective practice...

Encourage children to take part "Wow"



Supporting children to use their problem solving skills

Use non-verbal cues to have a go

Helping children to understand the problem by applying what they know, e.g. encouraging them to explore further through gestures and praise

Helping children to understand their findings, e.g. celebrating and praising their achievements

The number problem solving top tips

Children are natural problem solvers but they need to be supported to understand, practice and apply their problem solving skills in a broad range of contexts. Carefully plan opportunities to introduce and support children through the problem solving process:

Stage 1

Children get started by identifying how to engage with the problem.

Use carefully selected resources to create a rich number environment. Children should be motivated to use and repeatedly apply their skills to solve number problems. Create a 'have a go' culture, value the process and not just the correct answer.

Stage 2

Children combine skills and experiences such as trial and improvement, adding, subtracting, doubling and halving.

Practitioners should recognise, observe, potential problem solving number opportunities.

Identify characteristics of effective learning, thought process and the range of skills that are being demonstrated.

Stage 3

Children prove and apply their findings.

Sustaining children's thinking and supporting children's reasoning is vital.

Apply age and stage appropriate sustained shared thinking and mathematical reasoning techniques.

Stage 4

Children make conclusions and explaining findings (written, verbally and non-verbally) through skilful open ended questioning.

Support children to relate their ideas to previous problems they have solved. Use sustained thinking techniques to challenge children to apply their solutions to solve similar problems.

Sustaining children's number problem solving top tips

For babies and toddlers

Sustained shared thinking techniques for babies and toddlers

Focus, respond and extend babies and toddlers play and exploration, active learning and critical thinking through practitioner's running commentary – using single word e.g. "Pull" non verbal e.g. smiles and verbal praise cues "Wow!"

For young children

Supporting children's reasoning and thinking for young children

Describe
Help children to notice what is the same or what is different to previous explorations comparing other situations.

Representation and graphical mark making
Flexible use of drawing, tallies, fingers, numerals (invented or standards) to represent thinking.

Reasoning
Encourage children to reason repeat, engage in trial and error actions or systematic attempts to prove ideas.

Visualising
Helping children to look at what they have done, imagining what they could change or do differently.
Adapted from Jennie Penant 2014

For young children

Sustained Shared thinking techniques for young children

Invite children to elaborate "I really want to know more"
Recapping "So you think..."
Clarifying ideas "So you think that **if** you… this will happen"
Suggesting "You might like to try…"
Reminding "Don't forget that you said…"
Encouraging further thinking "You really thought hard about…, but, what about…"
Model thinking "I thought..."
Open ended questions "How did you…" "Why does…" (bear in mind that answering why questions is a highly complex skill and some children may not be able to do until KS1) "What happens next"

Number problem solving

Pre-number problem solving

Age band	Significant milestones	Examples of effective practice to support number problem solving

Birth to 11 months

- Babies are natural problem solvers. They explore and engage with familiar and unfamiliar objects
- Finding new ways to use the whole body and senses to make items move, fit together, and reappear. **Babies demonstrate very early signs of object permanence.**
- Child reaches for a partially hidden object

8 to 20 months

Early signs object permanence

- The desire to look for a hidden object emerges with awareness that things exist even when out of sight
- Can actively co-operate during routines, beginning to learn to take turns
- Repeats sequences numerous times to solve problems

16 to 26 months

- Problem solving through recalling familiar events, objects and sequences
- Understanding that problems can be solved through repeated patterns, actions, categorising and organising objects

Understanding of object permanence knows that things exist and where to look when out of sight with very little error

Number problem solving is nurtured through observation, exploration and imitation.

Create a rich enabling environment that will encourage babies to observe and explore:

- Set time aside for babies to explore through grasping and sucking. Then mastering how to use hands, feet and movement
- Observe and note how babies explore items and introduce resources match and extend the stage of exploration development resources for mouth exploration, whole body exploration in various ways then more resources that can be pulled and pushed

Guided sessions:
Plan sessions for observation and imitation:

- Model how to connect and link objects e.g. place stacking cups inside each other. Wait, watch and celebrate when babies and toddlers try to copy you. Extend this by modelling how to use objects in alternative ways
- Model how to make different sounds by using beaters on different instruments, using feet to kick and rolling shakers.
- Observe imitated actions
- Observe and note how toddlers find ways to open similar containers, connect and link toys. Image of (treasure baskets)
- Provide toys that encourage babies and toddlers to look for the result of their actions i.e. toys that make a sound by kicking, light and sound books, wrist and feet shakers, ball rolling activity boards

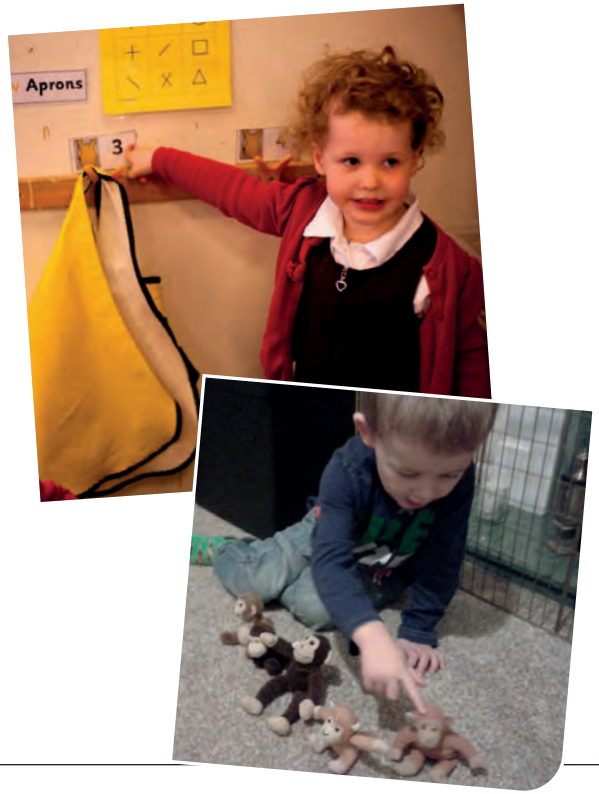
Carefully plan session for discovery and challenge:

- Introduce baskets of natural resources with similar properties. Different size and shaped containers with lids and fabric inside for babies and toddlers to use and apply skill of using fingers to lift lids and pull to retrieve items. Extensions could include varying the length of fabric, texture of fabric
- Observe how they vary their techniques to retrieve items. Offer running commentary “The ribbon”. Animated praise will encourage babies and toddlers to persevere
- Extend sessions introducing different size and shape containers where toddlers and babies push items through an opening. Vary the size of the items to push through the opening
- Challenge babies and toddlers to extend previously observed skills e.g. a baby that has mastered the ability to pull can be shown how to pull objects closer by dragging toys on materials. Set challenges by placing objects on blankets just out of reach
- Encourage use of recall and memory to solve problems
- Reinforce object permanence by playing discovery and rediscovery games, observe as babies and toddlers find different ways of finding partially hidden toys. Use tissues or small blankets to hide teddies
- Encourage babies and toys to take the lead in hiding objects using their hands or resources provided. Praise their solutions “Teddy’s under here”
- Toddlers can be supported to look for and retrieve up to three items out of different containers or under boxes

Respond to every day problems:

Encourage babies and toddlers to help look for spoon that has fallen, looking for missing toys under and behind cupboard

Age band	Significant milestones	Examples of effective practice to support number problem solving
22 to 36 months	• Learning to think critically to solve and make predications e.g. knows that a group of things change when something is added or taken away	



Number problem solving is nurtured by supporting critical thinking:

- Create a culture that spots and encourages problem solving naturally i.e. responding if a natural problem arises or setting up problems e.g. not putting out enough aprons, fruit, nappies for the dolls, hard hats in the construction area
- By encouraging children to identify that there is a problem (this is an essential stage of problem solving)
- Modelling how to solve it and seeking suggestions for solutions
- Provide activities such as jigsaws, slot-in puzzles, matching games, etc. and allow them time to try out ways to accomplish the task independently to support their thinking and problem solving skills

Create a culture for children to explore and investigate number in real life scenarios:

- **In the role play** – Are there enough eggs for each egg cup?
- **Outdoor areas** – Too many dolls for the prams, number opportunities woven throughout the setting e.g. interactive displays (number rhyme props - 5 current buns, numerals, book, song, finger puppets, dice, purse with 5 coins)
- **Loose part areas** with various containers

Model how to work jointly to solve problems:

- Through role play act as a taxi driver, your taxi will not drive without four passengers. Add and remove teddies
- Act as a sale assistant, you need to find and match pairs of shoes etc.

Plan guided sessions:

- Use puppets and props to demonstrate to identify and solve problems “Oh no mummy duck is upset - what happened?”
- Lead children to stand up and act out nursery rhyme problems. Ask three children to pretend to be monkeys and fall holding their head “One more monkey needs to see the doctor”. Repeat again and again the same processing different rhymes and encourage children to join in
- Use number rhymes to encourage children to predict what will happen if another speckle frog jumps into the pool
- Play games to encourage children to help you roll the dice and reach the end of a track. “What should we do now?”

Adult Role:

Work with individuals or small groups to model how to solve practical problems e.g. “I need one more brick to make my wall, can you help me?”

Sustain children’s and reasoning by observing and using reasoning techniques to enable children to identify and solve their own problems.

Number problem solving

Age band	Significant milestones	Examples of effective practice to support number problem solving

30 to 50 months

- Shows an interest in number problems
- May begin to use counting sets to solve problems
- Counting from one to solve problems

Number problem solving is nurtured by supporting children to think critically and apply their understanding of number to solve problems often by trial and error at first and then a more systematic approach.

Using the routine of the day to set challenges:

- **Tidy up time** – Observing how many items are missing from the labelled containers, shelves
- **Key person time** – Recoding how many children are absent. Reception children can add their name card with a number in the corner to a class number line
- **Create situations** to enable children to use their problem solving skills, e.g. only providing four aprons for the water area/six chairs at the snack table etc.
- **Snack and Lunch time** "How many slices of pizza do we need for everyone to have a piece today?"

Plan for challenges throughout the provision:

- Completing interactive number solving games e.g. feeding the hungry cat "Can you help me eat five multi-link cubes"
- Adding and removing props from the speckle frog board
- "Can you collect two pennies to pay for two pieces of fruit?"
- Sharing playdough out at the malleable table so everyone gets some
- Provide collections of items linked to children's interest with key challenge prompts "Share your shiny stones with Dino Pete and Dinosaur Susie". Observe if children are sharing fairly. Discuss how you know

Model how to use graphical marks to solve daily challenges – drawing two apples in response to the challenge. How many pieces of fruit have you eaten today? Writing my name on the correct number clip board for my preferred bike.

Plan guided sessions:

- **Using and moving objects** – to solve number problems, e.g. I had six cakes in my box. How many cakes has the greedy monster eaten?
- **Stage number problems through real life story contexts** – e.g. "Mrs Lyoba asked me to make six slices of toast." Show burnt slices, "Uh oh I burnt six slices", "How many more slices of toast do I need?"
- **Highlight number rhyme problems** – "If one more monkey is eaten by Mr Crocodile, how many monkeys will he have in his tummy?"
- **Use a class toy to pose problems e.g. in the outdoor construction area** – "How many parking spaces lines do I need to fit four cars in it?" "Oh no another car has arrived we now have five cars?"
- **Introduce and demonstrate how to use specific skills to solve problems** – "We have five bikes, if we park one how many are on the bike track?" Talk through the process of working this out. Show how to represent your thinking through using one graphical representation e.g. drawing a line for each bike. Work jointly for children to repeat this process. Set similar challenges and observe how children solve this problem independently
- **Work with individuals or small groups to model how to solve practical problems** – e.g. "I need one more brick to make my wall, can you help me?"

Sustain children's thinking and reasoning by observing and using reasoning techniques. Encourage children to develop their ideas further (see page 32).

Number problem solving

Age band	Significant milestones	Examples of effective practice to support number problem solving

40 to 60+ months

- Embedding counting from 1 to solve problems
- Beginning to count on to solve problems
- Begins to identify own mathematical problems based on own interests and fascinations

Number problem solving is nurtured by supporting children to think critically, work systematically to apply their understanding of number (counting on, sharing, doubling, halving) to solve a wide range of similar or different problems.

Using the routine of the day to set challenges:

- **Tidy up time** – Encourage children to do a stock check of clothes in the home corner. Hunt for missing items, check and replenish resources. How many pencils have we got all together? Have we got the same number of coloured pencils in each pot? How many new glue sticks will we need tomorrow? We need six scissors in this pot. We have got four, how many more do we need? Encouraging children to count on
- **Self-registration** – Children can add their name card with a number in the corner to a class number line
- Older children can collect data about favourite fruit, how much fruit is eaten daily by a small group of friends or the whole class

Plan for challenges throughout the provision:

- **Number station pit stop challenges** – Provide markers, note pads and challenge cards for children to reprint thinking to solve challenges. How many different ways can we post six pom poms in to two boxes? e.g. one handful of two and the other hand with. How many ways can you make 10 passengers sit in the train with three carriages?
- **Create whole class inquiry** – "Oh dear, a number has been stolen off the number line". Observe how children discover which number is missing. Discuss their solutions once the number has been found

Plan guided sessions:

Encouraging the children to:

- **Look what is in front of them to talk through problems** – "I can see three on the die, picture in your head, how many more do I need to win?"
- **Solve number riddles** – "Guess my number - I am one less than five and one more than three, who am I?"
- **Encourage children to visualise a word problem** – "If you have two bunnies and four carrots how many carrots could they both eat?"
- **Work in pairs to set and solve number problems** – This encourages children to verbalise their thinking. Small collection pots with a number label attached work together to fill the pots how do you know you are correct? Or fill one pot with 10 buttons but we need two of each different colour. Encourage children to use key questions/phrases "How do you know", "Show me how you...." "Why?"
- **Encourage children to make up problems using story props and rhymes** – Encourage them to see the pattern i.e. adding one more. Start by modelling how to create a problem. "Only three little ducks came back." "Where do you think the other ducks have gone?"
- **Model how to use and apply new techniques** – E.g. roll two dice count on from the largest number
- **Sustain children's thinking and reasoning by observing and using reasoning techniques** – Model how to talk through findings (see page 32)

The representations and graphical mark making process

Early exploration with mathematical marks

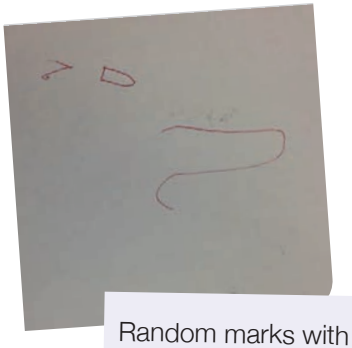
Early written numerals

Numerals as labels

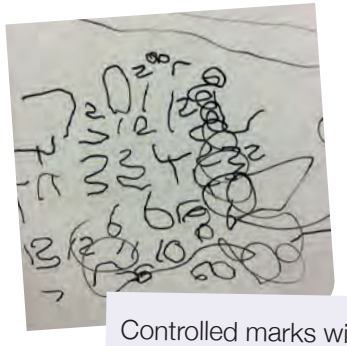
Representing quantities that are not counted

Representing quantities that are counted

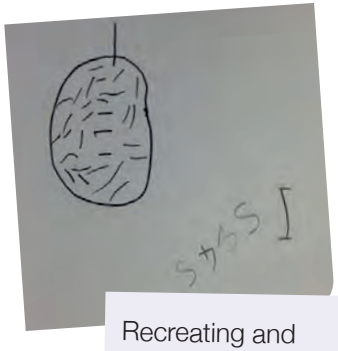
Examples of effective practice...



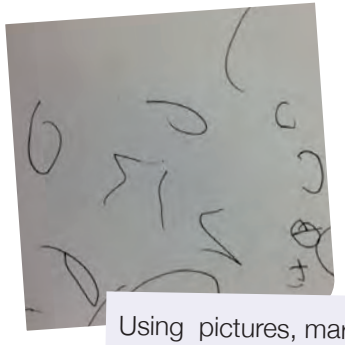
Random marks with ascribed mathematical meanings whilst playing “Four leaves”



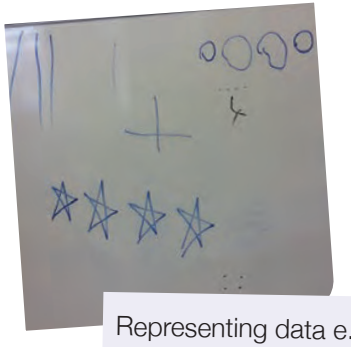
Controlled marks with attempts to writing numerals. Some clear features of standard written numerals.
“I like numbers”



Recreating and attempting to use standard numerals purposefully.
“1, 2, 3, 4, 5 leaves”



Using pictures, marks and or symbols to record an approximate amount e.g. lots or a few. “I found lots and lots of leaves”



Representing data e.g. exact tallies, drawing each item, specific symbols linked directly to the items they want to signify. “We all found four leaves”

The representations and graphical mark making top tips

Create a culture where children are supported to choose drawing, mark making, symbols and numerals to explore, communicate their thoughts, and signify meaning, and share their understanding about number

Plan object-led, and or symbolic play to nurture children's ability to communicate and represent their number thinking. Enrich children's number thinking skills by introducing opportunities, resources and vocabulary that build upon and reflect children's own cultural and social use of number

Create a number rich enabling environment. The greatest resource is you. Model how, when to represent number thinking. Use number representations and graphic mark making to express your thought processes

Observe and assess the range of methods children use to represent their thoughts and communicate understanding and use number

Praise and value and collectively celebrate how children represent their thoughts and numbers

Avoid situations where children are asked to record or practice writing numbers without a legitimate or meaningful purpose

Create opportunities for sustained shared number thinking and jointly talk about how and when to represent numbers, quantities, totals using a wide range of graphical mark making

Create opportunities to support children's age appropriate fine and gross marking skills (see the mark making to writing guidance for ideas)

Provide resources that captivate children's interest and make it exciting to use a range of graphical mark making tools and equipment e.g. cameras, clip boards, chalks on the ground etc.

Representations and graphical mark making

Pre-early-Representations and graphical mark making

Age band	Significant milestones	Examples of effective practice to support representations and graphical mark making
Birth to 11 months	• Babies are logical thinkers. They build an awareness of own physical space through touch and movement. They make meaning in play as they make gestures and oral sounds. These skills are crucial as it will be used later on to form concepts about, pre-number concepts and problem solving	
8 to 20 months	• Developing an awareness of self in relation to the world as they learn to crawl, bottom shuffle and cruise. They make meaning in play as they move their whole body • These skills are crucial as they will be used later on to form concepts about pre-number concepts and problem solving	
16 to 26 months	• Developing spatial relationship as they begin to use their bodies to explore shapes and move in different directions. They make meaning in play as they make actions and say some words • These skills are crucial as they will be used later on to form concepts about pre-number concepts and problem solving	

Number representations and graphical mark making begins by communicating meaning through play. Create opportunities for guided and independent play sessions.

Plan 'object' play sessions for young children to observe and build a knowledge of people, action, objects:

- Mirror play
- Treasure baskets
- Sensory boxes
- Cause and effect toys
- Items to be explored with the whole body.
- Wrist, feet and hand held rattles

Plan symbolic play sessions:

- Provide objects which are naturally linked together – model how to make links by your running commentary. "Nice hair" whilst brushing the dolls hair. e.g. whilst using a tea pot to pour a drink make "Umm" and drinking sounds. Whilst using a pan and wooden spoon say "Stir, stir" to drink
- Model your thoughts whilst using toys "Brum"- whilst playing with cars, "Wow" when the light flashes
- Create opportunities to support children to represent their thinking through early symbolic play
- Encourage children to use one object to represent another object and introduce how to use simple actions during pretend play. Pretend that a wooden block is a mobile, lie on a cushion and pretend to sleep

Create challenges for babies and toddlers:

- Toys that inter-link and connect in different ways. Model how to try and not give in. Talk through your thinking. Create time and space for trial and error opportunities
- Provide opportunities for physical exploration – Fingers, feet and actions to number rhymes and songs, Finger games and songs pointing out other body parts, Nappy art. Hand and foot painting. Messy play e.g. gloop
- Help to create an awareness of self in relation to the world e.g. mirrors in different areas around the room so that babies can see themselves in various situations

Age band	Significant milestones	Examples of effective practice to support representations and graphical mark making
22 to 36 months	• Beginning to show awareness of numbers in the environment • Early experimenting with symbols and marks representing personal ideas about numbers	**Through play toddlers gain an understanding of how number representations and graphical mark making are used by the adults around them.** **Create a number rich environment:** • Actively talk about numbers and point out numbers in the environment • Encourage children to ask questions about the numbers they can see and how and when to use them e.g. numbers on bus, licence plates, doors, mobile phones, cash machines, microwave etc. • Demonstrate how and when to represent numbers "We need one more apron". Write numeral one alongside a picture of an apron **Guided sessions:** • Jointly plan with children how to represent number ideas so others can understand e.g. writing birthday cards for friends • Plan for role play opportunities with a number rich theme. Provide tools and equipment to enable children to imitate adults using numbers e.g. writing down phone numbers next to the phone, create challenges whilst playing alongside children to use numbers in a meaningful way e.g. how to record the numbers of turns I can have on the electronic hairdryer • Encourage children to see you use numbers in role. Mummy bear writes a note on the door. Back in 5 minutes!

Representations and graphical mark making

Age band	Significant milestones	Examples of effective practice and essential resources to support representations and graphical mark making
 30 to 50 months	• Beginning to represent numbers using fingers, marks on paper or pictures • Shows an interest in representing numbers of personal significance. Sometimes matching numerals and quantity correctly • Shows curiosity about numbers by offering comments or asking questions • Shows an interest in numerals in the environment • May be encouraged to use graphical representations drawings, tallies, invented symbols to support their thinking	**Routines:** • Challenge children to represent numbers for purpose as soon as they enter the setting e.g. "How many friends can I see?" • Helping to itemise the numbers of pieces of fruit I want to eat this morning etc. **Create opportunities for a number rich environment:** • Ensure numbers are represented indoors and outdoors. Have number lines at child height • Display numbers horizontally and vertically to encourage children to recognise the different ways numbers can be recorded • Display numbers in the environment such as visits to shops • Create themed workshop spaces and have tools and equipment for children to readily represent their number thinking e.g. shopping lists, writing and following recipes in the mud kitchen • Providing resources to represent numbers such as dry wipe boards, paper, pens, crayons, magnetic numbers, chalk boards and chalk, messy mark making • Resources to explore numeral exploration e.g. magnetic boards, textured numbers • Number challenge pit stops – areas through the provision with challenge cards e.g. pencil and pad, asking children to seek and find objects around the room e.g. record how many door handles, or shoes, or jigsaws, etc. • Draw tallies when playing skittles to keep score. • Write numerals on a whiteboard then encourage children to do the same when reading a number story or rhyme • Allow children to measure items using rules, scales, etc. Encourage children to 'write down' or 'draw' their findings on paper, chalk boards, etc. **Guided sessions:** • Plan to model – how and when to use representations and graphical mark making. Sharing your thoughts will enable children to understand the process not just the end product • Refer to numbers displayed in environment, on flash cards etc. to support you whilst teaching • Use fingers, toys, stickers, marks to represent objects. • Model how to check that each object is represented • Create active maths sessions – using tallies, drawing to represent number of claps jumps, claps etc. solve the problem how many more wiggles to make five etc. keeping scores during games • Find ways to promote the use of graphical mark making e.g. when reciting number rhymes with props such as five little ducks represent number of ducks with a symbol, tally or numeral

Representations and graphical mark making

Age band	Significant milestones	Examples of effective practice and essential resources to support representations and graphical mark making

40 to 60+ months

- Show an awareness of when and how to represent numbers they have counted and to recheck for accuracy
- Record their mathematical thinking using representations (invented symbols, standard symbols) that they can interpret and explain
- Uses a flexible range of invented symbols and standard numerals to represent quantities
- Uses graphical representations (combining drawings, words, numerals and personal symbols) to help them find to calculate with small numbers

Routines:

- Challenge children to represent numbers for a purpose daily e.g. representing items that need replenishing in the workshop areas
- Taking the register, recording lunch and snack preferences
- Establish numeral graffiti walls – children represent items seen on the way into school
- Introduce 'a problem a day' – recording the solution to our problems

Create a culture where representing number is high priority:

- Create opportunities for a number rich environment e.g. Role play e.g. café, taking orders, how many drinks
- Design sheets in the modelling area for children to record how many of each material they need e.g. one rolling pin, three cutters
- Actively involve children in setting up themed areas
- Designing packaging, price lists, shop labels, security codes. Model how each character would represent numbers differently e.g. the shopper may use graphical mark making to draw how many items are needed, use lines to find the total, fingers to solve problems e.g. collect one more, the shopkeeper may use graphical representations to record how many customers came in the shop, work out the total
- Introduce the skills and resources needed for everyday resources that don't link to a theme but provide a wider graphical mark making opportunities e.g. maps, music sheets, tickets, calculators

Number challenge pit stops:

- Working in pairs or very small group to complete challenge cards. Help each pair or small group to share their thinking with other children or an adult
- Group children into number detective groups – very small groups that can work together whenever they choose to solve number problems
- Value and celebrate children's representations by including them in photo albums, displaying steps used to solve problems with child voice included

Guided sessions:

- Plan how to support children to use representations and graphical mark making to record quantities that are counted and not counted e.g. identify and solve problems
- Model open ended questions and share how to think through and represent each thought process
- Make connections to other problems and revisit and remind children how solutions were represented previously
- Encourage children to work with talk partners and share representations with others. Record these sessions and use these to support independent application
- Build up a book of the various written methods of calculation e.g. use fingers, toys, stickers, marks to represent objects. Include ideas how to check that each object is represented
- Refer to these when playing games, or adult focused activity i.e. "I remember when I used my fingers to represent my answer - let's check."
- Act as a scribe – discuss and help children to see their mental methods written down. Encourage children to make connections to what they already know. "I know six can be represented like that." – pointing to the number line"

Number sense milestones

Observation and assessments

Birth to 11 months
The number journey

Exploratory play experiences
Grosvenor Daycare

Number rhyme mobiles
Gaskells Nursery

Snack time
Oxford Grove Children's Centre

Significant number sense milestones

Number language

- Makes sounds with their voice during social interaction

Pre-counting

- **Developing counting awareness/pre-counting**
  Developing pre-counting skills by noticing the differences in quantities (up to three items) through touch, movement, listening, responding and vocalisation. (No counting is involved)

Number patterns

- Discovering how others respond to needs
- Makes vocalisation to repeated interactions

Pre-number problem solving

- Babies are natural problem solvers. They explore and engage with familiar and unfamiliar objects
- Finding new ways to use the whole body and senses to make items move, fit together and reappear
- **Babies demonstrate very early signs of object permanence.**
  Child reaches for a partially hidden object

Pre-representation and graphical mark making

- Babies are logical thinkers. They build an awareness of own physical space through touch and movement
- They make meaning in play as they make gestures and oral sounds
- These skills are crucial as it will be used later on to form concepts about, pre-number concepts and problem solving

Early Years Outcomes: Notices changes in number of objects/images or sounds in group of up to three.

Significant milestones: Look, listen, note and consider

Number language

- Can I use a range of sounds and facial expressions to join in with familiar number and action rhymes?

Pre-counting

- Am I able to follow simple instructions? I may need more opportunity to explore objects, or more time to respond to your facial expressions?
- Do I need more opportunity to discover and compare objects? Check if I am able to put items in and out of containers?

Number patterns

- Am I developing a more regular eating and sleeping pattern?
- Am I able to move my arms and legs to let you know I want to keep exploring and playing?
- Can I make a few different sounds in response to your repeated sounds — babbles, coos, and gurgles?

Pre-number problem solving

- Am I able to move my body to attempt to reach an item I want? I may need to be challenged to seek items out of reach
- Am I able to hold out my hand and gesture that I need support? I may need you to model cause and effect motions with games, toys and repetitive actions
- Am I exploring ways to handle toys squeezing soft fabrics shaking things that rattle? This is a clear sign that I am able to sort and compare items
- Am I able to hunt for hidden toys? I may need you to play more disappearing and reappearing games

Pre-representation and graphical mark making

- Am I showing understanding of how real objects are used?
- Note how I use my whole body to become familiar with objects and the specific actions that I can make e.g. picks up a comb and touches his hair. Record how I begin to use objects to express my ideas. This is form of object play helps me represent my thinking through exploration

Birth to 11 months

Characteristics of effective number sense

Characteristics of effective number sense

Playing and exploring
engagement

- I enjoy finding out how to use my voice to make a range of different sounds
- I explore how to get your attention by changing the way I use my voice
- I get excited when I anticipate what's going to happen after you put my bib on

Active learning
motivation

- I am motivated to find hidden objects
- I will keep trying to reach for objects close to me and far away
- I will change my voice e.g. giggle, screech, yelp, gurgle, when you show me a set of different objects, try to hide them and make them reappear

Creating and thinking critically
thinking

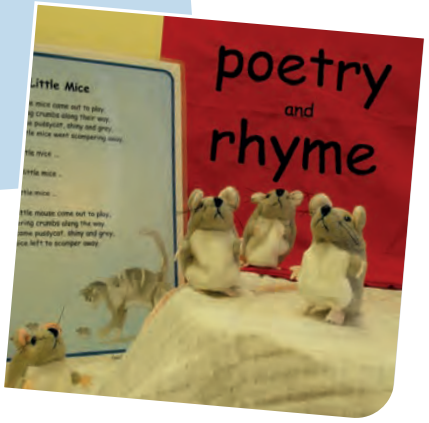
- I am beginning to think about the sounds I make
- I am beginning to work out how I can get objects away from you
- I am making a link that when I throw objects you will bring them back
- I am aware that my fingers can grasp, touch and hit different size objects

8 to 20 months

Heuristic play
Alexandra Under Three Centre

Treasure basket exploration
Grosvenor Daycare

Number rhymes home learning bags
Bolton Early Years and Childcare Team



Significant number sense milestones

Number language

- Develops an awareness of number names through their development of action rhymes and songs that relate to their experiences of numbers

Pre-counting

- **Developing counting awareness/ pre-counting**
  Developing pre-counting skills by comparing and discriminating between preferred quantities based on more or less during playful interactions

Number patterns

- Beginning to identify patterns in everyday routines

Pre-number problem solving

- **Early signs Object permanence**
  The desire to look for a hidden object emerges with awareness that things exist even when out of sight
- Can actively cooperate during routines, beginning to learn to take turns
  Repeats sequences numerous times to solve problems

Pre-representation and graphical mark making

- Developing an awareness of self in relation to the world as they learn to crawl, bottom shuffle and cruise
- They make meaning in play as they move their whole body
- These skills are crucial as they will be used later on to form concepts about pre-number concepts and problem solving

Early Years Outcomes: Develops an awareness of number names through their enjoyment of action rhymes and songs that relate to their experience of numbers.
Has some understanding that things exist, even when out of sight.

Significant milestones: Look, listen, note and consider

Number language

- I can recognise your voice when you use repeated phrases such as all-gone, number sequences 5, 6, 7, 8
- I can begin to make noises when you sing number songs
- I attempt to join in with facial movements, claps and hand movements when you sing number rhymes

Pre-counting

- Check if I am attempting to make sounds when you read repetitive and very familiar number stories. I may need you to slow down or say the numbers more clearly
- Check if I am able to help you clap as you count
- Am I attempting to copy some of your actions as you sing number rhymes?
- I may need to hear you model counting or listen as you sing and more number rhymes

Number patterns

- Am I able to copy repeated actions? I may need more opportunity for repetition to build up my memory
- Am I am beginning to anticipate daily routines? Lying down when you turn the lights down at nap time
- Do I work out how things should be used wanting to play with the same toy again and again?
- Look at my new skills and find ways to make other links e.g. if I've learned how to throw, set up containers for me to throw items into

Pre-number problem solving

- Am I able to experiment and try different ways to use items?
- Notice the different ways I experiment and manipulate items to fit together
- Look at the way I repeat actions whilst making sounds
- Will I try to look for you when you cover and uncover your face and with an item?
- Am I able to show you I can solve problems by anticipating a routine e.g. to drop a cup in the bowl, put hand wipes in the bin?

Pre-representation and graphical mark making

- Observe how I use my hands and feet to engage in pretend play and use one object to represent another e.g. using a stacking block to make a phone call. I am beginning to use objects to communicate meaning and express my thoughts e.g. reaching for my cup when I am thirsty

8 to 20 months

Characteristics of effective learning

Characteristics of effective learning

Playing and exploring
engagement

- I seek reassurance as I crawl to hidden objects
- Active play allows me to identify patterns and make links in my daily routines
- I am beginning to anticipate that you will make different facial expressions when you sing number rhymes to me
- I am learning to problem solve when I attempt to grab, repeatedly drop and explore new objects

Active learning
motivation

- I concentrate intently on the words you use when placing food snack in front of me saying “Two fat sausages”
- I am fascinated when you point to and count my toes and fingers
- I will persevere at moving my toys in several different ways
- I look for your approval when I keep trying to open and shut containers several times

Creating and thinking critically
thinking

- I increasingly recognise the number songs you sing
- I am beginning to see patterns as you point to each new object one by one
- I am aware that if I change my movements I can explore and find the three objects you have hidden around the room

16 to 26 months

Self-registration stations
Gaskells Private Day Nursery Ltd

Interactive displays
Grosvenor Daycare Centre

Number stories
Bolton Early Years and Childcare Team

Significant number sense milestones

Number language

- Says numbers randomly, for example 1, 3, 5

Pre-counting

- **Developing counting awareness/pre-counting** Early understanding of the concept lots and few. Early awareness of that items can be the same or not the same. Children at this stage develop these concepts by comparison and practical opportunities to select objects using one to one correspondence in practical situation
- This is important because these concepts lay the foundation for children to later develop an understanding of the many ways that numbers are related to each other

Number patterns

- Identifies patterns in routine and behaviour (needed for logical reasoning, predictions and problem solving)

Pre-number problem solving

- Problem solving through recalling familiar events, objects and sequences
- Understanding that problems can be solved through repeated patterns, actions, categorising and organising objects
- **Understanding of object permanence** - knows that things exist and where to look when out of sight with very little error

Pre-representation and graphical mark making

- Developing spatial relationships as they begin to use their bodies to explore shapes and move in different directions
- They make meaning in play as they make actions and say some words
- These skills are crucial as they will be used later on to form concepts about pre-number concepts and problem solving

Early Years Outcomes: Knows that things exist, even when out of sight. Beginning to organise and categorise objects, e.g. putting all the teddy bears together or teddies and cars in separate piles. Says some counting words randomly.

Significant milestones: Look, listen, note and consider

Number language

- I can say 1, 3, 5 randomly
- On occasion I may appear to say 1, 2, 3, 4, 5 in order but listen carefully I may not separate the words and stumble over number names. I may need to slow down when I say number names

Pre-counting

- Listen carefully am I able to attempt to sing number rhymes by myself?
- Do I show awareness that the numbers I am saying have a significant meaning?
- Look carefully am I able to understand why you are saying numbers as you point and touch the items you are counting?
- Can I recognise when items change quantity?

Number patterns

- Do I appear to show awareness that different things will happen throughout the day? e.g. nap time, nappy changing routine
- Notice how I respond to changes different from my everyday routine
- Am I beginning to join in with some of the actions to number songs and rhymes?

Pre-number problem solving

- Notice how and when I tackle problems
- Record the different skills I use to solve similar problems
- Note if I am motivated keep trying to reach items when I have to bend, stretch for just out of reach items or look above to track items. I may need you to play more challenging exploration games
- Do I show any signs that I have remembered recent hiding places?

Pre-representation and graphical mark making

- Observe how I engage in early symbolic play. Am I beginning to imitate the actions you make with markers? Note how I react when I use markers. Am I making sounds as I make random marks? Carefully observe my responses. Am I starting to realise that marker can be used as cause and effect? i.e. when I make a mark you react

16 to 26 months

Characteristics of effective number sense

Characteristics of effective number sense

Playing and exploring
engagement

- I am confident to try out my new number words when you count out my snacks
- I am willing to have a go at using the words I know when I follow your lead during number labelling games
- I enjoy having a go taking turns to count

Active learning
motivation

- I am curious to work out and practice the pattern in our games 'my turn your turn'
- I enjoy handing you the props whilst we sing our number songs
- I attempt to put my toys in different groups as I am curious about how they look and feel
- I keep trying to make you laugh as I hand you one item at a time and hear you count them

Creating and thinking critically
thinking

- I will try different ways to get more objects from you and my friends
- I am able to test and compare the way items feel in my hands
- I like to post different objects one at a time and will attempt to try to work out how I can post two objects at the same time

22 to 36 months

Number hunt
St Mary's Deane C of E primary School

Role Play - Goldilocks and the three bears
Tonge Moor Primary School

Numbers in the malleable area
Grosvenor Nursery School

Significant number sense milestones

Number language

- Uses some language of quantities such as more and a lot
- Recites number names in sequence
- Can predict a missing word in number rhymes, number songs, etc.

Counting

- **One-to-one counting**
  This is the ability to count using one to one correspondence.
- **Two skills are needed:**
  1. ability to say the standard list of counting words in order. At this early stage children are encouraged to recite some number names in sequence, whilst playing or singing number rhymes etc.
  2. ability to match each spoken number with one and only one object. At this early stage children may select a small number of objects from a group when asked for example 'please give me one', please give me two'
- Beginning to show an awareness of the empty set e.g. "all gone"

Number patterns

- Recognising and anticipating patterns in routine and behaviour (needed for logical reasoning, predictions and problem solving)
- Identifying and anticipating what comes next, in events that have personal significance and beginning to identify links and connections to symbols, images and some of the numbers that they know
- Developing a concept of more, less or the same
- **Subitising number** instantly recognising the number of 1, 2, 3 objects without counting. This is crucial for later number partitioning skills

Number problem solving

- Learning to thinking critically to solve and make predications e.g. knows that a group of things change when something is added or taken away

Early representation and graphical mark making

- Beginning to show awareness of numbers in the environment
- Early experimenting with symbols and marks representing personal ideas about numbers

Early Years Outcomes: Selects a small number of objects from a group when asked. Recites some number names in sequence. Creates and experiments with symbols and marks representing ideas of number. Begins to make comparisons between quantities. Uses some language of quantities, such as 'more' and 'a lot'. Knows that a group of things changes in quantity when something is added or taken away.

Significant milestones: Look, listen, note and consider

Number language

- I am getting confident at reciting number names but listen carefully. Am I missing out any numbers e.g. 6, 8, 9, 10
- Sometimes I may need to count out loud for you to check if I am saying number names in the wrong order
- Check am I using the words more or a lot during play

Counting

- Am I curious of how numbers and counting apply in my everyday life? I may need opportunity to see you model how to use numbers in my environment
- Listen carefully am I attempting to point to items and say numbers at the same time? I may need time to hear you use numbers to label items
- Notice if I try link a number to more than one item. I may not understand the need to touch one item at a time

Number patterns

- Notice how and when I can repeat patterns in my play e.g. joining in during number songs, body movements and actions
- Can I repeat a sequence of large movements and small actions e.g. playdough pressing?
- Can I anticipate that you will give me something when you ask would you like more?
- Am I able to look at my toys when you point out that you have fewer toys?

Number problem solving

- Am I able to anticipate the next number prop needed when you pretend to forget?
- Notice and record what suggestions I make to help you add and take away items to and from a set of toys
- Listen if I say any number words when I try to help the teddy to count to and from five
- Note if I use any number words, counting skills to help you match missing objects

Early Representation and graphical mark making

- Observe how I begin to imitate how different adults use marks e.g. pretend to be dad writing a shopping list or a doctor writing a prescription. Do I show any awareness that my marks carry meaning?
- Can you identify any repeated marks that I make? I may need to see you model how you communicate numbers through your representation. I may need to be exposed to more numbers around me

22 to 36 months

Characteristics of effective learning

Characteristics of effective learning

Playing and exploring
engagement

- I enjoy singing songs using numbers I know
- I like to be shown numbers in the environment
- I am willing to have a go at selecting a few items on request e.g. one grape, two apples

Active learning
motivation

- I get very excited when I look for numbers outside
- I am able to pay attention when comparing two groups of objects
- I am pleased that I can instantly recognise two slices of bananas or one slice of apple when you point to my snacks
- I keep trying to make marks to show you the numbers I can see around me

Creating and thinking critically
thinking

- I am developing my own ideas when and how to add and take away my friends toys
- I can plan what comes next when I sing number action songs
- I notice the pattern when you count and represent number names

30 to 50 months

Environmental numbers
St James' (Farnworth) CE Primary School

Spotting numbers everywhere
Karen Dickie (Childminder)

Finger counting displays
St James' (Farnworth) CE Primary School

Significant number sense milestones

Number language

- Uses some number names and number language spontaneously
- Uses some number names accurately in play
- Recites numbers in order to 10
- Using ordinal and narrative language e.g. first/beginning etc.

Counting

- **Embedding one-to-one counting** ability to say the standard list of counting words in order e.g. recites numbers in order to 10
- **Cardinality and stable/constant count** Children understand cardinality. I.e. know that the last number counted tells the size of that set. Know that the numbers in a set will remain constant as long as no items are added or taken away from the set
- Know that numbers identify how many objects are in a set e.g. separates a group of objects of three or four objects in different ways beginning to recognise the total is the same. Sometimes matching numerals and quantity correctly
- Use zero and the numeral to represent the empty set e.g. 0
- Realise not only objects but anything can be counted. Cardinality is important because it allows numbers to be used to describe and compare sets. This allows sets of items to be combined (addition) and separated (subtraction)

Number patterns

- Identifies and anticipates what more than, less than will look like
- Developed an understanding of one more than one less
- Begins to see a pattern of numbers as they use fingers whilst reciting number orders to 10. E.g. relationship of numbers 1-4 to 5 and 6-9 to 10
  Subitising (instantly recognises the number of up to 4 objects without counting). This is for them to be able to separate a group of three objects in different ways and begins to recognise that the total is still the same

Number problem solving

- Shows an interest in number problems
- May begin to use counting sets to solve problems
- Counting from one to solve a problem

Representation and graphical mark making

- Beginning to represent number using fingers, marks on paper or pictures
- Shows an interest in representing numbers of personal significance
- Sometimes matching numerals and quantity correctly
- Shows curiosity about numbers by offering comments or asking questions
- Shows an interest in numerals in the environment
- May be encouraged to use graphical representations drawings, tallies, invented symbols to support their thinking

Early Years Outcomes: Uses some number names and number language spontaneously. Uses some number names accurately in play. Recites numbers in order to 10. Knows that numbers identify how many objects are in a set. Beginning to represent numbers using fingers, marks on paper or pictures. Sometimes matches numeral and quantity correctly. Shows curiosity about numbers by offering comments or asking questions. Compares two groups of objects, saying when they have the same number. Shows an interest in number problems. Separates a group of three or four objects in different ways, beginning to recognise that the total is still the same. Shows an interest in numerals in the environment. Shows an interest in representing numbers. Realises not only objects, but anything can be counted.

Significant milestones: Look, listen, note and consider

Number language

- I enjoy showing you that I can count to 10 but can I count backwards from 5. Can I start counting from 2, 3, 4, to 10 or 6, 7, 8, 9, 10
- Check if I am pronouncing all of my numbers correctly
- I can hide toys by following your instructions. But listen carefully can I tell you where I found it e.g. tin number 10, tin number 4
- I can use the word first, and second check if I understand the meaning of third e.g. choosing the third car

Counting

- Can I show you and talk about sets of items? "I ate two apples". I may need more practice to match numbers to sets. Role play matching three cups to three saucers
- Do I get confused if you rearrange a set of items already counted? Saying more or less than the previous count. I might need more activities to count and rearrange and count again
- Note how I count a set of objects. When asked can I tell you how many items I have or do I need to recount again? I might need more practice in understanding the final number that I count represents the total
- Am I able to use numbers to make the comparison? "You jumped three times I can jump three times". "I have got six beads, you have got fewer than me"

Number patterns

- Check If I understand the number names and concepts of more and less as this will effect my ability to show you how to change toys to make more, less and the same as your set
- Am I able to anticipate what number you will sing next? E.g. can I sing missing parts of number songs?
- Notice how I manipulate my fingers as this may affect my ability to use fingers to count
- Check if I can recognise a small group of objects, dots and shapes without counting
- Notice am I beginning to recognise 4 or less items without counting them

Number problem solving

- Observe if I am able to spot deliberate mistakes i.e. when a puppet misses a number when counting. How did I check?
- Am I able to use my number skills to complete games in a group?
- Am I able to anticipate what number comes next to solve problems?
- Notice do I use number language when solving e.g. helping to hand out the medal to the car that came second
- Notice what skills do I use when trying to count to solve a problem

Representation and graphical mark making

- Listen carefully as I use markers during number rich activities. Am I beginning to use my marks to express my ideas about numbers? e.g. using marks as symbols to represent quantities or attempting to write numerals. I may need to see you model how to use symbols to express your thoughts/ solve problems or record numerals. I may need you to join me and make using number fun e.g. recording scores
- Do I show an awareness that every mark I make links to the exact number I am trying to represent? e.g. counting the items and checking that the marks I made match

30 to 50 months

Characteristics of effective number sense

Characteristics of effective number sense

Playing and exploring
engagement

- I can initiate how to solve a problem by counting from one onwards
- I take risks when using the new number names to answer questions
- I pretend money is real when I serve customers in the role play areas

Active learning
motivation

- I concentrate on similarities and differences of a group of objects
- I am really pleased that I can show you how old I am by holding up three fingers
- I am able to bounce back when I count incorrectly
- I am proud of how I record my thinking by drawing long lines to show you how many snacks I have eaten

Creating and thinking critically
thinking

- I am able to predict what number comes next as you ask for one less
- I am able to check and recheck how items are missing in the home corner
- I am able to look carefully at the pictures my friends make and keep score during our football match

40 to 60+ months

Numicon activities
Tonge Moor Primary School

Maths workshop
St James' (Farnworth) CE Primary School

Creating real opportunities to use number
St James' (Farnworth) CE Primary School

Significant number sense milestones

Number language

- Begins to use vocabulary subtraction
- Uses language of more or fewer
- Says the number that is one more than a given number
- Can explain their graphical marks
- Counts forwards and backwards within the number sequence 1 to 10
- Can count reliably from 0-20, say which number is one more or one less than a given number
- May be able to explain the strategies used to solve problems
- Use of ordinal language e.g. first, second, third

Counting

- **Embedding cardinality and stable/ constant count**
- Accurately counting actions or objects which cannot be moved
- Counting irregular arrangements of objects to 10, and beginning to count beyond 10
- Counts out up to 6 objects from a large group
- **Use counting skills to:**
- Partition and recombine small groups of objects
- Counting from one to solve number problems - counting a first set starting from 1 e.g. 1, 2, 3, 4 and adding this number to a new set of objects to solve addition problems (up to 2 single digit numbers)
- Or counting a first set starting from 1 e.g. 1, 2, 3, 4 and removing this away from a larger amount to solve subtraction problems (up to 2 single digit numbers)
- Counting on or back to solve number problems e.g. starting counting the largest set first then adding or subtracting this from the smaller set

Number patterns

- Embedding pattern of numbers as they use fingers whilst reciting number orders to 10 e.g. relationship of numbers 1-4 to 5 and 6-9 to 10
- Recognising the relationship 0-10 and significant stopping points. i.e. 5 can be used to count on to 10. 8 is 2 away from 10. 10 is a significant point to count on to 20
- Begins to become aware of patterns for 1 to 9 provides a guide to counting larger 2 digit number sequences
- Begins to recognise the patterns of pairs whist using fingers to count and object sort
- **Subitising** - the skill of visually recognising up to 5 objects is now used to help count, group and recognise objects mentally. This is needed for partitioning e.g. the ability to move around, or partition and regroup and combine small groups of up to 4 objects and recognises that the total is still the same
- Make reasonable estimates for small quantities

Number problem solving

- Embedding counting from one to solve problems (including doubling, halving and sharing)
- Beginning to count on to solve problems (including doubling, halving and sharing)
- Begins to identify own mathematical problems based on own interests and fascinations

Representation and graphical mark making

- Shows an awareness of when and how to represent numbers they have counted and to recheck for accuracy
- Record their mathematical thinking using representations (invented symbols, standard symbols) that they can interpret and explain
- Uses a flexible range of invented symbols and standard numerals to represent quantities
- Uses graphical representations (combining drawings, words, numerals and personal symbols) to help them to calculate with small numbers

Early Learning Goal: Children count reliably with numbers from one to 20, place them in order and say which number is one more or one less than a given number. Using quantities and objects, they add and subtract two single-digit numbers and count on or back to find the answer. They solve problems, including doubling, halving and sharing.

Significant milestones: Look, listen, note and consider

Number language

- Can I use words add, more, fewer, less, sum, total, score, double, the same etc? Because I have had plenty of opportunity to use them during play
- Can I select a number of objects on request from a large group because I have acted this out in role and with you?
- Can I count accurately to 20 listen carefully am I confusing the way I say fifteen or thirteen? Am I able to point out to a puppet mispronunciation of teen words or mistakes when counting e.g. twenty nine, twenty ten?

Counting

- Listen carefully am I able to keep track when counting randomly arranged items? I may need more strategies to help me touch count i.e. lining up and moving each item, as I count
- Can I use a number track to count backwards, find a missing number during outdoor games?
- Check If I am over reliant on counting forward. Do I struggle to count backwards or need help to use a number track?
- Am I able to predict how many more items I need to complete a set? Do you think we have a enough sheep for the shepherds?
- Am I able to count on to solve simple number problems i.e. How many stones are there all together? How do you know?

Number patterns

- Do I have a firm understanding of the number sequence to 5 and then 10 e.g. what comes before and after?
- Can I tell you what is the same/ different about numbers to 5 and then to 10?
- Do I have a firm understanding of the teen numbers? Can I show you 1 more and 1 less than any teen number?
- Can I sequence a random assortment of numbers 0-20?
- Can I play number visualising /subitising games? This may affect my ability to recognise a number and hold it in my head for partitioning e.g. the ability to move around, or partition and regroup and combine small groups of up to 4 objects and recognises that the total is still the same
- Can I use my knowledge of numbers to 5, 10 and 20 to make realistic estimations?

Number problem solving

- Observe if I am confident at spotting number sequencing problems i.e. find the stolen number from the number line
- I may need more practice using the everyday numbers resources
- Can I tell you how I solve problems? I may need to hear you share how you solved a number challenge
- Am I able to offer solutions to practical problems? E.g. checking to see if everyone has the same amount of grapes. I may need to see you use different ways to solve simple problems
- Can I keep trying to solve problems using different ideas? i.e. combining groups, counting backwards, forwards using fingers
- I may need your support to make connections and apply my number concepts

Representation and graphical mark making

- Check if I can recognise numbers in the environment clearly am I confusing any number e.g. 6 and 9, 2 and 5, 1 and 11 or 3 and 8
- Check if I know that the marks you make represent a group of items you have counted. I may need more time to see you model this process
- Check if I accurately make marks for each item I want to represent. I may need more play based opportunities to practice
- Record my exploration of symbol making when and how do I use drawings, words, numerals and personal symbols?
- Note if I am using my own methods to work out number problems. Do I need to be challenged by seeing you record number sentences or find the total using several calculation sequences?

40 to 60+ months

Characteristics of effective number sense

Characteristics of effective number sense

Playing and exploring
engagement

- I can initiate how to solve a problem by counting from one onwards
- I take risks when using the new number names to answer questions I pretend money is real when I serve customers in the role play areas

Active learning
motivation

- I concentrate on similarities and differences of a group of objects
- I am really pleased that I can show you how old I am by holding up three fingers
- I am able to bounce back when I count incorrectly
- I am proud of how I record my thinking by drawing long lines to show you how many snacks I have eaten

Creating and thinking critically
thinking

- I am able to predict what number comes next as you ask for one less
- I am able to check and recheck how items are missing in the home corner
- I am able to look carefully at the pictures my friends make and keep score during our football match

Number sense significant milestone overview

Stage development	Number language	Pre-counting	Number patterns	Pre-number solving	Pre-representation and graphical mark making
Birth to 11 months	Makes sounds with their voice during social interaction.	**Developing counting awareness/pre-counting** Developing pre-counting skills by noticing the differences in quantities up to three items through touch, movement, listening, responding and vocalisation (no counting is involved).	Discovering how others respond to needs. Makes vocalisation to repeated interactions.	Babies are natural problem solvers. They explore and engage with familiar and unfamiliar objects. Finding new ways to use whole body and senses to make items move, fit together and reappear. **Babies demonstrate very early signs of object permanence.** Child reaches for a partially hidden object.	They build an awareness of own physical space through touch and movement. They make meaning in play as they make gestures and oral sounds. These skills are crucial as it will be used later on to form concepts about pre-number concepts and problem solving.
8 to 20 months	Develops an awareness of number names through their development of action rhymes and songs that relate to their experiences of numbers.	**Developing counting awareness/pre-counting** Developing pre-counting skills by comparing and discriminating between preferred quantities based on more or less during playful interactions.	Begins to anticipate a pattern of everyday routines.	**Early signs of object permanence** The desire to look for a hidden object emerges with awareness that things exist even when out of sight. Can actively cooperate during routines, beginning to learn to take turns. Repeats sequences numerous times to solve problems.	Developing an awareness of self in relation to the world as they learn to crawl, bottom shuffle and cruise. They make meaning in play as they move their whole body. These skills are crucial as they will be used later on to form concepts about pre-number concepts and problem solving.

Number sense significant milestone overview

Stage development	Number language	Pre-counting	Number patterns	Pre-number problem solving	Pre-representation and graphical mark making
16 to 26 months	Says some counting words randomly, e.g. 1, 3, 5.	**Developing counting awareness/pre-counting** Early understanding of the concept lots and few. Early awareness of that items can be the same or not the same. Children at this stage develop these concepts by comparison and practical opportunities to select objects using one-to-one correspondence in practical situations. This is important because these concepts lay the foundation for children to later develop an understanding of the many ways that numbers are related to each other.	Identifies patterns in routine and behaviour (needed for logical reasoning, predictions and problem solving).	Problem solving through recalling familiar events, objects and sequences. Understanding that problems can be solved through repeated patterns, actions, categorising and organising objects. **Understanding of object permanence** – knows that things exist and where to look when out of sight with very little error.	Developing spatial relationships as they begin to use their bodies to explore shapes, and move in different directions. They make meaning in play as they make actions and say some words. These skills are crucial as they will be used later on to form concepts about pre-number concepts and problem solving.

Number sense significant milestone overview

Stage development	Number language	Counting	Number patterns	Number problem solving	Early-representation and graphical mark making
22 to 36 months	Uses some language of quantities such as more and a lot. Recites number names in sequence. Can predict missing word in number rhymes, number songs, etc.	**One-to-one counting** This is the ability to count using one-to-one correspondence. **Two skills are needed:** 1. Ability to say the standard list of counting words in order. At this early stage children are encouraged to recite some number names in sequence, whilst playing or singing number rhymes etc. 2. Ability to match each spoken number with one and only one object. At this early stage children may select a small number of objects from a group when asked for an example "Please give me one", "Please give me two". Counting is important because the meaning attached to counting is the key conceptual idea on which all other number concepts are based. Beginning to show an awareness of the empty set e.g. "All gone".	Recognises and anticipates patterns in routine and behaviour (needed for logical reasoning, predictions and problem solving). Identifies and anticipates what comes next, in events that have personal significance and beginning to identify links and connections to symbols, images and some of the numbers that they know. Developing a concept of more, less or the same. **Subitising** instantly recognising the number of 1, 2, 3 objects without counting. This is crucial for later number partitioning skills.	Learning to think critically to solve and make predications e.g. knows that a group of things change when something is added or taken away.	Beginning to show awareness of numbers in the environment. Early experimenting with symbols and marks representing personal ideas about numbers.

Number sense significant milestone overview

Stage development	Number language	Counting	Number patterns	Number problem solving	Representation and graphical mark making
30 to 50 months	Uses some number names and number language spontaneously. Uses some number names accurately in play. Recites numbers in order to 10. Using ordinal and narrative language e.g. first/beginning etc.	**Embedding one-to-one counting** Ability to say the standard list of counting words in order e.g. recites numbers in order to ten. **Cardinality and stable/ constant count** Children understand cardinality. I.e. know that the last number counted tells the size of that set. Know that the numbers in a set will remain constant as long as no items are added or taken away from the set. Know that numbers identify how many objects are in a set objects of three or four objects in different ways beginning to recognise the total is the same. Sometimes matching numerals and quantity correctly. Use zero and the numeral to represent the empty set e.g. 0. Realise not only objects but anything can be counted. Cardinality is important because it allows numbers to be used to describe and compare sets. This allows sets of items to be combined (addition) and separated (subtraction).	Identifies and anticipates what more than, less than will look like. Develops an understanding of one more than/one less than. Begins to see a pattern of numbers as they use fingers whilst reciting number orders to 10 e.g. relationship of numbers 1-4 to 5 and 6-9 to 10. **Subitising** (instantly recognising the number of up to four objects without counting). This is crucial to be able to separate a group of three objects in different ways and beginning to recognise that the total is still the same.	Shows an interest in number problems. May begin to use counting sets to solve problems. Counts from one to solve problem.	Beginning to represent number using fingers, marks on paper or pictures • Shows an interest in representing numbers of personal significance • Sometimes matching numerals and quantity correctly • Shows curiosity about numbers by offering comments or asking questions • Shows an interest in numerals in the environment • May be encouraged to use graphical representations drawings, tallies, invented symbols to support their thinking

Number sense significant milestone overview

Stage development	Number language	Counting	Number patterns	Number problem solving	Representation and graphical mark making
40 to 60+ months	Begins to use vocabulary involved in addition and subtraction. Uses language of more or fewer. Says the number that is one more than a given number. Can explain their graphical marks. Counts forwards and backwards within the number sequence 1 to 10. Can count reliably from 0-20 say which number is one more or one less than a given number. May be able to explain the strategies used to solve problems. Uses ordinal language e.g. first, second, third.	**Embedding one-to-one counting** Accurately counts actions or objects which cannot be moved. Counts irregular arrangements of objects to 10 and begins to count beyond 10. Count out up to six objects from a large group. **Use counting skills to:** Partition and recombine small groups of objects. Count from one to solve number problems - counts a first set starting from 1 e.g. 1, 2, 3, 4, and adds this number to a new set of objects to solve addition problems (up to 2 single digit numbers). Counts a first set starting from 1 e.g. 1, 2, 3, 4 and removes this away from a larger amount to solve subtraction problems (up to two single digit numbers). Counts on or back to solve number problems e.g. starts counting the largest set first then adding or subtracting this from the smaller set.	Embeds pattern of numbers as they use finger whilst reciting number orders to 10 e.g. relationship of numbers 1-4 to 5 and 6-9 to 10. They recognise the relationship 0-10 and points. i.e. 5 can be used to count on to 10. 8 is 2 away from 10. 10 is a significant point to count on to 20. Begins to become aware of patterns for 1 to 9 provides a guide to counting larger 2 digit number sequences. Begins to recognise the patterns of pairs whist using fingers to count and object sort. **Subitising** The skill of visually recognising up to five objects is now used to help count, group and recognise objects mentally. This is needed for partitioning e.g. the ability to move around, or partition and regroup and combine small groups of up to four objects and recognises that the total is still the same. Make reasonable estimates for small quantities.	Embedding counting from one to solve problems (including doubling, halving and sharing). Begins to count on to solve problems (including doubling, halving and sharing). Begins to identify own mathematical problems based on own interests and fascinations.	Shows an awareness of when and how to represent numbers they have counted and to recheck for accuracy. Record their mathematical thinking using representations (invented symbols, standard symbols) that they can interpret and explain. Uses a flexible range of invented symbols and standard numerals to represent quantities. Uses graphical representations (combining drawings, words, numerals and personal symbols to help them to calculate with small numbers.

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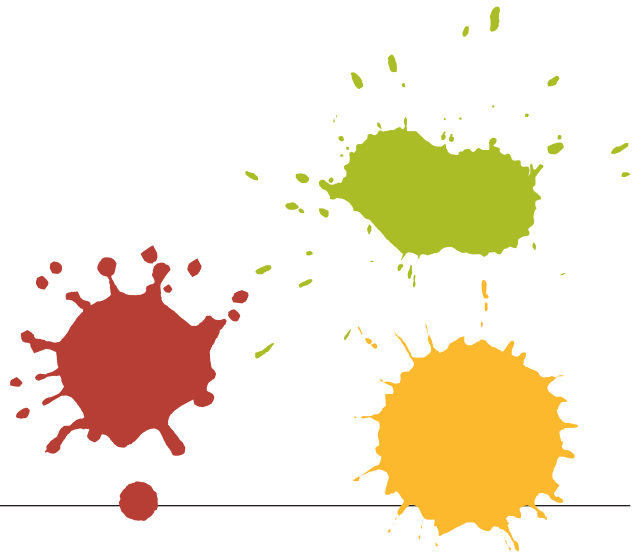

Glossary

- **A number** – a count or measurement, that is really an idea in our minds. We write or talk about numbers using numerals such as “4” or “Four”
- **Cardinal numbers** – numbers that says how many of something there are e.g. “There are five chips”
- **Concepts** – knowledge and understanding
- **Count principles** – basic way in which children learn to count
- **Decomposition activities** – activities where you explore different ways to separate a group of numbers into smaller groups
- **Estimation** – finding a number that is close enough to the right answer
- **Imaginative or pretend play** — where a child invents scenarios from his or her imagination and acts within them as a form of play, such as princess or pirate play
- **Number line** – marks on a line spaced evenly. Each line stands for a number. Number lines can start at any number
- **Number pattern** – a list of numbers that follow a certain sequence or pattern
- **Number sense** – an ability to use, understand and apply number skills and concepts in their everyday life. The key skills and concepts needed to support children’s number sense are number language, number pattern, counting, number problem solving, representations and graphical mark making
- **Number tracks** show numbers in order. Each space has a number in it. Numbers start at 1 and go up in order
- **Numeral** – a symbol or name that stands for a number
- **Object play**, such as playing with toys, banging pots and pans, handling physical things in ways that use curiosity
- **Object permanence** is a capacity to perceive that something exists even when it is not seen
- **Ordinal number** – is a number that tells the position of something in a list
- **Partitioning** – split the total numbers into small units of numbers
- **Subitising** – instantly recognising a number of objects without counting
- **Sustained shared thinking techniques** – quality play and interactive techniques to support children’s reasoning and thinking
- **Symbolic play** – is the ability of children to use objects, actions or ideas to represent other objects, actions, or ideas as play
- **Representations and graphical mark making** – visual marks and representations (graphics) young children choose to use to explore mathematical meanings and communicate their thinking

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