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Becoming Numerate in Hackney

Good Practice Guide

About the Good Practice Guide

The Becoming Numerate in Hackney project aimed to embed numerate behaviour in Hackney primary schools in order to improve attitudes to, and confidence with, numeracy.

The project worked with eight primary schools in Hackney, and three strands of development were focused on: numeracy across the curriculum, creating a number rich environment, and parental engagement.

This Good Practice Guide gives detailed descriptions of some of the key initiatives, with tips for how to implement them and examples of good practice from the schools involved in the project.

About our funder

UBS provides financial advice and solutions to wealthy, institutional and corporate clients worldwide, as well as private clients in Switzerland.

For over 30 years, UBS has worked to overcome disadvantage in its local communities. In Hackney, UBS supports education and entrepreneurship by funding carefully selected community partners and projects, and through the commitment and skills of its employees.

The Becoming Numerate in Hackney project was funded by UBS, allowing National Numeracy to work with a group of primary schools in the area.

UBS volunteers contributed to the Becoming Numerate in Hackney project by running workshops for teachers and pupils on the project.

Contents

A Number Rich Environment

A number rich environment is one that encourages and supports children in engaging in mathematical thinking throughout their daily lives and routines. The 'environment' may be in the classroom, in shared areas around the school, in the playground, in the local area, or in the home.

A number rich environment was chosen as a key element of the 'Becoming Numerate in Hackney' project to support adults and children, through identifying mathematics in the world around them, in making connections between abstract (symbolic) mathematics to the mathematics underpinning real life. This will support children (and adults) in developing number sense by making sense of mathematics and thus developing fluency, reasoning and problem solving.

Schools that have taken part in this project have offered the following suggestions of good practice they have developed (examples are shown on pages 7-11):

- Audit the mathematics environment in the classrooms and use the outcome of this to ensure that resources are available for children to use in exploring and explaining the mathematics.
- Start off small – add mathematics questions to displays that are already in shared school areas.
- Involve children in creating questions and looking for the mathematics around them.
- Provide opportunities for whole school involvement in the mathematics activities (e.g. whole school assemblies to discuss answers to questions in the environment, mathematics days or weeks).
- Consider questions that make children think, reason and explain the mathematics they are doing.
- Add mathematics questions or facts to the displays from other curriculum areas that are in shared areas of the school. Adults can introduce this and children can then be asked to contribute.
- Create mathematics trails (groups of children with an adult) for others to use.
- Have an interactive display(s) with a focus on real life mathematics to which children can relate (transport; local restaurant) with questions that draw out the mathematics.
- Go on 'learning walks' with groups of children (e.g. cross-phase, student council, children who are normally disengaged with mathematics), identifying mathematics in the environment and creating questions to add to the environment.
- Use playground markings as the focus for mathematics during lessons or at playtime. Support playground supervisors in developing questions that encourage mathematical thinking and reasoning.
- Have role play areas in KS1 including mathematics opportunities for children to make use of during the mathematics lesson or at other times.
- Consider where mathematics is used as part of daily life and routines and create opportunities for children to do this mathematics.
- Provide activities for children to make connections between the mathematics they do in a lesson and where they use it in different contexts.

Maths Trails

When adults and children are exploring where mathematics is in their lives and in the environment, a useful question to ask is: 'Where's the maths in that?' The maths trails examples in this guide show how this can be used. Maths trails take anything in our environment and use questions to encourage children to consider how mathematics is underneath all that we do or how we can use the mathematics we have learnt when looking at, or thinking about, what is around us.

Schools that introduced maths trails during this project found that the trails supported children in recognising the purpose of the mathematics that they had become familiar with in mathematics lessons and where it exists in their world, applying it in different contexts. It helped children make connections in mathematics. Children became more engaged in mathematical thinking and began sharing and asking questions of each other.

The examples shown for maths trails can be used in different ways. Some of these are:

- Create a booklet using photographs from around the school with questions appropriate for the age of the children beside these photos. Children can use these in groups or pairs during or outside mathematics lessons.
- Use the booklets created as prompts for children to consider when they are in the playground.
- Use the questions created around the photographs as prompts placed with the objects around the school.
- Give children a photograph from the school environment and ask them to write questions that link mathematics to what they can see.
- Use a part of a topic being developed in mathematics lessons (e.g. fractions) to support children in using the concept in different contexts and in making connections.
- Use these with children as part of Daily Maths Meetings to explore the mathematics in the world around them.
- Encourage children and adults to talk about the mathematics around them in everyday routines and activities.
- Support teachers in considering where the mathematics is in everyday classroom lives and how these can be used to engage children in mathematical thinking.
- Use not only the school environment but extend this to the local environment where parents or other adults can engage in the mathematics with their children. Maths trails can also be developed before, and used during, school trips to museums or other areas.

Estimation Stations

'Estimation Stations', where children estimate around a mathematical concept using given benchmarks and the language of estimation, support development of number sense and numeracy. Estimation is an important skill which children need to develop from a young age. Estimation stations are great to have in classrooms or in shared areas of the school as they provide regular opportunities for children to estimate.

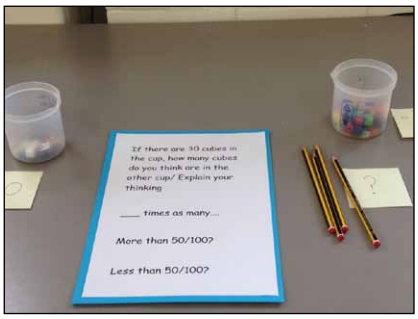
It is good practice to regularly change the focus of the estimation stations and use them to include a range of mathematical areas and concepts over time. For each estimation station it is beneficial to have benchmarks for children to use to help them make informed estimates, to develop their accuracy in estimation and to use the thinking and language of estimation (e.g. more than, less than, about half, almost, a bit heavier/lighter/ shorter etc.). Vocabulary to support children in their thinking and explanations can be displayed around the station.

Encourage children to explain their thinking using sentences and the appropriate vocabulary giving reasons for their estimates. Using post-it notes for children to write estimates and explanations is an easy strategy for including all children and to enable children to notice and consider other children's answers and reasoning. Opportunities for class discussions about estimations are very important in developing and refining the skill of estimation.

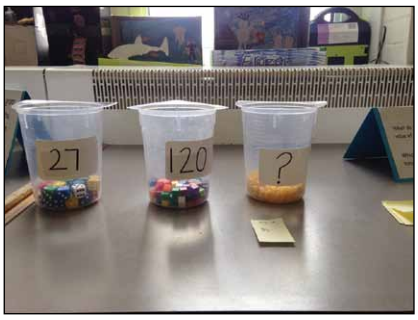
Below are some examples of ideas for estimation stations.

Number

- a set of objects with given amount labelled placed next to a different unlabelled amount of the same objects for the children to estimate
  (Photo A)
- a set of objects with given amount labelled placed next to an unlabelled amount of different objects for the children to estimate
  (Photo B).
- a picture of objects or people for children to estimate the number
  (Photo C).
- estimation of the number of people in a school/year group/phase based on knowledge of the number of children in a class. This idea can also be used for the number of adults in the school (have children say what information they used to help them make an informed estimation e.g. number of classes, number of adults in each class etc)
  (Photo D).
- calculation – What will the answer be more or less than? How do you know without doing the calculation?
  (Photo E).

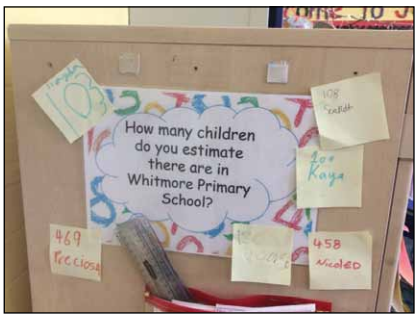


(Photo A)

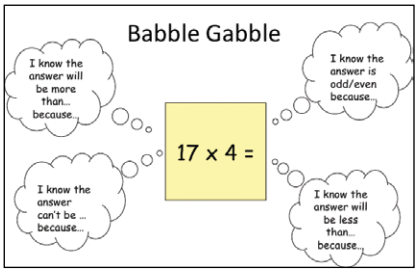


(Photo B)

(Photo C)



(Photo D)



(Photo E)

Measure

- show a container with a measured capacity (e.g. a cup with 250ml of liquid) next to a container with a different unlabelled amount of liquid for children to estimate.
- show a container stating its capacity next to a container with an unknown capacity for children to compare and estimate the capacity.
- use familiar objects, e.g. a can of drink or water bottles, as benchmarks.
- use weights as benchmarks for children to estimate the mass of objects. These can be familiar objects, e.g. fruit, packets of food, books etc.
- use measured objects, e.g. 1 kg of potatoes, as a benchmark for estimation of a bundle of objects (these could be potatoes but different numbers and size or could be different objects).
- use rulers, paper strips or measuring tapes to show a length for children to use as a benchmark for estimating the length of objects in the classroom or distances from the classroom (e.g. using a metre ruler in the corridor as a benchmark, estimate the length of the corridor or distance to the hall etc).
- use a Google map or paper map to show how far a kilometre is from the school and have children estimate the distance to familiar places from the school in kilometres.

Geometry

- show and label the size of an angle as a benchmark. Ask children to estimate another angle.
- use the classroom door to estimate angles.
- ask children to estimate the angles of the hands of the clock at different times of the day (compare to benchmarks, e.g. 3:00 etc).

The following pages show photographic examples of number rich environments in the schools that have taken part in this project.

Examples from the project

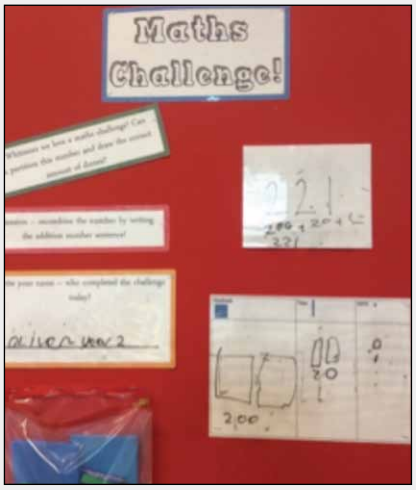
In the Classroom

Classroom display - representing numbers in different ways

KS1 Role play area

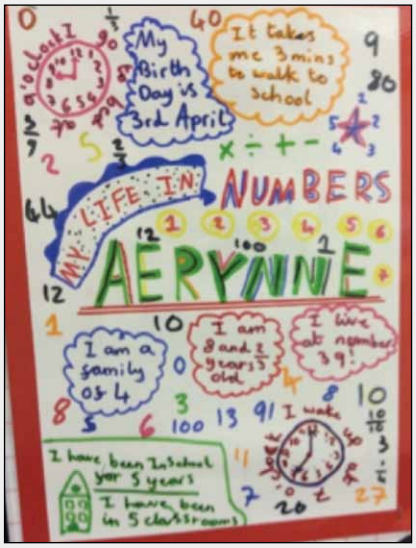
Mathematics resources are available and accessible

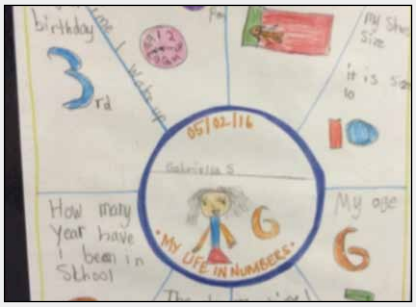
The same mathematical concept in different contexts



Interactive displays

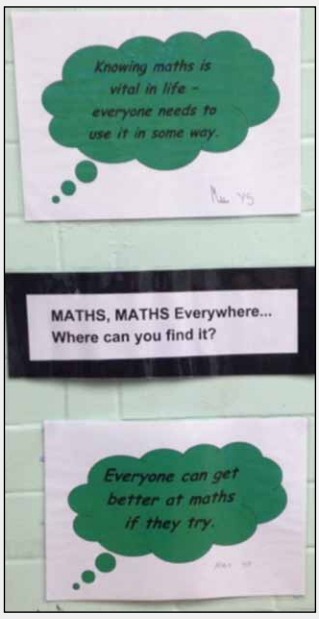
In Shared areas





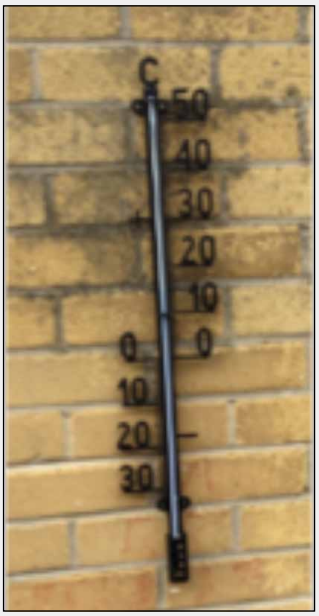
My Life in Numbers

Mathematics questions added to displays



Maths attitude statements around the school

Outside



Thermometers placed around the school for the temperature to be taken regularly, represented in different ways and analysed.

Examples of Maths Trails

In the School Environment

How many people rode their bikes to school today?

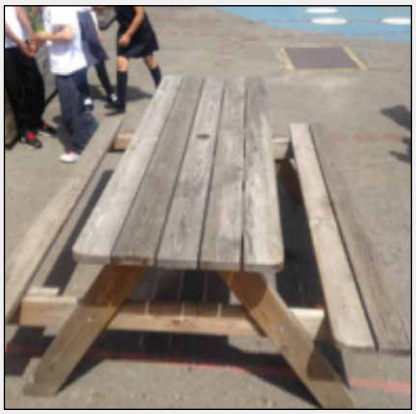
How many wheels are there?

How did you work out the answer?

How tall do you estimate the tree to be?

Is is taller than 1m?2m? 5m? 10m?

How could you measure the height of the tree?



Estimate how many children from your class could sit at the table.

Use two people to calculate how many children could sit on each seat. How did you do it?

Would the answer be the same if it was adults sitting at the bench? Why/why not?

How much soil is needed to go into the garden bed? What mathematics are you doing?

How much wood is needed to go around the top of the garden bed? What mathematics are you using? Draw a diagram to show.

Estimate the number of bricks in the hut? Say what you think it would be more than and fewer than.

Identify vertical and horizontal lines.

What angle is the roof of the hut? How can you work it out?

How many palings in each panel? Use this to calculate how many palings there are in the fence around this playground. Tell someone how you worked out the answer efficiently.

How many different angles can you see? How did you determine the type of angle?

What shapes can you see? How do you know?

What shapes can you see? How many are there?

Describe the shape for someone to draw.

Developing a mathematically rich environment in EYFS

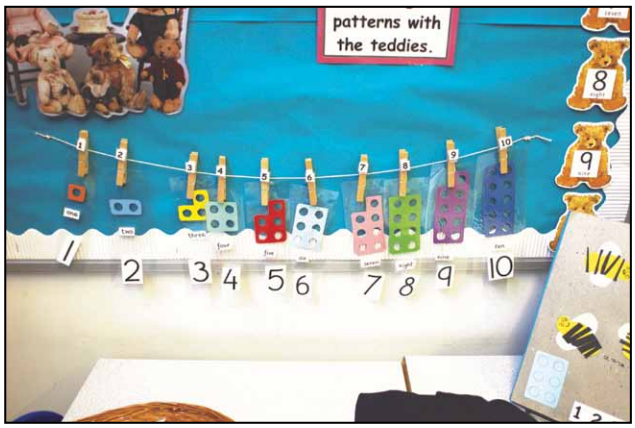
The first step in ensuring that children develop both the growth mindset and mathematical resilience needed to become competent and confident mathematicians is creating an environment which reflects the idea that mathematics is purposeful, meaningful and relevant. Above all, fostering positive feelings towards maths and ensuring that children develop confidence in their mathematical abilities is vital. A mathematically rich environment will also utilize those qualities that make children natural learners – curiosity, imagination and creativity.

A mathematically rich environment is not just about what is displayed in the FS setting, although the images that children see on a daily basis do have a considerable impact on their mathematical development. It is also about the mathematical experiences that children have, the mathematical conversations they are exposed to, and the attitudes and approaches towards mathematics of the adults they engage with.

Display

Look around you. What do you see? What evidence of mathematics is there? How does this balance with literacy?

- Are there different representations of number in addition to numerals? Can children see numerals matched with dice patterns, pair wise patterns (such as those found in the Numicon shapes), five wise patterns, tally marks? While young children need to recognize numerals and understand what they represent, they also need to develop 'images' of the number quantities up to at least 10.
- Do you have number lines and number tracks in a variety of places (i.e. not just the 'maths' area)? How accessible are these to the children? Display number lines and tracks should be at child height. Do you have number tracks on the floor inside or ground outside for children to jump along?
- Do you have 'washing lines' where children can peg up numerals and number representations? Washing lines can be used for many activities and with a variety of equipment. As well as ordering numerals and/or number representations, washing lines can be used to create patterns or to match items. Have a variety of cards/equipment to peg on the lines – cards can show numerals, dice patterns, tally marks, pair wise dot patterns – and change these regularly, mixing the types of representations to be matched.



Do you use number as a way of organizing equipment, activities or children?

- As well as labelling trays and containers to describe their contents, these could also be given a number. For example, the Duplo tray might be labeled '6' as well as 'Duplo'.
- Do you display the maximum number of children allowed in any area, e.g. '4 children allowed in the hospital'?
- Coat pegs can be numbered as well as named.

Having the corresponding number representation (pair wise or dice pattern) alongside the numeral makes this particularly effective.

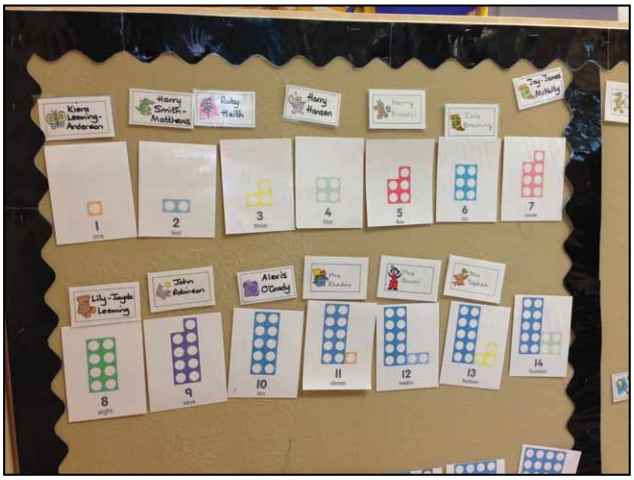
Daily routines

Have you identified which daily routines afford mathematical opportunities and do you regularly make full use of these?

Register

Do your children self-register? Several systems are described below – choose the one best suited to your setting:

- Using Numicon ten shapes and pegs, e.g. 3 ten shapes for 30 children. As children come in to the class, they each put a Numicon peg in the ten shapes laid out for this purpose. As the ten shapes get filled up, this generates discussions on how many children are in the class so far.
- If children self-register using their name cards, consider arranging the names of the children present in a structured pattern such as a pair wise grid. Again this helps children to develop stable images of 'whole' numbers which provide the foundational skills needed for calculating.
- Alternatively, children could put their name cards in numerical order according to when they arrive – so the first child in puts his/her name against the numeral 1, the second against numeral 2 and so on.



Date/calendar

As well as recording the date every day, do you make use of a calendar? While a conventional calendar is too complex for EYFS, 'building' your own calendar each month makes this more accessible for Reception children.

This activity helps children with counting, ordering of the numbers up to 31, sequencing of the days of the week, and naming the months of the year as well as developing an understanding of the passage of time.

Snack time

Snack time offers many opportunities for mathematics, such as matching, pairing, and sharing, as well as an opportunity to use the language of comparison and measurement.

By encouraging the children to take turns each day in carrying out specific roles – such as setting up the snack area, preparing the snacks and clearing away afterwards – all children regularly get the opportunity to develop a range of mathematical skills as well as positive personal, social and emotional skills. Mathematical skills addressed include: pairing (one plate and one beaker for every person); matching (do all the beakers have the same amount of juice?); comparison (which beaker has more juice?); sorting (clearing away); counting (how many satsumas do we have altogether?); calculating (can we give 3 grapes to everyone?).

Lining up

Lining up offers regular opportunities for children to practise the sequence of numbers as well as providing a meaningful reason for counting. You can use this opportunity to practise the sequence backwards as well as forwards.

For example, starting at the beginning of the line, get the children to count themselves as you move down the line, touching each one on the head. So the first child says 1, the second child says 2 and so on. When the end of the line is reached, repeat the process but this time starting at the end rather than the beginning so that the number sequence is said backwards. Although each child simply repeats the number they said previously, this activity is valuable in providing an opportunity for children to hear the backwards number sequence – often a difficult sequence for young children to master.

Use the same approach for reciting the even or odd sequence of numbers.

Activities

Provision areas

Are you exploiting the mathematical opportunities available in all provision areas, both inside and outside?

In considering this, ask yourself the following questions.

- Where do I usually see mathematics taking place on a daily basis in my setting?
- Do all children visit these areas regularly?
- What kind of mathematics usually takes place?
- Are there any areas that rarely have any obvious mathematics?
- Are all adults in my setting confident about identifying a range of possible mathematics in all provision areas?

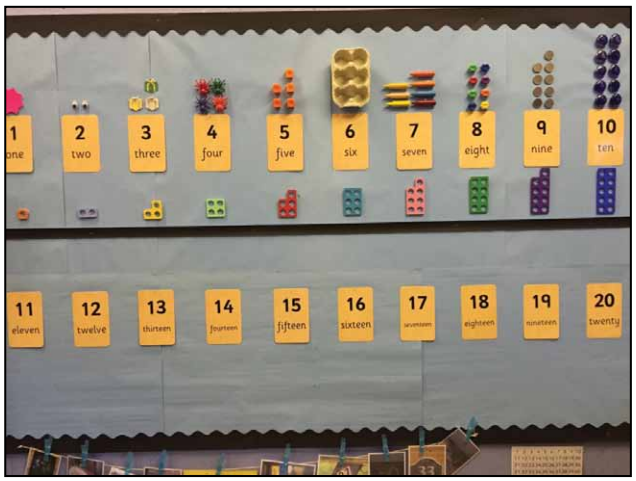
Over a period of time, it's important to ensure that mathematical opportunities are identified in all areas and that the range of activities offered extends beyond children just being asked to count or say who has more. It is also important to vary these in relation to the provision area. So for example, you might set up a bead threading activity in the maths area to address pattern one week, but the next week, pattern and sequences might be found outside on an obstacle course.

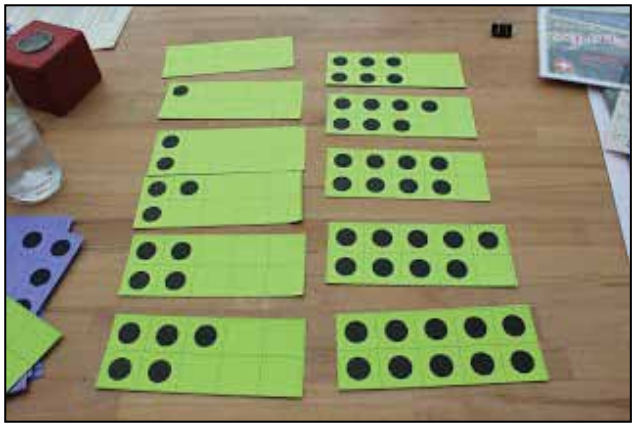
If you are aware of an area which doesn't usually afford mathematical opportunities, make this area a particular focus over the next few weeks, and invite ideas from the Early Years team. Thinking about this in relation to each of the pre number and early number skills might help you to identify opportunities.

Developing number sense and preparation for calculating

In order to provide young children with a secure foundation for later calculations, it is important to consider the images they encounter alongside the abstract numerals which we use to represent number.

Although children should see different representations of number, representations which show the structure of number such as Numicon and ten frames are the most powerful in terms of developing calculating skills.

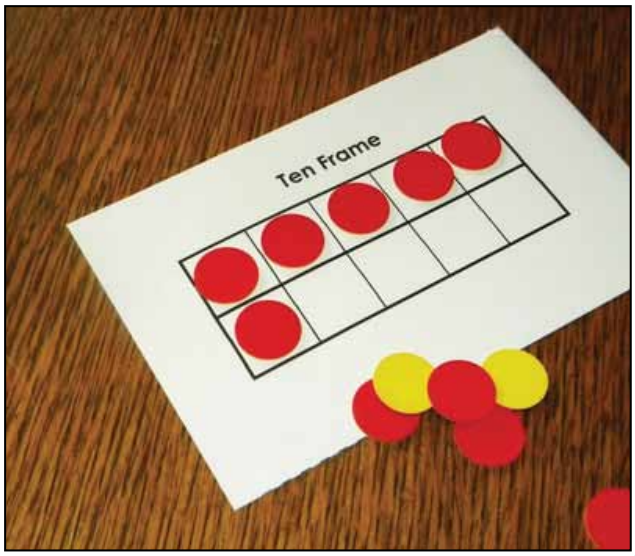


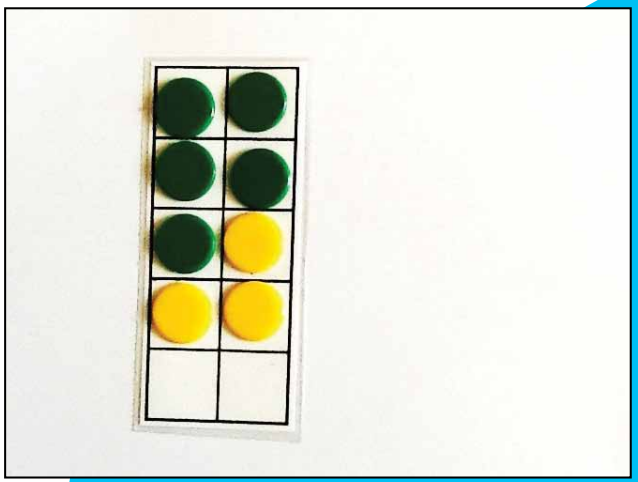


While counting is an important skill that must be mastered in the FS, supporting adults also need to be aware of children's subitising skills. Subitising is the ability to recognise how many are in a small group of randomly placed items without counting them. It develops from a skill that is present from birth, so all children start school with some subitising skills. The maximum range for subitising (even in adults) is thought to be only 4 or 5 and the average child will usually reach this by the end of YR.

Children should be actively encouraged to subitise and supporting adults should be aware of its importance, especially as an alternative to counting. For example, if a child correctly identifies 3 cotton reels without having to count them, s/he has used subitising skills. This should be encouraged and recorded as an important milestone by the adult who witnessed this. Unfortunately instead, all too often we hear the adult response 'Just check by counting'!

The use of structured representations of number builds on subitising skills and extends the perceptual range of subitising to include number quantities greater than 4. Thus children have a visual representation of all the numbers up to 10 and see them as whole numbers. This provides a strong basis for calculating. Numicon is a familiar example of the structured representation of the numbers 1 to 10. If you don't have Numicon, you can use 10 frames with counters or you can create pair wise patterns using Multilink.





Numeracy across the Curriculum

The National Curriculum states: "Teachers should develop pupils' numeracy and mathematical reasoning in all subjects so that they understand and appreciate the importance of mathematics." A focus of this project was developing cross-curricular mathematics or, to put it another way, getting children to think mathematically outside of mathematics. Children don't always recognise the mathematics in their everyday world and where they use it in other curriculum areas. Making explicit connections for children helps them recognise the maths around them along with developing the ability of using maths in a range of contexts.

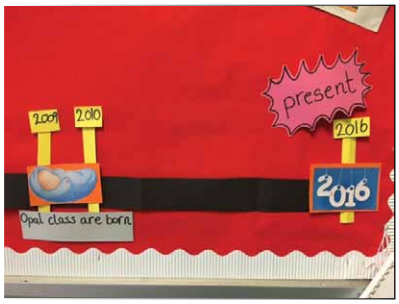
There are a number of different ways of developing mathematics across the curriculum. These include:

- taking **a topic or a curriculum area** and determining 'Where's the maths in that?', to develop links to mathematics
- taking **an aspect of mathematics** e.g. place value or fractions, and exploring ways this can be developed in other curriculum areas and in the school environment
- exploring **incidental mathematics** in the daily school routine, e.g. use of time throughout the school day
- including a Maths Day or Maths Week in the school year in which mathematical opportunities are created in all lessons – 'Where's the maths in that?'
- using events in the school to consider how maths is linked to these, e.g. summer fairs, school sports day, world book week.

Take a topic – where's the maths?

- Use the display boards belonging to other curriculum areas to attach maths questions that connect to the original display. This can be modelled by adults then added to by children (see photos).
- Consider the topics covered over the school year and create a class timeline of relevant dates that you can add to when each topic begins and during the topic when appropriate. This will help children see where different events happen in relation to others and link the years/ decades/centuries to the present (great maths can be done around this).
- Use a topic as a theme. An example, **Maths Links for Oceans and Seas in Y2**, is included later in this guide.
  - Think creatively about all the areas of mathematics that can be linked to the theme. Once all of these ideas have been listed, consider how the expectations for the specific year group can be linked to these and include the maths objectives in the planning for the unit.
  - Don't always exclude maths ideas because they don't directly link to the year expectations. Children are fascinated by the maths behind the focus, especially the bigger numbers. Use of this supports children in understanding the size of numbers and units of measure.
  - General ideas can include: children research facts and create fact books about the topic; timelines; maths through stories with a similar topic.

Adding maths questions to topic displays



Latin American forests are home to black howler monkeys, whose calls can be heard almost 5km away! How many metres is this equivalent to?

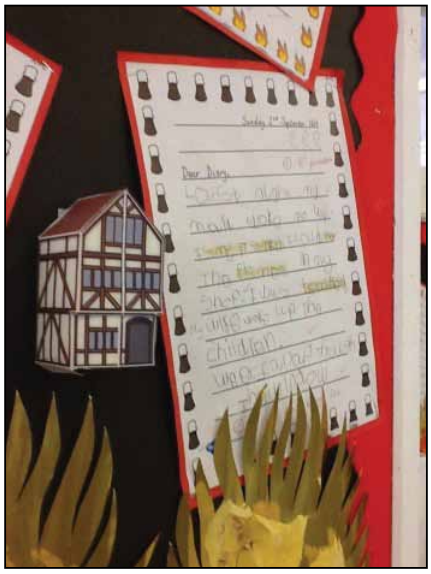
How old was Queen Elizabeth when she became Queen? In years, months...

How many years has it been since Queen Elizabeth died?

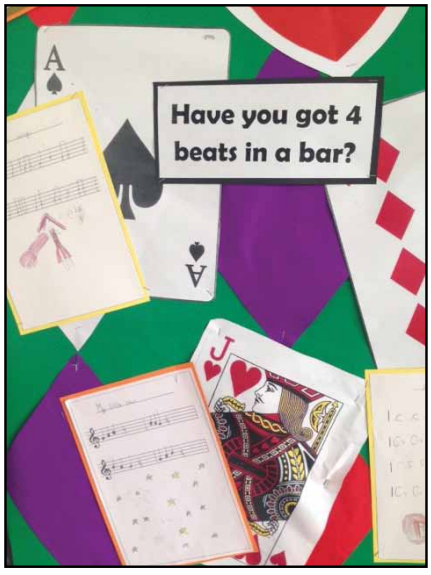
Rainforests get at least 250cm of rain a year. Sometimes it's almost double that at 450cm. How much rain fall could this be over 5 years?

Take an area of mathematics – where does it go?

Children playing 'Horizontal, Vertical and Diagonal' in P.E



Constructing Tudor houses



Maths in Music

Focus on an area of mathematics and determine how it can be developed through all areas of the curriculum, used as part of the daily routine, and identified in the world around us.

The following are examples of how this can be done for the area of fractions (include in this percentages, proportion and ratio when appropriate):

- Have children represent the same fraction in different ways and in different contexts so they develop a deep understanding of the concept.
- In the classroom, relate fractions to pictures, children and objects so that children can develop their understanding of mathematics. Have children identify, communicate and label (if appropriate) different fractions they see, including **measures** (fraction of water drunk out of water container; fraction of sandwiches eaten; fraction of school day left; the fraction the distance to the office is out of the distance to the school fence); **number** (fraction of children with cardigans sitting in one group or as part of whole class; fraction of red cubes out of total and the fraction of not-red cubes out of total; fraction of children present/absent). What is the whole? What part are you talking about? Ensure children talk about the fractions in whole sentences, e.g. two thirds of the children in my group are boys.
- Look for fractions in objects, pictures and activities around the school: fraction of staff in staff photos who wear glasses; fraction of tiles in the corridor that are the same colour; fraction of coat pegs that have a coat on them etc.
- Ensure the whole staff are involved in 'talking fractions'. In the dining hall: fraction of children with school dinners or their own lunch; fraction of specific food on plates; fraction of food being served (1/2 spoonful of peas); sit in this third of the room etc.
- As a whole school, explore ways that fractions can be used in the different curriculum areas. Help children in relating this to what they do in mathematics.
- Include fractions in homework activities, e.g. when are fractions used at home (cooking, time, capacity etc)? Children can take photos of, or record, fractions that they see, label them and bring them to school to add to a display.

What fraction of the person is the body?

How could you use this picture to talk about fractions?

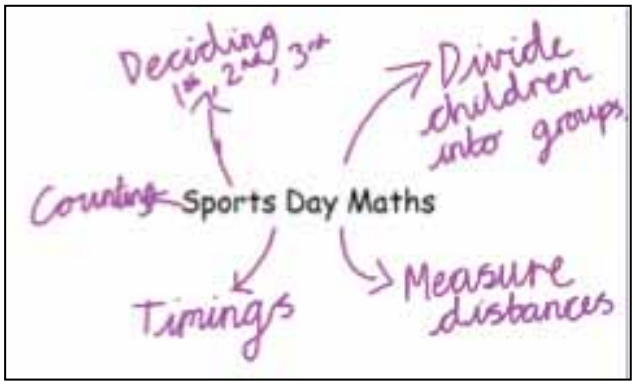
What fraction of the tiles are blue? What fraction of the numbers have a '3' digit?

Incidental mathematics

Incidental mathematics is the mathematics that we do as part of our daily routine and part of our lives. Doing incidental maths will help children with a range of concepts and in making the links between the mathematics they learn and what maths is like in different contexts. Some examples of incidental mathematics that can be done in school are:

- **Time**. This is often considered a 'hard to teach, hard to learn' area of mathematics yet we often refer to it as part of our lives. To develop this concept, give children experience of using, reading and interpreting time and time intervals throughout the day. Add analogue and/or digital clocks to the visual timetable so that children notice and talk about the times and so that questions can be asked about time duration. Refer to analogue and digital clocks that are in the classroom when asking questions or getting children to determine when they need to be ready, how long they have on an activity etc. Have timetables for different school activities that children have to interpret. Have children create timetables for class or school activities.
- **Reading scales**. Have thermometers in each classroom and in different areas of the school. Record the temperature each day in a way that is appropriate for the age of the children (line graphs, tables). Adults and children can ask questions around the information gathered. For younger children they might talk about what kind of weather it is and whether it is a jumper, coat or t-shirt day.

Reading scales – temperature and rain gauge



Involving children in doing the maths linked to whole school events

The photos on these pages show examples of ways to develop cross-curricular ideas developed by the schools that were part of the Becoming Numerate in Hackney project.

An example of developing maths links to a topic

Maths Links for Oceans and Seas - Year 2

Story books that could be used in this topic

Shark Swimathon
by Stuart J Murphy
- adding 2-digit numbers

Ocean Counting: Odd Numbers
by Jerry Pallota
– odd numbers

Underwater Counting: Even Numbers
by Jerry Pallotta
– even numbers

Is a Blue Whale the Biggest Thing There Is?
by Robert E Wells
- measurement

One is a Snail, Ten is a Crab
by April Pulley Sayre and Jeff Sayre
- partitioning numbers in different ways, developing number sense

These books could be used as the basis of the topic with all the other areas linked to this.

Locating and identifying oceans and seas

- Use mathematical information – directions, differences, scale.
- Describe where the oceans/seas are in relation to the UK and each other.
- Southern/northern hemisphere.
- Make a fact book about oceans. This might include for example: the deepest ocean is x miles; more than half of the planet is covered by water; number of different types of animals found in the oceans/seas; the size of the ocean compared to UK or in relation to another ocean. This could be a way of using different types of numbers – big ones, fractions etc – and in different contexts.

Life under the ocean and sea

- Mathematical information about the animals found under the sea/ocean – compare size, length etc. Which is longest/widest/heaviest/lightest? Would the animal/plant fit in the classroom, playground etc? Measure the length (if possible) of the animal against the length of the room or corridor.
- Look at sizes of sea creatures, e.g. create a life-sized model of a whale in the playground. Children could make a real size outline of a whale on the school field. They will have to think about how they would do this and what they could use to create the outline. They should be encouraged to come up with the ideas themselves with the teachers facilitating this.
- Give information about the different forms of life and have children order/sort them (eg. using Carroll or Venn diagrams).
- Give a set of animals and/or plants – get children to sort them any way they want or give them a sort and ask them to work out the similar criteria for the sort.
- Ask: what is the same/what is different? Can they find something else that would belong to the given group. How do they know? This could then be related to number/other areas of maths where children have to consider what is the same, what is different, sort according to specific criteria (given or one they decide on), or find another example that would belong to a given group.
- Links to diving - exploring depth in whole metres and, adjusting the weight (whole kilograms) of the diver helps them to sink. Air tanks come in different capacities - relate this to how long they can stay underwater. This might be too complicated an idea but the use of measures in whole units could be a useful context – e.g. exploring a shipwreck. This could also link with floating and sinking in science. Take a look at the following link in developing this through using the book **Who Sank the Boat?** by Pamela Allen: http://sciencenetlinks.com/lessons/sink-or-float/ Diving could also be related to how long a length of time is (seconds, minutes, hours etc) – eg. how long can you hold your breath?

Continents

- How many times will Great Britain fit into the continent?
- Look at size and order.
- How many countries are in the continent?

Position/direction/grid co-ordinates

- Before looking at co-ordinates and positions on maps of the UK or the world, have children create their own in the playground.
- Y6/Y5 children could help children create a maths trail in the playground or school environment.

Galapagos Islands and Charles Darwin

- Patterns on shells and animal skins – why do they have these patterns? Recreate the patterns.
- Continue given patterns – using colour/shape/nature/number.
- Timeline – where does Charles Darwin fit into the timeline of what has been studied before by children? Give dates of other people or events studied in history and have children order them and place them on a timeline. Add to this when appropriate.
- Compare the sizes of tortoises (you get giant ones in the Galapagos), giving some opportunities for comparison of length/height and multiplicative reasoning – four times as high/long etc.

Seaside

- Use the book **One is a Snail, Ten is a Crab** as a prompt for mathematics – eg. partitioning of numbers and calculations: How many feet can you see if there is a dog and two crabs? What number sentence would show this? How would you calculate the answer? Give a number sentence and get children to show you the animals that it would relate to. This can then be represented using mathematical apparatus – eg. Numicon or other apparatus. Children can make up a story problem that would go with it.
- Children choose a number (it could be their favourite number) and represent it using animals from the book. They could represent it using mathematical apparatus, write the number sentence and explain how they would work it out.
- Make a class book of numbers from the different numbers the children have represented.
- When was the traditional seaside Punch and Judy show introduced? Include this on the timeline.
- Locate seasides that the children may have visited on a map. Compare these to the Galapagos islands and beaches in different countries.

Parental Engagement

"Students' motivation to learn maths is higher among students whose parents discuss with them how mathematics can be applied to everyday life or who obtain mathematics materials for them."

The Programme for International Student Assessment 2013

Engaging parents and carers with their child's education leads to raised attainment, improved behaviour and improved school attendance. We know the evidence shows this but we are also aware that it is sometimes difficult to engage parents in the mathematics that their children are doing in school. Maths anxiety can play a role in this as, often, adults (and children) think of mathematics as calculations (in the symbolic and written form), algebra or the 'really hard stuff' and don't equate it to the mathematics of everyday life that we are all engaged in.

"Perhaps the single most important thing that parents can do to help their children with maths is to pass on a positive attitude." Tanya Byron, Clinical Psychologist

National Numeracy gives the following top tips for parents and carers:

Be positive about maths. Don't say things like "I can't do maths" or "I hated maths at school"; your child might start to think like that themselves.

Point out the maths in everyday life. Include your child in activities involving maths such as using money, cooking and travelling.

Praise your child for effort rather than talent - this shows them that by working hard they can always improve.

An aspect of the Becoming Numerate in Hackney project was to develop strategies and activities that support parents in overcoming maths anxiety and engage them more in maths in their children's school. Attitudes to mathematics play an important role in engagement. We want adults to think: "Everyone can do mathematics, it is part of my life and we do it every day. I can help my children with mathematics through what we do every day."

Examples from the project

Schools who chose Parental Engagement as a focus for the project creatively developed activities and strategies to use as a means to support parents and carers in identifying the mathematics they do every day, to engage them in school mathematics and to help them understand how they can support their children in becoming numerate.

Display boards

Display boards showing everyday use of mathematics were created in common areas where parents wait for children or which they can access when in schools. These included: a menu from a local restaurant with questions focused on the mathematics used when in a restaurant; local transport timetables and travel information, highlighting the mathematics involved in interpreting and using this information.

School newsletter

A mathematics section in the school newsletter could include: an explanation of an aspect of mathematics being learnt in school; an example of a maths display from the school shared area, with questions linked to it; puzzles for families to work on together; examples of good practice seen in the school or local environment; maths questions related to a familiar local landmark, event or scene; news of a celebration of mathematics in which everyone in the school participated.

Breakfast clubs

Mathematics breakfast clubs where children, parents and school staff engage in mathematics puzzles, activities, and ICT based games.

External companies

Commercial companies offer workshops and activities where they work with children during the day and invite parents to join them after school to share and celebrate what the children have achieved.

Parents and children maths mornings

A weekly parents and children maths morning was introduced with the Reception class, where parents had the opportunity to play maths games with the children.

Video clips

Video clips which show and explain different aspects of mathematics were made available on the school website or through Youtube.

Maths days

Maths days were held which gave parents and children the opportunity to work together on problem solving activities.

Leaflets

Leaflets for parents to use when supporting children with mathematics at home.

Homework activities

Homework activities that connect the mathematics covered in school to where the mathematics exists in everyday home life.

Maths Monkeys

Maths Monkeys (small soft toys) visit each child's home for a week. They record, in a journal that is shared at the end of the week, the mathematics they do while with the child. Further detail on this initiative is given later in this guide (p24-25).

Maths trail

A maths trail around the local streets that parents and children complete together.

Tangram art event

A tangram art event for parents to do with children in the school.

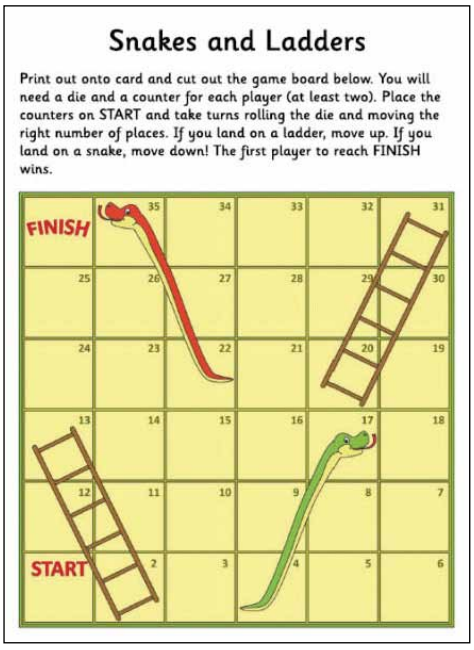
Parents' summer holiday maths packs

Parents' summer holiday maths packs with resources and ideas for activities. These can be shared during class time early in the autumn term.

The photos on these pages show examples of some of the activities that schools used to engage parents in mathematics.

Building on from the activities undertaken over the two terms of the project, some schools have planned what they will do in the new school year to continue to engage parents:

- Use mathematics lessons at the beginning of the term to focus on the summer maths activities
- Continue to look for opportunities to explore mathematics in the local area with parents and children
- Use the model of parents' maths mornings in FS to develop similar mornings for phase groups in the school
- Hold 'Round-About-Day' Y1-6, which involves maths activities and challenges in mixed age classes
- 'Doing Maths Everywhere!' which involves children taking photographs of themselves 'doing maths' in different and unusual places
- Add teacher/pupil maths tutorials onto the school website.



(Tall and short wall)

What fraction of the tall wall is the short wall?

(Coloured glass)

What fraction of the top glass windows are coloured glass?

Look at the door numbers on both sides of the road. What do you notice?

(Apex design)

Look at the apex of the houses on Princess May Road. Is there a repeating pattern? Where is it? Describe it?

An example of a successful parental engagement strategy

Maths Monkeys

One of the schools involved in the Becoming Numerate in Hackney project uses Maths Monkeys to engage children and their parents in mathematics through exploring, with the monkeys, the mathematics around them and linking this to the mathematics learnt in school. This year the Maths Monkeys were 'Multilink' and 'Moneypenny'.

Children host a Maths Monkey in their home for a week. They write journal entries which focus on mathematical activities the child and monkey experienced that day. At the end of the week children present the journal to the class. During this time, the class has time to exchange ideas, express their feelings, foster collaboration, re-visit mathematical concepts and reinforce understanding.

Through this, children experience mathematics in many enjoyable ways, for example:

- Rock climbing: mathematical discussion about height, comparison, time and shapes
- Ballet class: finding 'body shapes'
- Lunch: weighing ingredients, fractions of a pizza.

In recording their activities with the Maths Monkeys, children take photographs and represent their mathematics in different ways: pictorially, diagrammatically, in number sentences and as stories.

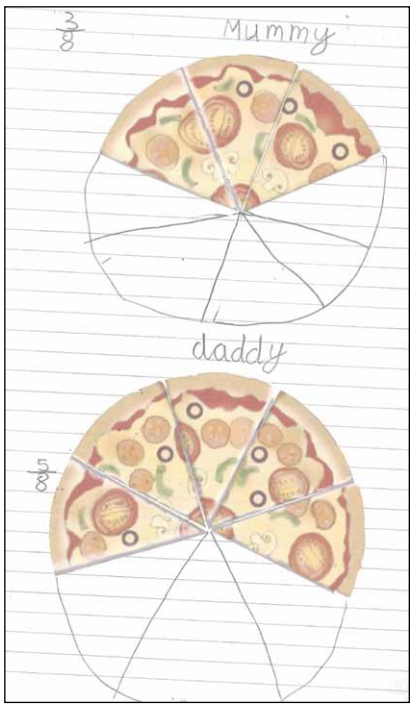
On this page are a few examples of pages and photographs from the journals.

Parents and children both enjoy taking part in this initiative. Children are really engaged in the talk about mathematics and interested in what the monkeys have been up to. They relate the maths they do with the Maths Monkeys to the mathematics they are learning in lessons – e.g. fractions, calculations, geometry, money, time – and talk excitedly about the mathematics, using maths vocabulary accurately. The children who took part in this initiative displayed fluency, reasoning and problem solving in their responses.

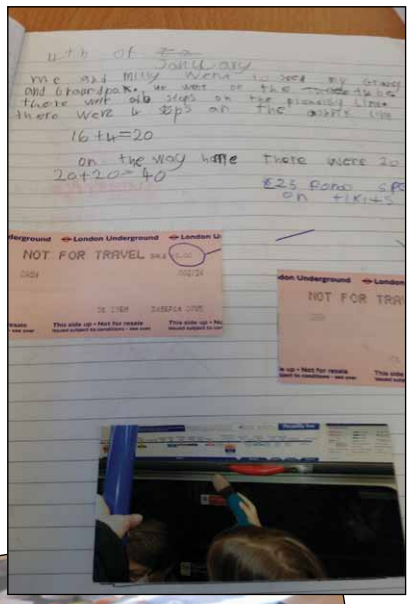
Parents have also fed back to the school that their children are now enjoying maths, looking everywhere for things related to numbers, seeing maths as part of everyday life, and benefiting from increased confidence.

As one six year old pupil says: "Maths doesn't always have be to concentrating hard – it can be fun and interesting."

With much thanks to Iolande Basso and Year 2 at Parkwood Primary School for sharing their Maths Monkey experiences with us. Of course, a big thank you to Moneypenny and Multilink for helping children to engage in the mathematics.


3/8
Mummy
daddy
5/8


by Milly
Diary Entry starts here
Date: Friday, March 28/14
I estimated that my daddy put
Icing sugar for my banana


NOT FOR TRAVEL


MATHS !!

Morning Maths Meeting

The Morning Mathematics Meeting (MMM) is a short 15-20 minute (10 minutes in EYFS) meeting between the class teacher and children, which takes place daily throughout the school year. The MMM does not replace but supplements the daily mathematics lesson and serves a different purpose.

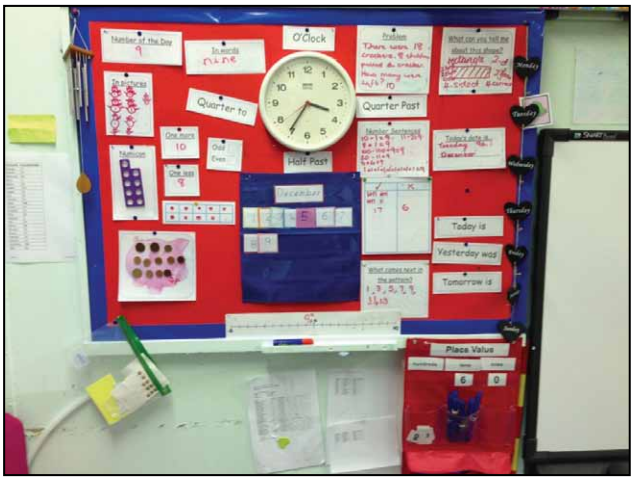
The key purpose of the MMM is to develop number sense, estimation skills, and flexibility in thinking and in the application of mathematical ideas and procedures. The MMM provides opportunities for constant revision and honing of basic skills, concepts and knowledge to support numerate behaviour across the whole mathematics curriculum. This helps to underpin the deeper key themes explored during the daily mathematics lesson.

This is achieved in the following way:

- The focus is on enjoyment and engagement of all pupils – activities should be fun, lively and interesting.
- The format provides opportunities for repetition and rehearsal of basic number work but in a non-threatening, fun and inclusive way.
- The basic structured routine follows a similar format every day. Variation comes from the type of activities used, which provide practice in a number of different skills.
- Learning is facilitated through mathematical conversations between children, as well as with the class teacher who leads the session. Some jottings or writing can take place but only to support the thinking process.
- Activities are short, lasting between 1 and 3 minutes, and are conducted at a brisk pace. Over time, these help to build up fluency.
- The class works together as one, regardless of ability or attainment. Activities are designed so that children can answer on a number of levels.
- Establishing a non-threatening atmosphere where children are willing to share their ideas and discuss misconceptions is a key aspect of the MMM. Suitable tasks for this purpose are those that have a number of different answers or can be solved through several methods.
- Where possible, activities are tailored to suit interests or events relevant to the pupils or class and can include songs, guessing games, or rhymes, as well as responding to current news items or events in school.
- Developing a feeling of 'awe and wonder' about mathematics is integral to the rationale of the MMM.

Key points when planning MMMs:

- Plan for a half term with your year group, choosing regular daily routines interspersed with less frequent activities.
- Think about the mathematical topics you will be teaching over the half term as well as any particular weak areas specific to your class.
- Include some regular daily routines appropriate for your class, such as using calendars, the register, counting, number or problem of the day.
- Try to carry out a variety of activities in each session covering number, shape and space as well as those with a more cross-curricular theme.
- MMMs work best when there are at least 6 activities, rather than spending time on just 2 or 3.
- Use the MMM to help keep skills sharp on a topic recently taught or to pre-assess understanding of a topic you will be teaching the following week.



Examples from the project

Schools who implemented Morning or Daily Maths Meetings used a variety of ideas, including some questions or activities suggested by National Numeracy. Here are a small sample of things to do in the MMM. Any of these questions could be adapted for different age groups or ability levels.

May 2016

wk	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	25	26	27	28	29	30	1
17							
	2	3	4	5	6	7	8
18	Early May Bank Holiday (May Day)						
	9	10	11	12	13	14	15
19							
	16	17	18	19	20	21	22
20							
	23	24	25	26	27	28	29
21							
	30	31	1	2	3	4	5
22	Spring Bank Holiday						

How many days are in May? What day does May begin on?

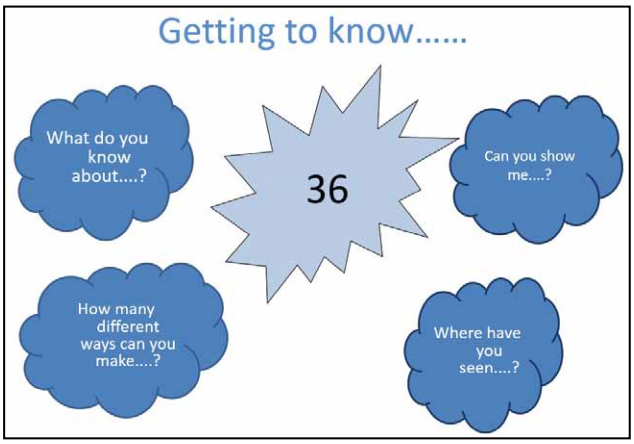
We go swimming every Monday – how many days will we go swimming this month? Would this be the same every month? When will it be the same? When will it be different? Explain the reasons for this.

What date is the first Wednesday in May? What do you notice about the dates of each Wednesday? Does this happen for any other days? Why does this happen?

How many days will you go to school in May? How did you calculate your answer? What will the number sentence for that be?

Mary gets £5 every school day for her bus fare and her lunch. How much would she get in May?

What will the date of the first Saturday in June be?



Talk about what they know. Get them to represent it in different ways on whiteboards, with practical resources, and then write the number sentence. (Can you show me; how many different ways can you make...?)

Can you show 36 in a simple and easy representation; in a difficult and complex representation? What makes it easy? What makes it difficult?

Where might you see 36? What does it mean in that context? E.g. house number, on a label on a packet of biscuits.

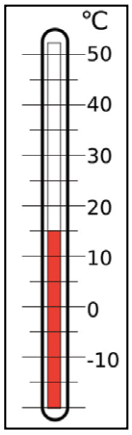
When is 36 a big number? (E.g. £36 for a bag of apples / number of people in my car) When is it a small number? (E.g. 36ml of water when I'm thirsty / 36 people in a school).

What number is represented? How do you know? What calculations did you use? Which is an efficient way of adding these? Give me another example of numbers where you could use this strategy.

Show me another way of making this number without using number bonds to 10. How are you sure it is this number?

Represent one of these as a number sentence. (Show a number sentence and ask children which picture it is representing).

What would I do to (point to one of the representations) if I could change it so it now equals 27?

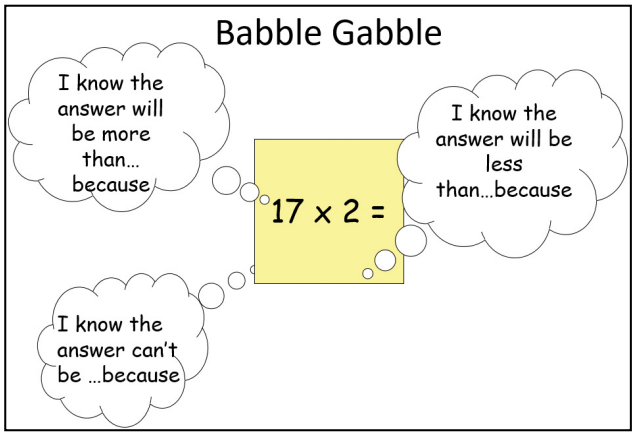


This is yesterday's highest temperature. What was it? Do you think today will be hotter/colder? What do you think it could be? What weather is it – jumper / t-shirt / coat / raincoat etc?

Look at the temperature now – what is the difference? Where would it go on this thermometer? Do you think the temperature would be higher / lower tonight / in January / in July? Explain your thinking.

Would you go ice-skating if it was this temperature? What would you like to do in this temperature?

Last Wednesday's temperature was 7 degrees lower. What was the temperature then?



Don't ask for the answer!

Have children talk in pairs or groups of 3 to consider what they know about the answer using the thought bubbles to lead their thinking. E.g. I know the answer will be more than 20 because 2 tens are 20 and I have some more that I need to calculate. I know the answer is more than 30 because 2 fifteens are 30 and 17 is more than 15. Every time they give an answer it must be in a sentence containing 'because'. (This means they have to explain and justify).

It can help some children if, when an approximation is given, it is shown on a number line in relation to the answer so you can challenge them to get closer.

14:45 Bologna	BA541	Cancelled
14:45 Milan-Linate	BA577	Estimated 15:47
14:50 Newcastle	CX1210	Delayed
14:50 Venice	BA579	Estimated 17:31
14:50 Kiev	BA841	Expected 16:06
14:50 Copenhagen	BA815	
14:55 Hamburg	CX7150	
15:00 Madrid	IB3176	Delayed
15:00 Beijing	BA038	Expected 15:04
15:00 Hong Kong	BA022	Expected 14:54
15:05 Barcelona	BA489	Estimated 15:54
15:10 Edinburgh	AY5970	
15:10 Amsterdam	BA435	
15:10 Tokyo	BA006	Expected 15:04
15:15 Rome	BA549	Estimated 16:07
15:20 Frankfurt	BA905	
15:25 Los Angeles	BA268	Expected 15:49

What do you see in this picture? Where might you see something like this? What information does it give? How is the information useful? Who needs this information?

What do the letters and numbers in the third column mean? How do you know that a plane is from a particular airline? How many different airlines have planes arriving at this airport? Which airline has the most / least planes arriving / departing?

Where have the planes come from (cities / countries?) How would you sort the cities/countries? Which country has the most / least planes arriving? What time is the plane from ... due? How late is the plane from ...?

Can you order the plane numbers? How would you sort the planes?

Which planes are on time? Can you write the plane times in a different way? How many planes are delayed? Which plane is expected to arrive earlier than its due time?

You need to arrive 2 hours before your flight time. What time do you need to arrive to fly to ...?

200 people are on each plane. Estimate / how many people are in the air?

From the information given, can you estimate how many planes arrive in an hour?

The flight from Edinburgh takes about 1 ½ hours. What time was the Edinburgh flight scheduled to leave? Tokyo is 9 hours ahead of the UK. If the flight from Tokyo is approximately 12 hours long, what time did the plane leave Tokyo?

Estimate the time difference between here and the places that the planes arrive from. (Use a world map for this and provide a benchmark – e.g. Tokyo is 9 hours ahead).

Give me an example, and another, and another…

A pair of numbers that have a **difference of 2**

As the children give examples, add more criteria – e.g. two negative numbers, one negative number, a decimal number, fractions, numbers more than / less than etc.

An example that no-one else will think of.

A hard and complicated example; an easy example.

True or False?
How do you know?

$\frac{3}{4} < \frac{4}{5}$

Can you do this without using equivalent fractions? How do you know? Can you draw a picture to support your explanation. When could $\frac{3}{4}$ be more than $\frac{4}{5}$?

Problem of the day

Dylan read 2/3 of his 240 page book and Ethan read 75% of his 160 page book .

How many more pages did Dylan read than Ethan?

- Read the problem of the day.
- Write the number sentence/draw a picture or diagram to help.
- Work out the answer and explain your reasoning

If this is the answer, 36.5 kg....., what could the question be?

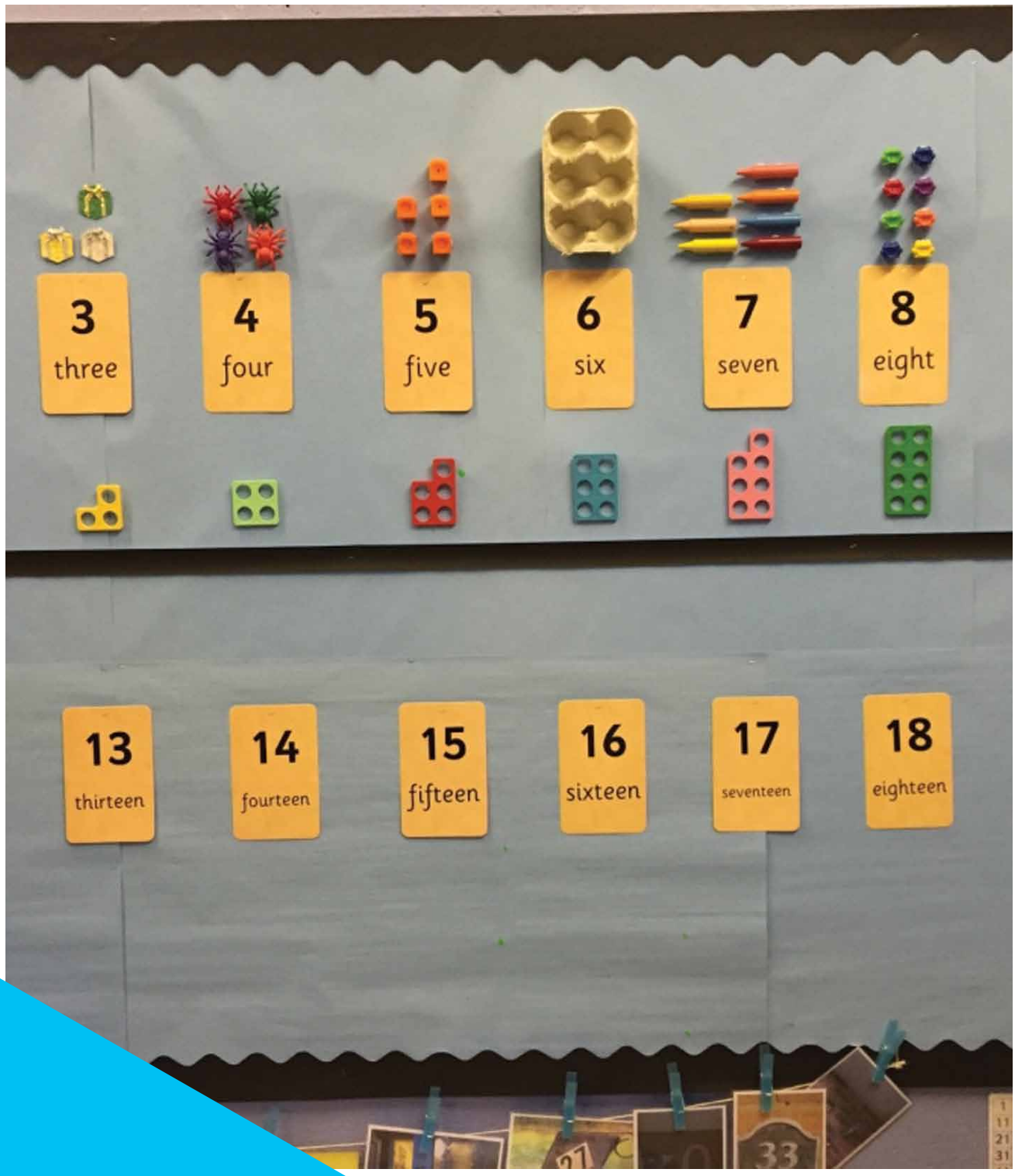
Before children start to explore the problem, ask them what they think the answer might be.

Children could use diagrams to help them explain the answer.

What numbers could I use so that Ethan reads more pages than Dylan?

Get some children to change the numbers but still have the same answer.

Can they change the numbers so both Dylan and Ethan read the same number of pages?


3
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18
eighteen

With special thanks to...

Colvestone Primary School
Gainsborough Primary School
Jubilee Primary School
London Fields Primary School
Parkwood Primary School
Princess May Primary School
Whitmore Primary School
William Patten Primary School

About National Numeracy

We want everyone in the UK to reach a level of numeracy that allows them to fulfil their potential. We believe changing attitudes is key to this.

National Numeracy is an independent charity established in 2012 to help improve levels of numeracy among adults and children, to create more positive attitudes to maths and to influence public policy. Where possible it works in partnership with other organisations to achieve these aims.

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