Primary
& Early Years
Magazine 47

National Centre
for Excellence in the
Teaching of Mathematics

Welcome to Issue 47 of the Primary Magazine. In this issue we feature the Japanese artist Katsushika Hokusai. A little bit of history looks at one of the world's most famous travellers, Marco Polo. Focus on... explores the mathematical possibilities of winter, and Maths to share looks at oral and mental starters.

Contents

Editor's extras

You will all be aware that the first draft of the National Curriculum is being rewritten as a result of the response of many, particularly the Advisory Committee on Mathematics Education (ACME). The team responsible for the rewriting is headed by Lynne McClure. Other members are Ann Watson, Helen Drury and Shahed Ahmed. It is currently with ministers at the Department for Education, and is likely to be ready for public viewing and comment sometime in January. We wanted to alert you to this as it is important that everyone reads it and responds. More details will be in the next issue of the Primary Magazine.

News of some events taking place this term

The NCETM Digital Technologies Conference, 27 February, London

Is your school considering buying iPads for use by your children? If so, you cannot afford miss the NCETM conference Working together to integrate digital technology in mathematics teaching and learning: Putting the tools in the hands of the learners. This digital technologies conference is for primary and secondary school teachers, and takes place on Wednesday 27 February at the Institute of Education, University of London.

The aims of the conference are:

- to familiarise participants with a range of technologies that could be used to enhance mathematics teaching and learning and to showcase some new developments, initiatives and reports
- to prepare delegates on how to use digital technologies in mathematics by sharing successful strategies.

The NCETM will be working with teachers and those providing digital technologies to schools for use with mathematics to fill the conference with classroom and learner-focused activities.

There will be workshops presented by primary and secondary school teachers. The day will include a final panel session with members Vanessa Pittard, who is responsible for STEM in the Department for Education; Dr Alison Clark-Wilson of the University of Chichester, and Professor Richard Noss, co-Director of the London Knowledge Lab and one of the authors of the recent NESTA report, Decoding Learning.

This conference is free to attend, and you can find more details and book your place via the conference webpage.

The NCETM Professional Lead Development Support Programme

There are still a few places available on the PD Lead Support Programme, a series of national free face-to-face events for CPD leads in teaching schools and improvement agents. Events this term are in Nottingham, Peterborough, Exeter, Sheffield, Guildford and London. These events are for:

- Specialist Leaders in Education (SLEs) and other colleagues from Teaching School Alliances charged with organising and running mathematics PD opportunities;

- teachers based in schools with a remit for supporting colleagues in their own and other schools such as Mathematics Specialist Teachers (MaST) and ASTs
- other teachers who are charged with organising and running mathematics PD opportunities;
- mathematics and/or numeracy advisers and consultants from Local Authority teams;
- independent mathematics consultants and organisations offering mathematics PD;
- colleagues from HE institutions offering PD.

This programme consists of four elements:

- an initial 24-hour residential development day, beginning at 17:30 on the first evening and ending at 15:30 on the second day;
- planning, execution and evaluation of an interim task based on input offered in the first residential;
- a second 24-hour residential (with timings the same as the first);
- a commitment to plan and offer future PD opportunities drawing on the input, discussions and experiences gained during the programme and to offer regular (termly) feedback regarding reach and impact for at least a year following accreditation (a re-accreditation process is offered after one year).

Colleagues completing this programme will be accredited by the NCETM to provide professional development in the priority areas of arithmetic proficiency in primary schools and algebraic proficiency in secondary schools and colleges.

Accredited PD Leads will:

- receive a certificate indicating their status as an 'NCETM Professional Development Accredited Lead';
- be entered into a directory of Accredited PD Leads which will be held on the NCETM portal;
- receive an 'NCETM Professional Development Accredited Lead' logo which can be used on any relevant documentation to signal your accreditation.

There is no cost attached to attendance at the two residentials: accommodation and meals are included, but please note that travel and supply costs if appropriate, should be met by those attending.

If you are interested in taking part, you can find out more on our news page.

Conferences

The conference season is on the way. Here is some information about three of them:

Booking is in progress for the NAMA conference, Mathematics Learning – Nature or Nurture, which will be held from 14 - 16 March at Aston University, Birmingham. Colleagues are invited to attend all or part of this great CPD opportunity. For full details of this conference, please visit NAMA's website.

Would you like to hear top speakers on communicating and teaching mathematics? If your answer is 'yes', you must go to the MA's Annual Conference! Booking for Telling the Great Stories of Mathematics has now opened, and it takes place from 3 - 5 April at Loughborough University. The speakers are Rachael Horsman, Marcus du Sautoy, David Spiegelhalter and Art Benjamin. For details on how to book, visit their website.

The ATM annual conference, Maths for Real, will take place in Sheffield from 2 - 5 April. As always there will be a wide range of sessions available, evening activities and, of course the ATM Workshop. Try out lots of practical mathematical activities, work through some problems together in the workshop and remember why you love mathematics. To find out more, visit their website.

EYFS

You might be interested in joining the Early Years Forum. The focus of this forum is children's mathematical thinking, learning and teaching from 0-8 years. It welcomes members to share experiences and raise questions; to discuss pedagogy and research and to recommend books they've enjoyed. This community is likely to be of interest to Early Years teachers and practitioners, maths coordinators, Early Years advisory teachers and consultants.

There is currently a hot debate on the New Early Years Foundation Stage Early Learning Goal for Number. You might be interested in sharing your opinion, reading a letter written to Elizabeth Truss by the ATM and MA Primary Group and another by Helen Williams and Sue Gifford.

And finally...

Why not take a look at some of the work of Vi Hart? She does some amazing mathematical things with food. But first, watch her Doodling in Math Class: Connecting Dots. This might be something you would like to try out with your children! Vi is a professional mathemusician at Khan Academy.

The Art of Mathematics
Katsushika Hokusai

Katsushika Hokusai was born during the Hōreki period in Japan. This period started in October 1751 and ended in June 1764. During this time Emperor Momozono and Empress Go-Sakuramchi were ruling the country. His exact date of birth is unknown but it is believed that it was on the 23rd day or the ninth month of the tenth year of this period which makes his birthday in October or November 1760.

He was born into a family of craftsmen in the Katsushika district of Edo, which later became Tokyo. His childhood name was Tokitarō. It is believed his father was the mirror-maker Nakajima Ise, who produced mirrors for the shogun (Japanese military dictator). We are not sure who his mother is, but, because his father never made Hokusai an heir, it is believed that his mother might have been a concubine! Hokusai began painting at around the age of six, possibly learning the art from his father, whose work on mirrors also included the painting of designs around the mirrors.

Katsushika was known by at least 30 names during his lifetime. The use of multiple names was a common practice of the Japanese artists of the time, but the number of names he used was far greater than that of any other major Japanese artists. He changed his name when he changed his artistic style and this has been helpful for breaking his life up into periods.

At the age of 12, Katsushika was sent by his father to work in a bookshop and lending library. These were popular in Japanese cities at the time where books were made from wood-cut blocks. At 14, Katsushika became an apprentice to a wood-carver, where he worked, possibly making books, until the age of 18. At 18 he was accepted into the studio of Katsukawa Shunshō, an artist well-known for his portraits of actors and other superb paintings. His style was called *ukiyo-e*, a style of woodblock prints and paintings which Hokusai was quick to master.

After a year, working with Shunshō, Hokusai's name changed for the first time. He was named Shunrō by his master. It was under this name that he published his first prints, a series of pictures of Kabuki actors published in 1779.

During the time he worked in Shunshō's studio, Hokusai was married to his first wife. Little is known about her, except that she died in the early 1790s. He married again in 1797, this wife also died after a short time. He fathered two sons and three daughters with these two wives, and his youngest daughter Oyei eventually became an artist like her father.

Shunshō died in 1793 and Hokusai began exploring other styles of art, including the European styles he was exposed to through the French and Dutch copper engravings he was able to acquire. He moved away from the images of courtesans and actors that were the traditional subjects of ukiyo-e and focused on landscapes and images of the daily life of Japanese people. This change of subject was a breakthrough in ukiyo-e and also in Hokusai's career.

In 1798 Hokusai became an independent artist and became known as Hokusai Tomisa. By 1800, Hokusai had adopted the name he would most widely be known by, Katsushika Hokusai, the former part of this name referred to the part of Edo where he was born and the latter meaning, 'north studio'. That year, he published two collections of landscapes, *Famous Sights of the Eastern Capital and Eight Views of Edo*. He also began to attract students of his own, eventually teaching 50 pupils over the course of his life.

Hokusai screen

He became increasingly famous over the next decade for his artwork and his talent for self-promotion. One of the self-promotions he is known for happened during a Tokyo festival in 1804, where he created a portrait of the Buddhist priest Daruma said to be 600 feet (180 m) long using a broom and buckets full of ink!

Between 1812 and 1820 Hokusai changed his name a few times and started writing art manuals with quick lessons in simple drawing. This served as a convenient way to make money and attract more students. He also published 12 volumes of manga (Japanese comics) before 1820 and three more were published posthumously. They include thousands of drawings of animals, religious figures, and everyday people. They often have humorous overtones, and were very popular at the time.

During one of his later periods, beginning in 1834, Hokusai worked under the name "Gakyō Rōjin Manji" (The Old Man Mad About Art). During this time he produced *One Hundred Views of Mount Fuji*, which was a significant landscape series.

Hokusai wrote this about himself:

> *'From around the age of six, I had the habit of sketching from life. I became an artist, and from fifty on began producing works that won some reputation, but nothing I did before the age of seventy was worthy of attention. At seventy-three, I began to grasp the structures of birds and beasts, insects and fish, and of the way plants grow. If I go on trying, I will surely understand them still better by the time I am eighty-six, so that by ninety I will have penetrated to their essential nature. At one hundred, I may well have a positively divine understanding of them, while at one hundred and thirty, forty, or more I will have reached the stage where every dot and every stroke I paint will be alive. May Heaven, that grants long life, give me the chance to prove that this is no lie.'*

In 1839 a fire destroyed Hokusai's studio and much of his work. By this time, his career was beginning to wane as younger artists such as Andō Hiroshige became increasingly popular. But Hokusai never stopped painting, and completed *Ducks in a Stream* at the age of 87.

Hokusai Museum, Obuse, Japan

He died on 18 April 1849, aged 89, and was buried at the Seikyō-ji in Tokyo.

For more about the life of Katsushika Hokusai visit Katsushika Hokusai, The Complete Works.

Some mathematical ideas for the work of Katsushika Hokusai

You can find lots of Katsushika's paintings at the complete works website. Here are just a few ideas...

Show the children Viewing Sunset over the Ryogoku Bridge from the Ommaya Embankment.

Ask them to estimate the number of people in the boat. Discuss why they can only make an estimate (about 13), e.g. they can only see parts of people and they might be parts of separate people or parts of the same one.

Look at the colours, how many different ones can they see. You could use this as an opportunity to practically explore ratio. The children could attempt to make the colour of parts of the river or the sky. As they do, they record the ratios of each paint they use, e.g. one part blue for every four parts white (1:4). The rest of the class could guess the different ratios and see who is the closest.

You could give copies of the painting to pairs or small groups of children and ask them to make their own versions experimenting with mixing different colours – recording their ratios of course.

Discuss the different 2D shapes that can be seen and make a list of these. How many different triangles and quadrilaterals can they see? Can they name them? Ask the children to make their own boat and river picture and include the shapes they spotted in the painting.

Show the children the painting Hibiscus and Sparrow.

You could repeat the ratio ideas from the painting above for the leaves, petals and sparrow.

Ask the children to look for examples of symmetry. They could make their own symmetrical leaves and petals by folding paper into halves or quarters, cutting out the appropriate shapes and shading in interesting, but symmetrical patterns. They could make several and then turn these into a collage of a hibiscus. They could then make a sparrow in the same way and add it to their collage.

Ask the children to find pictures of other animals that are symmetrical, e.g. a butterfly, face of a lion, front view of a giraffe. They could draw the line of symmetry, cut along it, give half to a partner, stick their halves on paper and then draw the other half of the animal.

Focus on the sparrow. Ask the children to tell you the names of the other birds that they know. You could make up some numbers to indicate how many of each have been seen in a garden somewhere in the UK. You could ask them to make a table of this information. They could then turn this information into a pictogram, bar graph or pie chart.

Katsushika created several paintings involving plants and birds or insects. You could explore some of these and compare their positions.

Show the children The Great Wave Off Kanagawa from *Thirty-six Views of Mount Fuji*.

You could use this painting as an opportunity to rehearse measuring. Give copies of the painting to pairs or small groups of children. Ask them to measure the height of the tallest wave in centimetres and then convert this to inches. If the scale of the painting is 1cm:0.5m, how tall in metres is the wave? You could vary the ratio.

Give the children string and ask them to measure the lines of the waves, by tracing the lengths with the string and then measuring along a ruler. You could repeat the inches and ratio ideas from above.

Can the children see Mount Fuji? You could ask them to use the internet to find mathematical facts about it, e.g. height in metres and/or feet, how long ago it erupted, where it lies in comparison to Tokyo (including distance in kilometres and miles). You could then ask the children to make a mathematical fact file about Tokyo including such things as population, temperature, rainfall, currency. You could then do data handling and calculation activities around the facts they find out.

Once they have found the height, they could scale it down, draw a small version and then make a painting similar to *The Great Wave Off Kanagawa* around their Mount Fuji (Mount Fuji is the highest mountain in Japan at 3 776.24 m (12 389 ft). It is an active volcano that last erupted in 1707–08, it lies about 100 kilometres (62 miles) south-west of Tokyo).

Show the children People Crossing an Arched Bridge.

The real size of the original painting was 23 inches by 15 inches. You could use these measurements to explore perimeter, area and converting from imperial to metric. The children could mark out the actual size on the playground or in the classroom if you have space. You could then make a copy, draw a grid onto it, cut out the pieces and give one to a child or a pair. The children could then scale their piece up by multiplying – by the same amount each. They could draw their piece onto a larger piece of paper and as a class you could put the pieces together to make a large version of Katsushika's painting.

The ideas here are just to give you a taster of the mathematical activities that could be involved when looking at artists such as Katsushika Hokusai. We know you can think of plenty of others! If you try out any of these ideas or those of your own, please share them with us!

Focus on…
Winter

Snow, rain, ice, hail…winter is here! It officially started on 22 December, the shortest day of the year.

When you think of winter what comes into your mind? Dark nights and mornings? Freezing temperatures? Long journeys to work? Roaring log fires? Snowball fights? A winter wonderland?

Do you wrap up warm and enjoy the winter or put up with it and wait for the spring?

Whatever you think about it, you can't get away from the fact that, in January, we are in the middle of the coldest season of the year.

This article explores some fascinating facts about winter with mathematical ideas to try out in the classroom.

Information for this article has been taken from these sources:

- Tidbit Fun
- TopTenz.net
- Yukozimo.

Why not visit them to find more fascinating facts?

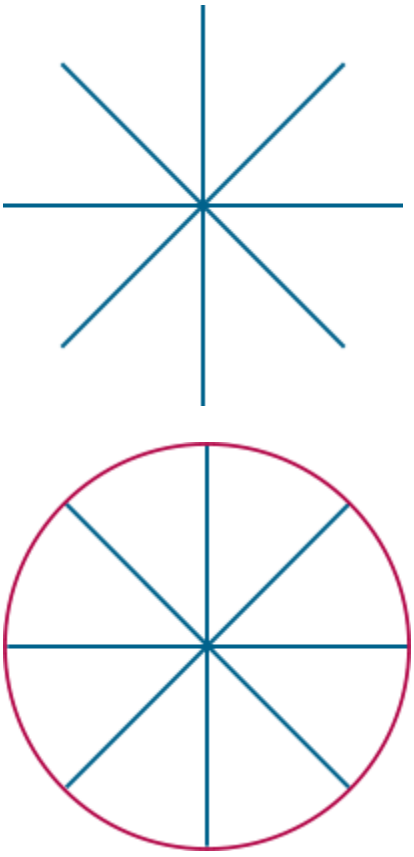
Let's begin our exploration with snow!

Did you know that...

The world's biggest snowflake fell on 28 January 1887 in Montana, USA. It was 15 inches across and 8 inches thick! The runner-up was one that fell in Siberia, almost a century later in 1971: it measured 8 by 12 inches.

The children could convert these measurements to centimetres using the conversion of one inch being equivalent to 2.54cm or, if rounded, 3cm or 2.5cm.

Once they have done this they could create a circle by drawing diameters (about 38cm) through a central point and the joining the ends up. This will help them visualise the approximate surface area of the snowflake:



They could then measure the circumference of their circle and find the approximate surface area by multiplying the diameter by three.

The children could fold their circle into eighths, cut a pattern, open it up to create their own snowflake and explore its symmetry.

They could explore the depth, using shapes or boxes by measuring them to make 8 inches. They could place their snowflake on top to get a really good idea of how big it was.

You could compare the measurements of the largest and second largest snowflakes in terms of diameter, depth and surface area.

They could compare the winter temperatures and rainfall in both places to see if there is any significance as to why the snowflakes were so huge.

No two snowflakes are the same – amazing when you think about it! Throughout time, snowflakes have fascinated scientists and philosophers, but the man who devoted his entire life to showing us the diversity and beauty of snowflakes was an American called Wilson A. Bentley (9 February 1865 – 23 December 1931). He was known as 'The Snowflake Man' and captured more than 5 000 photographs of snowflakes.

Ask all the children to make snowflakes by folding a square piece of paper into quarters or eighths and cutting out a design. How many different designs can they make individually and as a class? You could use their results to explore symmetry and shape.

You could show this picture and ask the children to identify shapes and lines of symmetry. They could then cut out the different snowflakes and make a symmetrical picture – maybe a snowflake man!

The heaviest snowfall on record was in Silver Lake, Colorado, on 14 - 15 April 1921, when the town received 67 inches of fresh snow in 24 hours!

The children could convert the inches to feet and inches and then metres and centimetres. They could measure this height against the wall of the classroom and compare with their own. How many of your class would have been buried in the snowfall?

You could take the opportunity to revisit time equivalences for 24 hours, e.g. days, minutes, seconds. Ask problems such as if the snow started falling at 06:25, when did it stop? The children could work out on which days of the week 14 and 15 April fell in 1921.

The children could find out mathematical facts about Colorado including annual temperature and rainfall. They could make up graphs and charts to show the information they find.

The largest single snowstorm on record lasted for five days in 1955 in Alaska, and left more than 141.5 feet of snow!

You could ask the children to convert 141.5 feet into metres (about 43.1m) and then ask them to visualise how deep that would be. They could cut up strips from A4 pieces of paper and stick them together to make this length.

You could compare this to heights of people, a bus, house, block of flats etc. and find out which of these would be buried.

The children could find out information about Alaska and make a mathematical factfile, including area of land, population, annual temperature and rainfall, currency, population. This information could be represented in different ways.

On average, one inch of rain is equivalent to 24cm of snow.

You could ask the children problems such as how much rain would be equivalent to different amounts of snow and vice versa, how much snow would fill a two-litre bottle?

Apparently each winter one septillion (1,000,000,000,000,000,000,000,000) of snow crystals drop from the sky and that it takes about a million little droplets to make one snowflake.

We'll leave it to you to make up mathematical ideas for this fact!!

Other wintry thoughts:

According to legend, we will have a cold winter if:

- animals have thicker coats of hair or fur
- squirrels build their nests low in trees and gather nuts early
- ants build their mounds high
- larger numbers of spiders are seen in the autumn
- birds are seen migrating early or huddling on the ground.

The coldest place in the world is of course Antarctica. The coldest temperature ever reported here was -129°F or -89.4°C.

In the UK, the coldest recorded temperature is -27.2°C. It was recorded in Braemar, Aberdeenshire, Scotland on 11 February 1895 and 10 January 1982 and also on 30 December 1995 in Altnaharra, in the Scottish Highlands.

The coldest recorded temperature in England was -26.1°C, on 10 January 1982 in Shawbury, Shropshire.

ice hotel

In Scandinavian countries, they build hotels out of blocks of ice. These are a tourist attraction. After a day's activity of, for example, husky sledging or snowmobiling, tourists can spend a night in a room in an ice hotel. The temperature is at a constant -50°C. If you make it through the night you get a certificate to prove it!

You could use this as an opportunity to work on finding differences between negative numbers.

The children could use the formula to convert from one type of degree to the other using calculators.

As a class you could use a data logger or thermometer to record temperatures in the grounds of your school over a two-week period. Results could be presented on a bar or line graph. After this the children could work out the mode, mean, median, range of the information they collected.

The longest winter road in the world is constructed each January on ice and snow. It is called the Wapusk Trail and has a length of 467 miles. It links Gillam, Manitoba, with Peawanuk, Ontario in Canada. This type of temporary road has a crucial role in enabling goods to be delivered to communities without permanent road access. Warm weather forces the closure of the winter road starting in March or early April.

You could ask the children to convert the length of the road to kilometres. They could use maps of England to explore different routes that they think might be the same distance as the world's longest winter road.

snowmobiling

Popular winter activities include ice-skating, skiing, carriage rides, snowmobiling, snowball fights, sledding and tubing.

Ask the children to describe each sport and activity and to add any that they can think of. Make a list on the board and take a vote to find out which would be the most popular if the children had the chance to pick one.

They could then display this information on a pictogram, bar graph, pie chart

Dutch daredevil Wim Hof holds the world record for running the fastest half marathon barefoot on snow and ice. He completed the marathon in 2 hr 16 min 34 sec near Oulu, Finland, on 26 January 2007. Hof's stunning abilities to withstand harsh winds, snow, ice and freezing temperatures won him the nickname 'Ice Man'

By courageously swimming 80 metres under the North Pole ice, Wim Hof earned another Guinness World Record.

You could use these facts to work on time and distance, e.g. how many minutes and seconds or seconds make the completed marathon time, if a swimming pool had a length of 15m how many lengths is the same as 80m?

The ideas here aim to give suggestions of the mathematical activities that could be involved in work covered by a topic on winter. There are so many more! Please share those that you use with us.

A little bit of history – Marco Polo

Marco Polo is one the best known travellers in history. He is famous for his travels to China and Persia and his work for the Kublai Khan. He was also a writer. The exact time and place of his birth are unknown but it is believed that he might have been born on 15 September 1254 in Venice. We do know that he was born into a wealthy and cosmopolitan Venetian merchant family. Marco Polo's father, Niccolò and his uncle, Maffeo, were jewel merchants who travelled to other countries to trade. They were on one of these trips when Marco was born. It was on the same trip that Marco's mother died and he went to live with an aunt and uncle. They made sure that he had a good education and he learned about merchant subjects such as currency and the handling of cargo ships.

In 1260, Marco's father and uncle travelled to the Black Sea and then on to central Asia joining a diplomatic mission to the court of Kublai Khan, the Mongol ruler of China.

This trip lasted for nine years. Khan requested that they return with people who could explain Christianity to him. In 1269 they returned home to Venice and met Marco for the first time. Two years later, in 1271, they went back to China, this time with Marco, who was 17 years old. Four years after leaving, in 1275, they reached Kublai Khan's summer court. For the next 17 years they lived on his land. Little is known about these years, but Marco was obviously popular because he was sent on different diplomatic missions giving him the opportunity to see many parts of China.

After their stay, the Polos accompanied one of Khan's daughters to Persia for her marriage. They sailed from a southern Chinese port and travelled to Sumatra, Ceylon (now Sri Lanka), southern India, and the Persian Gulf. After the wedding they left the princess in Iran and travelled overland to Constantinople and then to Venice, arriving home in 1295.

The whole trip lasted for 24 years, the Polos travelled around 15 000 miles and came home with many riches and treasures.

This map shows the Polos' journeys (click the map for a larger downloadable PDF version):

Map of the Polos' travels

When they arrived home they found that Venice was at war with Genoa. Marco became involved in a naval conflict between the two and in 1298 was captured by the Genoese. In prison, he told stories of his travels to his cell mate, who began to write them down. These writings resulted in a book which became

extremely popular and was translated into many languages. We know this book as *The Travels of Marco Polo*. It descibes the Polos' journeys throughout Asia, giving Europeans their first introduction to the inner workings of the Far East, including China, India, and Japan.

After Polo was released from prison in 1299, he returned to Venice. His father and uncle had bought a large house and they continued to trade. Marco joined them and soon became a wealthy merchant. In 1300 he married Donata Badoer, the daughter of Vitale Badoer, another merchant. They had three daughters, Fantina, Bellela and Moreta. Marco financed other expeditions but never left Venice again. He died on 8 January 1324.

Some mathematical ideas to feed into a topic about Marco Polo…

You could give the children copies of the statements of the timeline for the life of Marco Polo. They could then order these and display as a poster. You could ask them to work out the difference between different dates.

Marco Polo in Tartar costume

You could give the children copies of the map that shows his journeys. They could compare this to a current map of the world and label the different countries. They could also locate where they live. They could use the scale on the map to work out the distance for each trip.

You could focus on the distance of the longest trip: 15 000 miles. The children could convert this distance to kilometres. They could find the distance between two known places and compare to 15 000 miles. They could work out, for example, how long it would take if travelling an average of 65 miles a day.

Together make a list of the different countries Marco Polo visited. Have any of the children been to them? Are any of the children from them? If so you could make a table to show the information and the children could make a pictogram or bar chart to show the information.

Give pairs of children one of these countries to explore. They could make up a factfile of mathematical data which includes area of land, population, currency, temperature and rainfall. This could lead into data handling lessons which involve graph/chart making and finding means, modes, medians and ranges of the information. They could also make currency converters showing the equivalences to pounds sterling. This could include mental calculation strategies such as doubling, halving, addition, multiplying by 10. An activity like this is also good for exploring ratio.

You might be interested in exploring the interactive map of Marco Polo's travels from My Reading Mapped.

Information sources

- BBC History
- History timelines
- Wikipedia.

Image Credits

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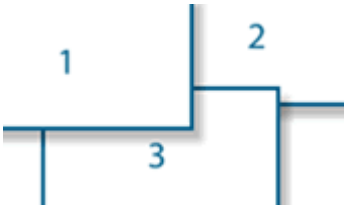
Map of the Polos' travels courtesy of Wikimedia Commopns, in the public domain
Marco Polo in Tartar costume courtesy of Wikimedia Commons in the public domain



Maths to share – CPD for your school

Oral and mental starter activities

After a request to produce an article about oral and mental starters, maths to share is going to do just that! If you have any other areas of mathematics that you would like to see featured please let us know.

Before the meeting, ask colleagues to prepare a favourite oral and mental starter to bring with them to demonstrate.

Gather together the following resources to use during the meeting:

- Digit cards
- +/- cards (from What Makes a Good Resource)
- Calculators
- Show me strips
- Partitioning cards
- Pendulum (3 interlocking cubes on a piece of string)
- Counting stick
- 100 squares.

Begin the session by using the +/- cards. Full instructions can be found in Positive and negative number cards from What Makes a Good Resource. Give each colleague a card. Say a starting number (e.g. 5), and in turn colleagues give the instruction on their card (e.g. + 19, - 2). As they do, everyone does what has been said to the new numbers made: 5 + 19 = 24, 24 -2 = 22, 22... Continue until everyone has said what is on their card. Compare finishing numbers: did you all get the same answer? Discuss the skills used to obtain the numbers, e.g. rounding and adjusting, partitioning. Ask colleagues to think of ways this activity can be differentiated so that it is suitable to use with all ages.

In 1999, when the National Numeracy Strategy came to our schools, the oral and mental starter was an important part of the three-part lesson. Now that the NS is gradually becoming a distant memory, some people feel that the starter is no longer a necessary part of the lesson, particularly as it is not a requirement by Ofsted. Others, however, believe that it is still important to rehearse, reinforce and consolidate mental calculation skills and/or previous learning.

Schools take different approaches to starter activities. One approach is to have a separate session, outside the daily mathematics lesson, to rehearse mental calculation skills including recalling those important number facts such as pairs to 10, 20 and 100 and times tables. Many schools have extra guided reading sessions outside the literacy lesson, so why not have an extra 15 minutes to reinforce and consolidate these important mathematics skills?

Lead a discussion on how oral and mental starters are currently carried out in your school. Questions you might consider asking could include:

- is there a consistent approach?
- if not, should there be?
- would it be worth considering adding an extra 15 minutes during the day to focus on mathematical fluency of key skills?
- when would be the best part of the day to do this?

Ask colleagues to consider the purpose of an oral and mental activity, whether it be a starter at the beginning of the lesson or an extra session during the school day.

Originally there were four purposes:

- revisiting areas that needed consolidation from previous main teaching sessions
- keeping learned concepts alert in the mind and skills sharp
- rehearsing number facts
- practising skills that might be needed for the main part of the lesson.

What do colleagues think of these? How often do their starters relate to these four purposes?

You could suggest that it might be a good idea to keep a note of areas that are notorious as 'trouble spots' e.g. time and fractions and practice these for a few minutes at least once or twice a week as part of the starter. This helps with memory – frequent retrieval of learnt skills.

Discuss other areas of the mathematics curriculum that might need frequent rehearsal and make a list of these.

Focus on the importance of mental calculation strategies and how these need frequent rehearsal because they can so often get lost when more formal methods are introduced.

Together make a list of the most common of these. Your list might include:

- partition and recombine
- doubles and near doubles
- use number pairs to 10 and 100
- adding near multiples of ten and adjusting
- using patterns of similar calculations
- using known number facts
- bridging though ten, hundred, tenth
- use relationships between operations
- counting on
- x4 by doubling and doubling again
- x5 by x10 and halving
- x20 by x10 and doubling.

Invite colleagues to demonstrate the starter ideas that they brought with them to the session. As a group decide which mental calculation strategies or mathematical skills these would best rehearse and how they could be adapted for different age ranges.

You might like to work through the following ideas and after each discuss the value of them:

Digit cards

- show answers to questions including tables facts, doubles/halves, more/less than, fractions of a number, square and prime numbers, square roots, next number in a sequence
- make and read big numbers by adding cards e.g. make 34, now 234, now 2 348,
- 23 487, 123 487, 9 123 487. Show the cards that show how many hundreds there are, tens, millions, thousands
- swap the digits in the 'big' numbers and say whether the numbers are now bigger or smaller and by roughly how much: 9 123 487, swap the 1 and 9: the number is smaller by roughly 8 million smaller. Adapt this to suit the age range of the children.
- select four digit cards, make the highest lowest, closest to 1000 etc.

Whiteboards and pens

- same as with digit cards but added bonus of writing the numbers as well (do this after experience with cards)
- writing numbers and then making them 10, 100, 1000 times larger
- answering mental calculation questions e.g. bridging 10, 100, 1000, doubling and halving, addition of near doubles.

Partitioning cards

- working in groups of four, ask each child to make any two-digit number: who has highest on table, lowest, closest to 50 etc?

Calculators

- number recognition and calculator skills which need to begin in FS and continue into KS1 and KS2 e.g. switch on, enter number, clear, add.....
- place value: key in 4, now make it read 54 without clearing and typing it in again! (+50), make it read 754 (+700), make the 5 a 3 (-20).

Pendulum

- swing the pendulum from side to side. As it swings, count on or back in steps of different sizes from 0 and any given number, e.g. multiples to link to tables facts
- split class in half, one half count in fours as pendulum swings towards them, other group count in eights as it swings towards them. Then everyone count in both: fours one way, eights the other – good practice of doubling
- number pairs to 10, 20, 100 etc. For example: as it swings one way, call out a number, as it swings the other way, the children call out the number that goes with it to make 10/20/100
- doubling and halving: call out a number as it swings one way, children call out half or double as it swings other way
- money: to make amounts of money - for example, £1: call out 40p as it swings one way, children call out 60p as it swings other way – this links well with number pairs.

Counting stick

- counting in steps of different sizes: 0 at one end 60 at other to count in 6s, then extend to 60s, 600s, 6000s, 6 millions, 0.6, include 0 to 1 so counting in fractions and decimals, amounts of money e.g. 50p, weights e.g. 250g, capacity and length
- questioning as if a number line – what would go on this division what about half way between these divisions.

Show me strips

- using a paper clip on the paper show me strip (divided into tenths as the counting stick) ask the children to position it to show different numbers e.g. if the line goes from 0 to 1, they place the clip on $\frac{3}{4}$, if from 0 to 20, place the clip on 10, 8, 15 etc
- do this for counting in steps of different sizes.

100 square

- take your finger for a walk – great for adding near multiples and adjusting: finger on 7, add 10, add 19, take away 9, add 38...

Playing with digits

- write three digits on the board and ask the children to use all three to make up as many different new numbers as they can e.g. 3, 5, 6: 356, 365, 14 (3 + 5 + 6), 9 (3 x 5 – 6), $1\frac{1}{3}$ (3 + 5 ÷ 6).

Ways to make a number

- ask the children to make 20, give specific operations or several operations to use e.g. subtraction and multiplication: (3 x 12) – 16, division and addition: (48 ÷ 8) + 14, fractions: $\frac{1}{4}$ of 80, $\frac{2}{3}$ of 30.

Using what I already know

- 6 x 3 = 18 – what else do I know?

As a group, make a note of all ideas covered and build up a whole-school bank of effective starters. Ask colleagues to try some of these out in their classrooms and to feed back how they worked at a future staff meeting.