Primary Magazine

Issue 20

National Centre for Excellence in the Teaching of Mathematics

Welcome to the 20th issue of the Primary Magazine. Our famous historian is Fibonacci, our artist is Georges Seurat, and our CPD opportunity aims to develop subject knowledge in the area of volume and capacity.

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From the editor

Are you aware of the work of Maulfry Worthington and Elizabeth Carruthers from the Children's Mathematics Network? They have done much research into mark making and its role in the development of mathematical thinking. They, and many others, question the value of worksheets, claiming that they do little to encourage the mathematical thinking we wish our children to develop. There are a great many examples of the results from their research on their website, which are worth exploring. The first issue of the Early Years Magazine explores this with some research – Making your mark by Ian Thompson – which is also worth a look!

Maulfry and Elizabeth have recently written a new booklet for the DCSF, published shortly before Christmas 2009. Unfortunately there is no hard copy, but it is available to download.

Remember the two students Amy and Bethany who wrote a short article on the mathematics trail they made up for Brodsworth House? They were part of the Inspiring Mathematics Champions project, supported by Yorkshire Forward and the NCETM. They have now produced a report, Inspiring Mathematics Champions: a model for continuing professional development, which considers how this project could be utilised for the CPD of practice and pedagogy within mathematics education.

Another year, another World Maths Day! World Maths Day 2010 is on 3 March. The countdown has begun and you can register now. According to their website, this year features an exciting new format with multi-levels for all age groups and teachers, and parents and media are invited to participate for the first time. Last year two million students from 204 countries correctly answered 452 681 681 questions – there must be a good problem or two to be solved with those statistics!! Why not become a part of this year's Maths Day?

Teacher Enquiry Funded Projects

Are you interested in undertaking some action research? If so, you may be interested in the latest round of Teacher Enquiry Funded Projects (TEFPs). There are five focused themes, including one to do with developing cross-curricular approaches for learning mathematics, and funding of up to £5 000 is available for successful applicants. Applications must be received by **Monday 8 March**.

If you are a little daunted by the idea of applying for TEFP funding, we are still looking for teachers, LA consultants and any other educators of influence to consider bidding for an NCETM Regional Project. To inspire you, why not have a look at one of the projects that some teachers in the South West region have been engaged in and what they got out of it:
Rachel Brittain, Mathematics Subject Leader and Assistant Headteacher of Red Oaks Primary School wanted to research the best ways to help pupils learn their times tables and involve all staff in trialling a range of methods.
"Improving times tables and maths results in general featured highly on our SIP. The project and, of course, the finance, gave us a clear focus and the funding to do this in a way that otherwise wouldn't have been possible on a tight school budget."
You can read Rachel's final report here.

If you're inspired, contact your regional coordinator, who can advise you on the best way to submit a bid.

We are also still hoping to hear from mathematics subject leaders who would like to take part in a project using the Excellence in Mathematics Leadership tool. Again, contact your regional coordinator and they will guide you on possible approaches.

Up2d8 maths

In this Up2d8 we look at pocket money following news from the Halifax in December that pocket money given by parents is less than it was in 2005 but more than last year, despite the recession. We look at other data that they found, for example boys receiving more than girls, and regional differences.

We would be extremely grateful if you could give us some feedback on how you have used the Up2d8, if it has worked well and how it can be improved. Please leave comments in the Primary Forum.

In addition to the ideas on the spread, here are some more that you could adapt and try:

- you could ask the children to tell you how many pence each of the amounts on the first spread are worth and use this as an opportunity to find differences and totals of four digit numbers
- you could ask children to make up and write two, three, four etc. digit numbers on their whiteboards and then turn them into pounds and pence. Use this as an opportunity to discuss the decimal point in the context of money
- you could turn your role play area into a bank and let the children use money and make transactions, use cashpoint cards etc
- you could find a bank statement similar to the one below, either yours or one from the internet. They could explore such things as the amount of money paid in and the dates, and how much interest is paid in total

DATE	DESCRIPTION	WITHDRAWALS	DEPOSITS	BALANCE
	NEW ACCOUNT			NIL.
21 SEP 07	FOCUS RESEARCH & M FOCUS MONIES		24,000.00	24,000.00
26 SEP 07	FOCUS RESEARCH & M	24,000.00		NIL.
2 OCT 07	FOCUS RESEARCH & M FOCUS MONIES		5,000.00	5,000.00
5 OCT 07	UNTAXED INTEREST		9.64	5,009.64
5 NOV 07	UNTAXED INTEREST		10.20	5,019.84
15 NOV 07	FOCUS RESEARCH & M	5,019.00		0.84
5 DEC 07	UNTAXED INTEREST		4.58	5.42
30 JAN 08	FOCUS RESEARCH & M higher interest		25,025.79	25,031.21
5 FEB 08	UNTAXED INTEREST		9.82	25,041.03
5 MAR 08	UNTAXED INTEREST		54.77	25,095.80
10 MAR 08	FOCUS RESEARCH & M FOCUS MONIES		16,277.58	45,373.38
4 APR 08	UNTAXED INTEREST		76.80	45,450.18
7 APR 08	FOCUS RESEARCH & M FOCUS MONIES		8,487.25	53,937.43
6 MAY 08	UNTAXED INTEREST		90.43	54,027.86
21 MAY 08	FOCUS RESEARCH & M FOCUS MONIES		11,185.18	65,213.04
5 JUN 08	UNTAXED INTEREST		104.59	65,317.63
4 JUL 08	UNTAXED INTEREST		102.16	65,419.79
7 JUL 08	FOCUS RM LTD	10,000.00		55,419.79
9 JUL 08	FOCUS RESEARCH & M FOCUS MONIES		8,000.00	63,419.79
5 AUG 08	UNTAXED INTEREST		109.03	63,528.82
11 AUG 08	ANNUAL BONUS		25.00	63,553.82
3 SEP 08	HMRC VAT REPAY		4,004.41	67,558.23
5 SEP 08	UNTAXED INTEREST		106.47	67,664.70
10 SEP 08	FOCUS RESEARCH & M A T		4,000.00	71,664.70

- you could ask the children to research pocket money increases/decreases over the last 10 years on the internet, plot the information on a line graph and analyse the results giving possible reasons for the rises and falls e.g. the amount went down from £8.37 in 2005 to a low of £6.24 in 2008, possibly because of the recession
- in the FS you could give the children some real coins to look at. They should each choose one coin that they would like to be the coin of the lesson and give reasons why e.g. they like the shape, the

- design on the surface is interesting. They present their choice and reasons to the class who then vote for the one they want as coin of the lesson
- as an extension to this, they could try to find out as much about the coin as possible from information on the internet
- you could ask them to find out about different coins from around the world. They could look on Google Images. Ask them to compare these with ours
- you could make a jigsaw puzzle out of a photocopy of a coin for the children to complete
- you could play a memory game. Put different coins on a tray, ask the children to try to memorise them. Take one off and then ask them to identify the one that is missing
- you could ask questions such as: I receive three coins for my pocket money, how much do I get?

Download this Up2d8 maths resource - in PowerPoint format.

Download this Up2d8 maths resource - in PDF format.

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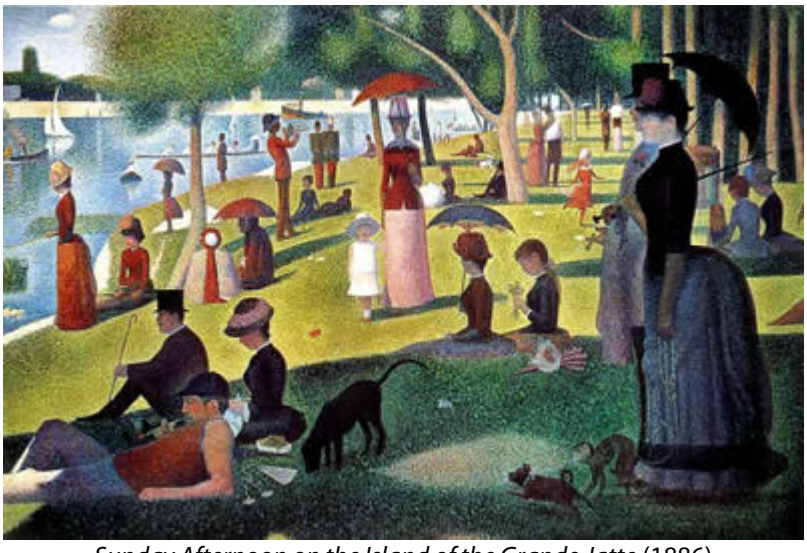
The Art of Mathematics
Georges Seurat (1859 - 1891)

Georges Seurat was born into a wealthy family in France on 2 December 1859. His father was a legal official from Champagne, his mother a Parisian. Georges was an artist but he also spent much of his life studying colour theories. He studied at the École des Beaux-Arts for two years, where he was strongly influenced by painters such as Rembrandt and Francisco de Goya. After his military service, Seurat shared a studio in Paris with two friends. After a while, he moved into a studio of his own, where he spent two years mastering the art of black and white drawing.

Bathers at Asnières (1883), Seurat's first major painting

Georges began to exhibit his work at the official *Salon* in 1883.

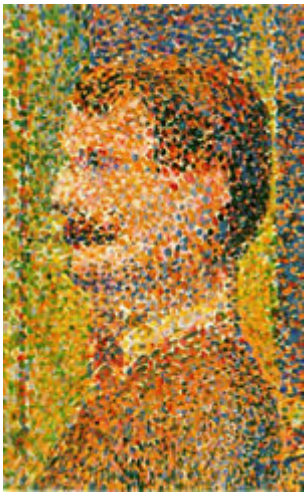
However, when his work was refused by the Salon the following year, he founded the *Société des Artistes Indépendants* with several other artists. His famous canvas *Sunday Afternoon on the Island of the Grande Jatte* was the centrepiece of the 1886 exhibition.



Sunday Afternoon on the Island of the Grande Jatte (1886)

Seurat created large paintings using tiny dabs or strokes of pure, contrasting colours. The tiny strokes were too small to be seen when looking at the entire picture. From a distance, the coloured dots came together to create a brilliance that mirrored actual light conditions. This technique is called *pointillism* and was the beginnings of the Neo-impressionism movement. The development of colour theory in the late 19th century played a key role in developing Neo-impressionism. Seurat used his understanding of colour theories to enhance his work. He helped to develop a system of pure colour, where colour mixing was not necessary.

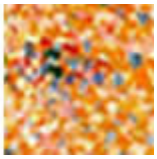
Neo-Impressionism was not initially welcomed by the art world. Its use of tiny dots to compose a whole picture was considered even more controversial than the preceding movement, impressionism. The meticulous regularity of brush strokes was thought to be too mechanical, too far from the accepted ideas of creativity in the 19th century. However, its fame quickly spread with a peak lasting around five years, from 1886 to 1891. The Neo-impressionist movement did not end with the death of Seurat in 1891 but continued to develop over the next decade.



Detail from *La Parade* (1889) showing pointillism

During his short life, Seurat produced seven large paintings, 60 smaller ones, and lots of drawings and sketchbooks. He spent winters in Paris, drawing and producing one large painting a year, and summers on France's northern coast. He kept his private life very secret. He lived quietly with Madeleine Knobloch who was the model for his painting *Young Woman Holding a Powder Puff*. In February 1890 she gave birth to his son, Pierre Georges. It was not until two days before his death that he introduced his young family to his parents. Georges probably died of diphtheria. His son Pierre died two weeks later. Shortly after his death, Madeleine gave birth to his second son. His name is not known and he is believed to have died at birth or soon after.



Early Years/Key Stage 1

Show the children some Seurat pictures, finishing with the detail from La Parade. As you look at each picture, focus on different shapes and count objects such as umbrellas, yachts or dogs. Zoom in on a small area to allow the children to see the dots forming the picture. Look at the colours within the close-up. Are they what the children expect? Gradually zoom out to enable the children to see how the dots coalesce to form the picture.

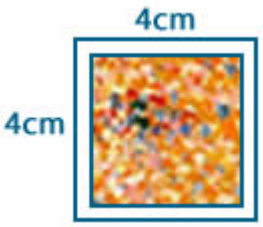
Choose a selection of familiar objects, perhaps themed to your current topic. Ask the children to paint an object using only spots or dabs of paint. This could be with a brush or a finger. Experiment with adding dots of contrasting colour. Look at the picture from a distance to see the effect. Estimate how many dots it took to make the picture. Count a small section and use it to work out an estimate of the number of dots in the picture. How close is this to the first estimate? Older children might like to try using a 1 cm^2 window to help with their estimation.

Experiment with painting other objects or scenes using the pointillism technique. Explore which colour combinations give the best overall effect.

Key Stage 2
Use your whiteboard or a lamp to help draw a faint silhouette of a friend. Ask the children to complete their picture with coloured spots just like Seurat did. Look at the detail from La Parade to see which colours help to add depth. Keep checking the picture from a distance to see that the right effect is being produced.

How many dots make a picture? Use strips of card to make a 1 cm^2 window. Site the window in various places on the picture and count the spots. Calculate the average, then measure the whole picture and estimate how many dots have been used to create the picture. Count how many dots different children make in 1 minute. Find the average dots made and calculate the amount of time to make a picture.

How many dots make a Seurat picture? Make a 4 cm^2 window. Enlarge a small part of one of the pictures. Use the window to calculate the number of spots in the whole of the enlarged piece. Then use the internet to find out the size of the whole painting. How much of the painting was the smaller piece that you examined? You could use this as an opportunity to work on percentages. Calculate the number of dots in the whole painting. If Seurat worked at the same speed as the children, how long did it take him to complete his painting? Should you double the time to allow for thinking time? Let the children decide!



Watch a slideshow of 106 of his paintings at this site.

Further information on Seurat can be found on these sites:

- Wikipedia
- Artchive

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Focus on…Transport in the air

This is always a hot topic for debate – is air travel really destroying the planet, or is that outweighed by the benefits to humanity, allowing us to travel to places that would otherwise be far out of reach?

According to most scientists, air travel is one of the most harmful things you can do to the environment. However, UK domestic flights account for less than 0.5% of UK carbon dioxide emissions (much less than the 21% coming from road transport). It is the fact that they are emitted at a higher altitude that attracts extra environmental concern. Noise pollution from aeroplanes is also something which affects many and is often the main reason for local opposition to airport runway extension plans. The number of people disturbed by noise around Heathrow however, has dropped from two million in 1974 to just 300 000 today.

Air travel as we know it began in November 1783, when the first successful human flight was made in a hot air balloon. Two French brothers by the name of Montgolfier created a giant linen and paper balloon. They filled it with hot air and sent two friends into the sky above Paris. The balloon is reported to have travelled for 5 miles, a flight lasting over 20 minutes. Earlier in the year, a balloon containing a sheep, a duck and a rooster stayed in the air for just 15 minutes before crashing to the ground!

The first successful manned flight in an aeroplane was in 1903, by brothers Orville and Wilbur Wright. They built their plane in their bicycle shop, and its flight lasted just 12 seconds. It wasn't until five years later that they made a plane that could fly for more than one and a half hours. By 1909 they were building planes for the military.

Aeroplane travel has advanced a great deal since the first efforts of the Wright Brothers. Planes now travel thousands of miles at altitudes of more than seven miles, carrying hundreds of passengers. Propellers have been replaced by jet engines and passenger planes now reach speeds of over 600 miles per hour. Could the Wright Brothers have ever imagined that?

The British Air Transport Association claims that nine out of ten Britons have flown in an aeroplane, and this will only increase in the near future. The ethics of air travel could prove an interesting debate with children, but even more interesting if it involves us all in some mathematics!

Amaze your pupils with some of these facts, and let us know of any exciting maths activities that they inspire…

- the wings of commercial airliners today are positioned closer to the tail than the nose of the plane. This is to compensate for all the extra weight of passengers and their baggage!
- the first 'Great Paper Aeroplane Competition' was held in New York in 1967
- the world record holder for flying a paper aeroplane is Ken Blackburn: the flight lasted 27.6 seconds!

A Department for Children, Schools and Families initiative to enhance professional development across mathematics teaching

- Leonardo da Vinci is thought to have designed the first helicopter in the early 1480s, known as 'the aerial screw'
- the Air Ambulance is the busiest voluntary emergency service in the country; over
- 19 000 missions each year, serving 177 Accident & Emergency departments
- British Airways passengers consume over 40 tonnes of chicken and over half a million boxes of chocolates each year!
- nine out of ten British people have flown in an aeroplane
- the first female flight attendants in 1930 had to be unmarried nurses and were required to weigh no more than 8st 3lb (52kg).

Facts found from these sites:

- Butlerwebs
- BATA
- Airline Equality
- Boeing
- Wikipedia

The topic of 'Transport in the Air' can conjure up an almost limitless supply of ideas and activities for use in the classroom. You could take a look at baggage allowances, these are a great opportunity for an investigation: ask the children to pack (either real or imaginary) a suitcase and find the combination of items that weighs in below the allowance.

Links with history might include looking at how designs of aircraft have changed over the years, placing new inventions on a timeline. Google Earth, now in its fifth version and free to download, has a new feature allowing users to see historical aerial views of an area.

Wonderful links with geography can be made by using this feature to examine the affect that airport and runway expansion plans have had on the surrounding landscape.

In science, children can make their own paper aeroplanes or helicopters (the link has simple video and diagrammatic instructions for a whole range of designs). They can enjoy the careful construction, adapting their designs to improve flight, timing and measuring length and distance, all culminating in a grand class, or even school, competition – all fairly tested of course!

Ask the children to consider how they travel to school (unlikely to be by plane!). The Stats4Schools website has a whole unit of work suitable for upper Key Stage 2, based on the statistics of pupils in the UK and the modes of transport used for travelling to school. Lesson plans and resource sheets are provided with large data sets requiring pupils to really interrogate the data. Are the results for the children in their school similar?

The Manchester Airports Group (MAG) education website hosts a huge range of excellent teaching resources, aimed at Key Stages 1-4 (although equally useful for Foundation Stage). Materials include electronic interactive Big Books (also available as pdf files), where pupils can find out about the different operations involved in a large international airport. There are many activities centred around the different stages of air travel, covering most curriculum subjects. A real gem for teachers!

Planemath is an American website (so maps and terminology are American), with some fantastic activities linking the world of air travel with mathematics. Problems include those relating to weight (ensuring the plane is not over-loaded), distance (planning shortest flight paths between cities), time (looking at plane timetables using 12- and 24-hour clocks), capacity (ensuring enough fuel is added to travel the required distance) and shape (recognising structures from a 'bird's eye view'). Some wonderful ideas for the classroom covering a whole range of topics!

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Starter of the Month

Here are some starter suggestions which link with the Focus Transport in the air.

Foundation Stage
Ask the children to tell you what clothes they might take on holiday. Discuss the different types of holidays and the weather conditions of each. Explain to them that you are going skiing for the first time, so you know you will fall over fairly often! You will need to take several ski outfits as they will get wet. Your suitcase will only fit two ski jackets and three different pairs of ski trousers. How many different outfits will you be able to make?

Provide the children with pictures to manipulate to support their thinking. Have they found all of the possibilities? Did they work in a logical order? Discuss how they could rearrange the order of their outfits.

Key Stage 1
Talk to the children about what happens if we go on holiday by aeroplane. Use some of the online resources listed here and in Focus on to immerse them in the mathematics of the airport environment. Show them the images of bags and read the weights of each bag together. Provide the children with 1kg weights to handle and explain that they can take 20kg of baggage onto your aeroplane. Which bags would they take? Can they find a different combination? What if they could take more than one of each bag? How much would all of the bags weigh altogether?

Lower Key Stage 2
Download Google Earth and enter the name of an airport into the search box. Watch with the pupils as the camera 'flies' to the location. Use the zoom function to focus on the runways of the airport. Can they see any numbers? Show them the numbers at each end of a runway (the numbers should be read with the 'zebra crossing' below them). In pairs, ask them to write down the pair of numbers. Repeat with three more airports. What do they notice about the numbers (they always have a difference of 18). Show them the number at the end of a runway at another airport. What number do they think will be at the other end? You can download a list of numbers from runways of some major airports.

This activity has been adapted from Adam Boddison's website, as part of the Motivate *series of video conferences.*

Upper Key Stage 2
Children could work on the 'Airport Runways' activity outlined above. Can they think why the numbers differ by 18? What if the numbers were all 10 times bigger – i.e. differ by 180? If appropriate, explain that the numbers refer to the compass directions of the runways. So a runway numbered 09 and 27 points to east (90°) and west (270°) respectively. See Wikipedia for more examples.

Drag the cursor along a runway to give pupils the sensation of 'flying' along its length. How long do they think it is? Google Earth's 'line tool' can be used to mark the start and end points, which will then give a total length in both kilometres and miles. Show them another. Is it longer or shorter?

Challenge them to find runways for as many of the eight compass directions as possible. Which airports' runways would be parallel to each other? Perpendicular? What is the angle between the runways of Birmingham and Coventry? Heathrow and JFK?

A little bit of history
Famous Mathematicians – Fibonacci

Fibonacci is said to have been the greatest European mathematician of the middle ages. His full name was Leonardo Pisano Bogollo, he was also known as Leonardo of Pisa, Leonardo Pisano, Leonardo Bonacci, Leonardo Fibonacci or, most commonly, Fibonacci! He was born in Pisa in Italy (hence Pisa as his surname) in around 1170AD.

His father was Guglielmo Bonacci, which is where his nickname *Fibonacci* came from. It was shortened from the term *filius Bonacci*, which means 'the son of Bonaccio'. His father was a wealthy Italian merchant who was a kind of customs officer in charge of a trading post in Bugia. Bugia is now known as Bejaia, a port east of Algiers in North Africa. As a young boy, Fibonacci travelled with his father to help him with his work. It was in Bugia that he learned about the Hindu-Arabic numeral system which was to become one of his most significant contributions to the European world of mathematics.

I II III IV V

The Europeans were using Roman numerals at the time and he saw that calculating with Hindu-Arabic numerals was much simpler and more efficient. This inspired him to travel throughout the Mediterranean to study under the leading Arab mathematicians of the time in order to learn more about their way of doing things. After he returned in around 1200, he wrote a book Liber Abaci (Book of Abacus or Book of Calculation) published in 1202, when he was 32. In it he wrote about all he had learned and it was in this way that he introduced Hindu-Arabic numerals to Europe. See A little bit of history in Issue 8 of the Primary Magazine for a more detailed look at the history of our number system.

His book also posed and solved a problem involving the growth of a hypothetical population of rabbits. The problem was based on several assumptions:

- you start with one male and one female rabbit who have just been born
- each will reach sexual maturity after one month
- the gestation of a rabbit is one month
- a female rabbit will always give birth to one male and one female
- rabbits never die

The question he asked was: how many rabbits will there be in one year? The solution to this forms a sequence of numbers that was to become known as the Fibonacci sequence. This sequence was known to Indian mathematicians as early as the sixth century, so he didn't invent it, but he did introduce it to the West.

Why not explore the rabbit problem with your class? You can find the solution on the ThinkQuest website. There is a great picture book The Rabbit Problem by Emily Gravett which explores Fibonacci's problem – and lots more, in a really delightful way.

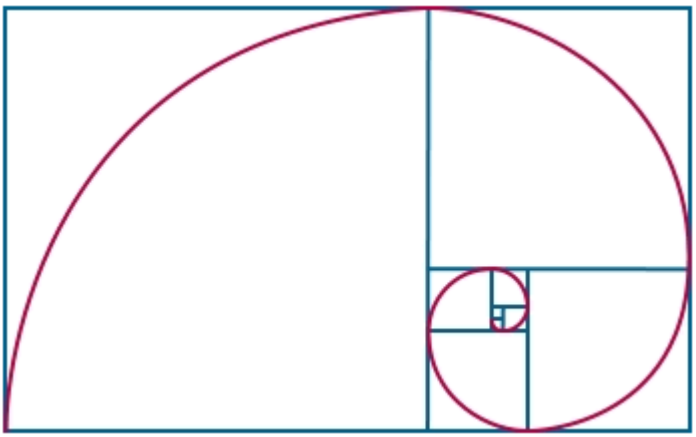
In the Fibonacci sequence, each number is the sum of the previous two numbers, starting with 0 and 1. It begins 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610 etc.

How far can your children take this sequence in up to five minutes?

The higher up in the sequence, the closer two consecutive Fibonacci numbers, when divided by each other, will approach the golden ratio. You could give the children calculators to see how close to the golden ratio they can get with the consecutive Fibonacci numbers in their sequences.

Fibonacci numbers appear all around us in nature. It is worth exploring this website with your children – some cross-curricular maths!

Fibonacci is also famous for his rectangle and spiral. Visit the Nrich website for more about this and also some very challenging Fibonacci problems.



You might like to explore some of these number puzzles either by yourself or with your class.

Fibonacci died in 1240s and there is a statue commemorating him in the cemetery of the cathedral in Pisa near the famous leaning tower.

Information sourced from:

- Wikipedia
- Dr Ron Knott's site

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Maths to share – CPD for your school

Measure - volume and capacity

This session is based around common misconceptions in the area of volume and capacity.
The aim of this CPD is to discuss these misconceptions and further develop subject knowledge.

Before the session you will need to copy and cut out the capacity cards.

Warm-up activity
Ask each person to write a measure of liquid volume between 0 – 2 litres and pass it to a partner. Ask them all to stand.

Call out the following instructions one by one:

Stay standing if the capacity on your card is:

- greater than 0.4 litre
- less than 1 500 ml
- greater than ¾ litre
- less than 1.2 litres
- greater than 900 ml
- less than 0.95 litres

When only a few people are left, ask for their values and check with the group whether they should be standing. How can they justify that they are still standing?

Solution – people standing will be between 900 ml and 950 ml
(adapted from NNS Professional Development materials 5-day course 2001).

Misconception 1: Mathematical language – confusion between liquid volume and capacity

Ask colleagues to tell their partner what they understand by the terms 'volume' and 'capacity' and also what they think the children's experiences of the words might be e.g. volume: loudness. Use coloured liquid in a glass or the picture of the wine below to support discussion.

The volume of an object is the amount of 3-D space that it occupies. Liquid volume and solid volume are measured in different units, although the concepts are the same. Liquid volume is measured in millilitres and litres and solid volume in cubic centimetres and metres.

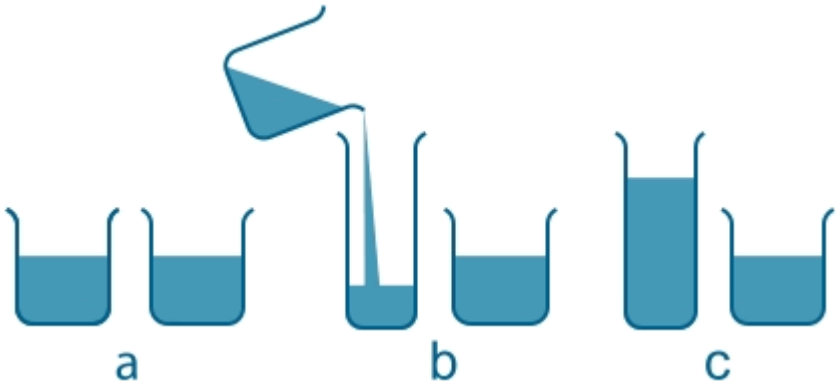
NB. It is not necessary to do much work on solid volume in the primary age range.

Only containers have capacity. The capacity of a container is the maximum volume of liquid that it can hold. Hence capacity is measured in the same units as liquid volume. Thus, a wine glass may have a capacity to hold 250ml, but the liquid volume of the wine may only be 150ml.

A Department for Children, Schools and Families initiative to enhance professional development across mathematics teaching

Misconception 2: Conservation of liquid

Children often believe that the amount of liquid has changed when a set amount has been poured from one container to another of a different size. They believe that there is more liquid in the one that has the highest level e.g. the left hand containers in figures b and c.



Piaget would argue that children are not able to understand this notion of conservation until they have reached the Concrete operational stage of development (7 - 11 years).

Is this consistent with your observations? Ask colleagues to discuss.

How can we facilitate children's learning in this area? Ask colleagues to share effective activities that have facilitated learning in this area.

Teachers will need to provide pupils in KS 1 and KS 2 with lots of opportunities to take part in practical activities transferring liquids from one container to the other, as they do in Foundation Stage. Encourage the use of mathematical language more than/less than/equal to.

Misconception 3: Reading Scales

What misconceptions occur when children are reading scales?

- some children pick the container up and fail to keep it vertical when reading the scale
- some children read the scale by looking at the value at the top of the meniscus (curve in the surface of a liquid, produced in response to the surface of the container or another object. It can be either concave or convex)
- some children read the scale from different heights so that parallax (difference of orientation of an object viewed along two different lines of sight) occurs. Some pupils do not understand the measurement between marked divisions on a scale.

How can we facilitate children's learning in this area? Ask colleagues to share effective activities that have been successful.

Teachers need to ensure that children have the opportunity to use and read a range of measuring scales on **real containers** with different scales in different orientations. Encourage children to make sure that they have the container on a flat surface and are looking at the liquid at the same

level. They must ensure that they are looking at the base of the meniscus. Encouraging children to estimate liquid volume before measuring will support some of these activities.

The Primary National Strategy Interactive Teaching Programme Measuring Cylinder is a useful tool for demonstrating reading a scale alongside practical activities.

Misconception 4: Converting one unit to another

Converting millilitres to litres presents a challenge for pupils because it involves multiplying and dividing by 1 000 (Primary National Strategy Year 5 – use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 or 1 000).

Teaching mental calculation strategies: guidance to support teachers in Key Stage 1 and Key Stage 2 (pages 44-46) provides a range of activities to support this.

Again, practical activities using a mixture of litres and millilitres should be encouraged.

Closing activity: Converting from imperial to metric and vice versa

Converting between imperial and metric units is introduced in Year 6 of the Primary National Strategy for Mathematics. However, children of all ages need to be aware of the use of both in the years before this, as several of both are still used in real life in the UK.

Give pairs of colleagues the capacity cards and ask them to work together to place all the capacity cards in order, smallest to largest. They must be prepared to justify the position of each card during the feedback. (They may need a hint that 4 pints = 2.272 litres – this amount will enable them to work out all other amounts).

Solution ½ pint, 0.3 litre, ½ litre, 1 pint, 3 pints, 3½ pints, 2 litres, 0.5 gallon, 7 pints, 4 litres, 4.5 litres, l gallon (activity from NNS Professional Development materials 5 day course, 2001).

How can this activity be adapted and used in the classroom?

Plenary

Ask colleagues to think of all the real life examples they can think of in which millilitres and litres and pints and gallons are used as measures. How can these be exploited for use in the classroom?

The overriding message for enhancing children's learning in capacity as with all measures is that children should be engaged in practical activities not paper-based ones.

You can evaluate your subject knowledge in this area using the NCETM Self-evaluation Tools.