Primary Magazine

Issue 31

National Centre for Excellence in the Teaching of Mathematics

Welcome to the 31st issue of the Primary Magazine. Our feature A little bit of history focuses on the Victorians, we look at the art of Friedensreich Hundertwasser and we focus on the magic of mathematics. Our CPD opportunity explores the use of colour rods to support mathematical thinking and our ICT article explores the use of the internet for data collection; It's in the News! features the New Year.

Contents

Editor's extras

I'm sure you're aware that the cost of the foods that make up our staple diet have gone up over the last three years, amid warnings that the era of cheap food is over. You could use these facts from mysupermarket.co.uk to work on some related calculations, and you could also use this as an opportunity to explore percentages:

Food	Average price 2007	Average price 2010	% change
Rice, pulses and grain	£1.36	£2.15	+58
Tea	£1.71	£2.23	+30
Baby milk and drinks	£2.95	£3.80	+29
Baby food and snacks	£1.06	£1.28	+21
Dog food	£2.99	£3.60	+20
Bread	£0.93	£1.10	+18
Eggs	£1.60	£1.89	+18
Cat food	£2.75	£3.10	+13
Bacon	£2.93	£3.21	+10
Fresh meat	£7.32	£8.01	+9
Poultry	£4.96	£4.67	-6
Fresh fish	£5.34	£4.92	-8

You could ask the children to work out the difference in cost of a supermarket shop today and in 2007.

You might like to explore this website for an interesting observation of the current population of the world and a wealth of other information which is updated as you look. You could use this for a variety of mathematical work with the children.

The Mathematical Association (MA) and the Association of Teachers of Mathematics (ATM) are now advertising their annual conferences. Each has a special primary day which you might be interested in attending. The MA conference 'Mathematics: The Big Picture' takes place from Thursday 14 to Saturday 16 April and features keynote speeches from Lynne McClure, the director of NRICH, Rob Eastaway and Andrew Jeffrey, as well as a wealth of exciting workshops. Their 'Primary Day' is on Friday 15 April. For more details and booking information visit their website.

The ATM conference 'Celebrating Gattegno' takes place from Monday 18 to Thursday 21 April. As we all know, Caleb Gattegno made a significant impact on teaching and thinking about education. Within mathematics this included the creation of ATM, the promotion and use of Cuisenaire Rods, the creation of geoboards, developments of the animated geometry work of Nicolet, and the Gattegno 'tens' chart for number. This conference also has a wealth of workshops and some significant speakers. For more information and booking forms visit their website.

It's in the News!

2011 is just around the corner – doesn't seem long ago that we saw in 2010! We thought this would be a good annual event to explore in this issue. Even though the schools aren't open over this time, it will be a good resource to use to the start the first term of the new year. There are links to geography and history, and the slides give opportunities for work on a variety of mathematical concepts including measurement and probability.

Before you use the slides you might find it helpful to look at the following websites for further information:

- timeanddate.com
  count down to New Year in seconds, minutes, hours and days
- newyearfestival.com
  information about New Year celebrations all around the world
- Wikipedia
  New Year's resolutions
- new-years-day.com
  history of New Year
- eziniearticles.com
  history of New Year's resolutions.

This resource provides ideas that you can adapt to fit your classroom and your learners as appropriate. As always, we would be extremely grateful if you could give us some feedback on how you have used it, if it has worked well and how it can be improved.

Download this *It's in the News!* resource - in PowerPoint format.

Download this *It's in the News!* resource - in PDF format.

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The Art of Mathematics
Friedensreich Hundertwasser

Friedensreich Hundertwasser was an Austrian painter and architect. He was born in Vienna as Friedrich Stowasser on 15 December 1928. In 1936 he attended the Montessori School in Vienna for a year. His school report talks about his “unusual sense of colour and form”.

The Second World War was a difficult time for the family because Friedensreich’s mother was Jewish. His father, a Catholic, had died in1929, just three months after he was born. The family were able to pose as Catholics and Friedensreich joined the Hitler Youth to complete the disguise.

Academy of Fine Arts Vienna by Christian Groer

After his school graduation in 1948, Friedensreich spent three months at the Academy of Fine Arts, Vienna, where he was strongly influenced by a Walter Kampmann exhibition in the Albertina and by Schiele exhibitions. It was at this point that he began to sign his work Hundertwasser. Sto is the Slavic word for one hundred, hundert in German. Friedensreich means ‘Peaceland’, peace-rich or peaceful, so Friedensreich Hundertwasser means something like Peace-Kingdom Hundred-Water. He travelled extensively for many years, taking a small set of paints with him wherever he went so that he could record anything that caught his eye. Hundertwasser painted wherever he was, at home and on the road, in cafés and restaurants, on the train or on aeroplanes, in hotels or at the homes of friends or acquaintances. He did not have a studio and did not paint at an easel, simply spreading the canvas or sheet of paper out flat in front of himself. He either took incomplete paintings on his travels, or he left them at his places of residence and continued to paint them on his return.

In Florence, Hundertwasser met French artist René Brô and followed him to Paris, where he stayed with the family and continued to work with Brô. Hundertwasser began to develop his own style, a kind of expressionism. He did not paint reality – his buildings are colourful and rounded, trees are extremely tall, everything is inaccurate. He used intensive, radiant colours and would often put complementary colours next to each other to emphasise a feature, such as the double movement of a spiral. He disliked edges and straight lines, calling straight lines "the devil's tools", so everything is rounded, wavy and different. It was in 1953 that Hundertwasser painted his first spiral, which was to become an enduring feature of his work, though his spirals are never regular.

In the early 1950s, Hundertwasser moved into architecture. There are various YouTube videos which are worth watching to get a feel for his buildings. His designs are unique and often incorporate the natural features of the landscape - schools, factories, service stations, a district heating plant, an incineration plant and many more. Watch the YouTube video The Magic of Friedensreich Hundertwasser, which shows the construction of a Hundertwasser-designed school in an amazing 23-second, time-lapse video.

In 1954 Hundertwasser became ill with jaundice. He spent two months in hospital in Rome where he painted a large number of watercolours. Hundertwasser married Herta Leitner in Gibraltar in 1958, but the marriage only lasted two years. In 1962 he married Yuko Ikewada. This time, his marriage lasted four years. He lived and worked on board the Regentag in the Venice lagoon for many years, though he travelled widely. He also sailed his boat across the Atlantic to the Caribbean and through the Panama Canal to the Pacific in 1975, and to Tahiti via Rorotonga to New Zealand in 1976. He loved New Zealand, frequently revisited it and chose to be buried there in the Garden of the Happy Deeds, under a tulip tree.

Hundertwasser experimented with many techniques and invented new ones in a range of different media. He painted on different types of paper, used wrapping papers and found materials such as plywood. On the front, or more frequently on the reverse of his paintings, he noted where and when he painted them and any technical information about the work. He also used a range of techniques such as woodcuts, silk screen and etching to produce prints. He would often use different colours when reprinting work. Hundertwasser also made a tapestry, though he later used others to do the weaving for him. He made other 3D objects to express his quest for beauty and variety, including traditional Japanese cicada kites in the shape of an insect, an architecture game and the ceramic Flower House. He also designed flags, stamps, coins, and posters.

Hundertwasser died from heart failure on board the Queen Elizabeth II on 19 February 2000, while sailing from New Zealand to Europe.

Activities

If you are able to, get a feel for Hundertwasser's paintings by downloading and watching Hundertwasser, the painter from YouTube. Ask the children what they noticed. They are likely to talk about colours, spirals, concentric shapes and may well comment on the flow of lines and images and high level of detail. Ask questions such as:

What sort of colours do you think Hundertwasser liked? How do you know?
What sort of lines did he like? What makes you think that?

House in Vienna by Hundertwasser and Krawina photograph by Christian H.

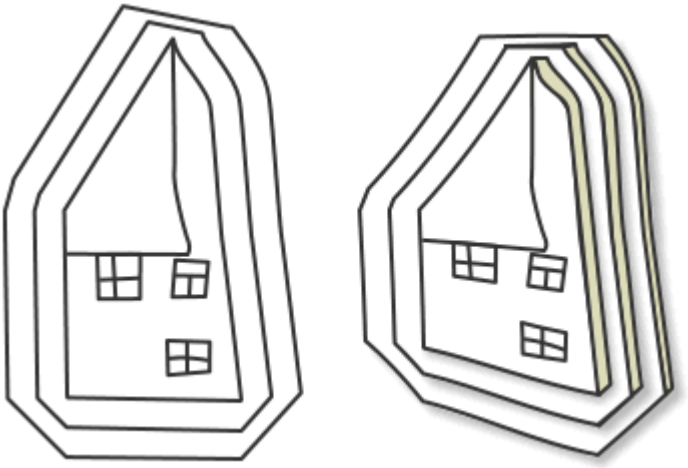
Hundertwasser designed Hundertwasser House in Vienna with Krawina, a fellow architect, and worked on the construction site throughout 1985. The House is in fact a block of flats, but like no other. Watch one of the YouTube videos of Hundertwasser's buildings to get an idea of his architecture. Finish by looking at Hundertwasser House. There are four useful pictures on Wikipedia Hundertwasser House page. The internal floors are uneven, the roof is covered in grass and trees grow out of windows. In addition, Hundertwasser believed in *Window Rights*:

"A person in a rented apartment must be able to lean out of his window and scrape off the masonry within arm's reach. And he must be allowed to take a long brush and paint everything outside within arm's reach. So that it will be visible from afar to everyone in the street that someone lives there who is different from the imprisoned, enslaved, standardised man who lives next door."
Hundertwasser, January 22, 1990

Agree a size for the basic rectangle; say 15 cm by 25 cm. This fits easily on a sheet of A4 paper or card but does not fill it. Ask the children to paint the rectangle in a single bright colour, using the edges of the rectangle as a guide. They could curve or extend the edge outward a little. Once dry, children can add windows in a variety of shapes and other decorations in the style of Hundertwasser. Cut out the near rectangles and assemble them into a large block of flats. Add a grass roof, turrets, and curved balconies. Here's one created by a class of Year 2 children at Bignold Primary School and Nursery, Norwich:

Picture in the style of Hundertwasser by Year 2 children at Bignold Primary School and Nursery

Hundertwasser created this 3D object through 61 print runs using 29 silk screens, 13 colours, and 32 metal embossings in seven colours and five perspex panels! Create a 3D object by drawing a simple image such as a tree, a person or a house on card. Cut out the object and draw around it lightly. Draw another outline 0.5 cm outside the first. Keep measuring the space to ensure consistence. Now redraw the object on the larger piece of card. Repeat until you have three pieces. Mount the pieces within a larger picture with a layer of card in between each layer to help create a 3D effect. Alternatively, create three more pieces of the same size as before to make the rear view of the object and mount all six pieces upright (using a wooden block or cardboard and spacers) to create a layered 3D object. Experiment with how much larger to make each piece and how many 'slices' to achieve the desired effect.



Paint mixing

Hundertwasser made many of his paints himself. He painted with watercolours, in oil, with egg tempera, with shiny lacquers and ground earth. He used various paints in one painting and put them next to each other, so that they contrasted in texture as well as colour.

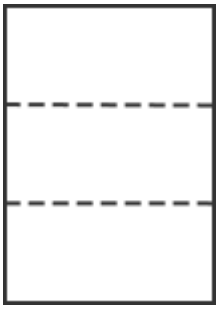
Use ratio to mix powder (or other) paints. Children will need something simple such as a teaspoon to measure identical amounts. Children should choose two colours to mix to create different shades. Beginning with the ratio 1:1, mix the powder paint and begin to paint a spiral. Vary the thickness of the line. Some children could choose to flatten the spiral or make a bulge one side too. Make new shades by

keeping one colour constant and increasing the other in the following ratios – 1:2, 1:3, 1:4, 1:5, 1:6 etc. Stop when the edge of the paper is reached. Repeat the process, starting with 1:1, then 2:1, 3:1, 4:1, 5:1 etc.

This time, work from the outside into the centre of the spiral. Try to end each sequence with the larger proportion an even number to lessen the chances of identical mixtures in the two spirals ending up beside each other. Discuss why this should work with the children. Vary the activity by using different types of paint for the second spiral.

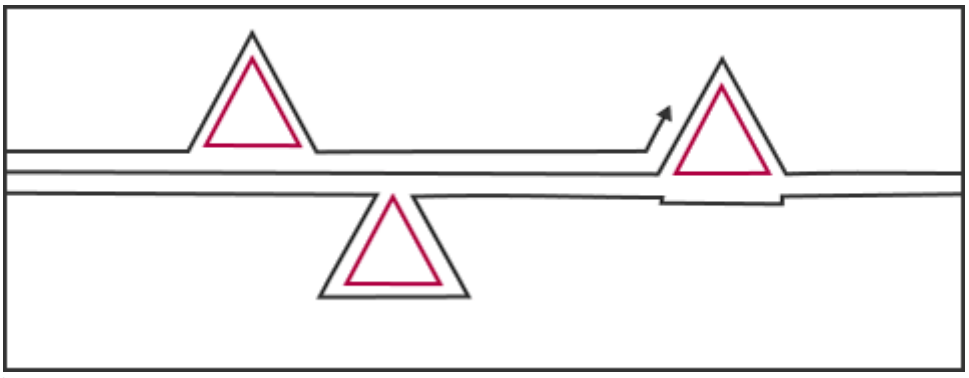
For inspiration on spirals, take a look at Der große Weg in the Belvedere, Vienna.

Flow lines



Fold a piece of A4 paper into three and cut into three equal pieces. Draw one, two or three identical geometric shapes on the paper (see example below). The example uses triangles drawn in red simply to make them stand out. Start in the middle of the short side, drawing a line from one side to the other, but around objects in the way. All lines should be equidistant from each other, say 0.2 or 0.3 cm. Continue drawing lines from side to side until there is no more space. This really focuses on the properties of the chosen shape, so avoid using more than one shape in any piece of work, though changing the orientation from that usually seen is a very useful extension. Complete the activity by making concentric or spiral shapes within the start shapes. Children could simply use a pencil or a range of coloured pencils. Felt pens are best avoided as they can be too thick, easily smudged and mistakes cannot be rubbed out.

This artwork is really 'anti-Hundertwasser', since he abhorred straight lines. Once the children are secure with the properties of the chosen shape (or shapes), ask them to take the idea, be creative and make it Hundertwasser-friendly.



For further information on Hundertwasser and his work:

- Hundertwasser, a three-minute video with clearer photography than many.
- The six-minute video, Hundertwasser, focuses on his buildings. Persevere – some of the better pictures are in the last third of the video.
- For a longer (10 minutes) video about Hundertwasser, his pictures and buildings try Friedensreich Hundertwasser - 10. Todesjahr.
- Wikipedia
- hundertwasser.de.

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Focus on…The Magic of Mathematics

Like What is it that makes mathematics so mysterious to so many people? Is it the continuous quest for the unknown, using what seem like unexplained, unfamiliar, even 'secret' rules and systems? To others, it is this very magical nature of mathematics, the thrill of solving the mystery, finding the solution, and working out how and why things work that makes the subject so appealing. The links between the worlds of mathematics and magic are unmistakable. Indeed, many of the greatest tricks ever seen rely heavily on maths to make them work.

This month we 'Focus on…' the magic of mathematics. Earlier this year, Martin Gardner, an American Mathematics and Science writer, passed away at the age of 95. He specialised in 'recreational mathematics' with a great interest in magic. He is considered to be the first 'mathemagician' (a mathematician who is also a magician) to whom the term was applied. Persi Diaconis, another American mathematician and former professional magician stated that, "…inventing a magic trick and inventing a theorem are very similar activities." We hope you will enjoy exploring the connected nature of maths and magic… and have some fun along the way!

The term 'Magic Square' is one with which most mathematics teachers are familiar. Magic Squares were known to Chinese mathematicians as early as 650BC, and are believed to have come from the legend of 'Lo Shu' or 'Scroll of the River Lo'. The story tells of a turtle emerging from the flood waters in ancient China, displaying a pattern on its shell. The pattern was a series of numbers arranged in a three by three grid, so that the sum of the numbers in each row, column and diagonal added to 15. The 'Lo Shu Square', as it became known, is the only magic square of order three in which 1 is at the bottom and 2 is in the upper right corner. All magic squares of order three are obtained from the Lo Shu by rotation or reflection.

4	9	2
3	5	7
8	1	6

Traditional Chinese representation of the 3x3 "Lo Shu" Magic square
from "The Astronomical Phenomena" (Tien Yuan Fa Wei)

Magic Square Activities

Children in Foundation Key Stage can spot the missing numbers in incomplete magic squares. Encourage them to use number tiles or a number track to ensure each number is only used once. Corresponding amounts of small counters or seeds can be placed onto each of the numbers in the grid. Ask the children to find how many in total for their given row or column, supporting with the 'teens' numbers as appropriate. What do they notice? Can they arrange their 15 seeds in a different way e.g. 4 + 9 + 2 or 10 + 4 + 1? How many ways can the class make 15 by adding three numbers?

Key Stage 1 pupils will enjoy hearing the story of Lo Shu, many versions of which are available on the internet. Ask them to explore whether the arrangement of numbers found on the turtle's shell is the only way in which the numbers 1-9 can be arranged so that all rows, columns and diagonals add up to 15. How many ways can they find?

Provide older pupils with examples of magic squares of different sizes, with some numbers missing. Can they find the necessary totals for each row, column and diagonal and use these to complete the grids? Some examples are provided to get you started. The total for each line in a 3x3 grid should be 15, 34 for a 4x4 grid, and 65 for a 5x5 grid. Can they see any pattern in these numbers? What would they expect the total to be for a 6x6 grid? Will it be greater than 100? Is it possible for the total of any line on a 6x6 grid to be more than 200? Why/why not? (It's actually 111!) It might interest you to know that the total for every row, column and diagonal can be calculated using the following formula:

$$\text{Total} = \frac{n\,(n^2 + 1)}{2} \quad \text{where 'n' is the number of squares in each row}$$

The largest reported magic square, which added up to 578 865, was completed in 1975 by a 13-year-old boy!

There are many websites available that demonstrate how to construct your own magic squares using simple rules and patterns, and even some that will generate magic squares for you at the click of a button:

- dr-mikes-math-games will generate magic squares of a given size…you will need to patient for the larger squares
- Mr Excel explains a method for creating your own magic squares of any size
- mazes.com gives a whole host of examples and methods for creating your own magic squares.

'Mentalism' is an accepted form of magic, where the person performing the magic, the 'Mentalist', appears to demonstrate highly developed mental abilities, often relating to mathematics. Some tricks associated with mentalism are surprisingly easy to carry out. Try this trick from NRICH on a friend, colleague or pupil and astound them by working out their age and their shoe size!!

1. write down your age
2. multiply it by 1/5 of 100
3. add on today's date (e.g. '2' if it's the 2nd of the month)
4. multiply by 20% of 25
5. now add on your shoe size (if it's a half size, round to a whole number)
6. 6inally, subtract five times today's date
7. show your answer.

The 'hundreds' are the age and the remaining digits are the shoe size e.g. 1105 is an 11-year-old child, wearing size 5 shoes. Challenge yourself to consider why it works, that is where the real mathematics is used.

The internet is packed with wonderful examples of what appear to be incredible feats of mental arithmetic, or even magic. In fact, there is always a 'magician's secret', a way of fooling (and astounding) the audience. Try some of these examples to get you started:

- Rob Eastaway discusses maths and magic, He introduces some wonderful activities and 'tricks' for use in the classroom, before discussing the mathematics behind them
- Cut The Knot provides 21 magic maths activities – you'll be amazed they work

- EasyMaths has examples to amaze all ages – with the crucial explanations too.

There are an incredible number of card tricks available that rely on quick mathematics to work. 'Motivate' hosted a video conference entitled 'Maths, Magic and Mystery' and used an activity, Finding the Mystery Card. NRICH also hosts a great number of 'tricks' with cards, encouraging pupils and teachers to find the mathematics behind the mystery.

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Page header - magic square photograph by Mataparda some rights reserved
Traditional Chinese representation of the 3x3 "Lo Shu" Magic square
from "The Astronomical Phenomena" (Tien Yuan Fa Wei) in the public domains.

A little bit of history
The Victorians

In this article, we are being really cross-curricular and looking at some of the ways that you can link mathematics into a topic of the Victorians. If you are looking at this period of history, try some of the ideas. This will mean you can double up on the maths that you do during the day!

However, due to the large amount of ideas and resources, this feature can only be read directly on the portal, otherwise the interactive nature of the way they are presented will be lost.

Image Credits
Page header - Queen Victoria image from Wikimedia commons in the public domain

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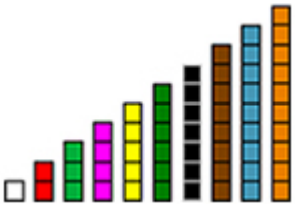


National Centre for Excellence in the Teaching of Mathematics

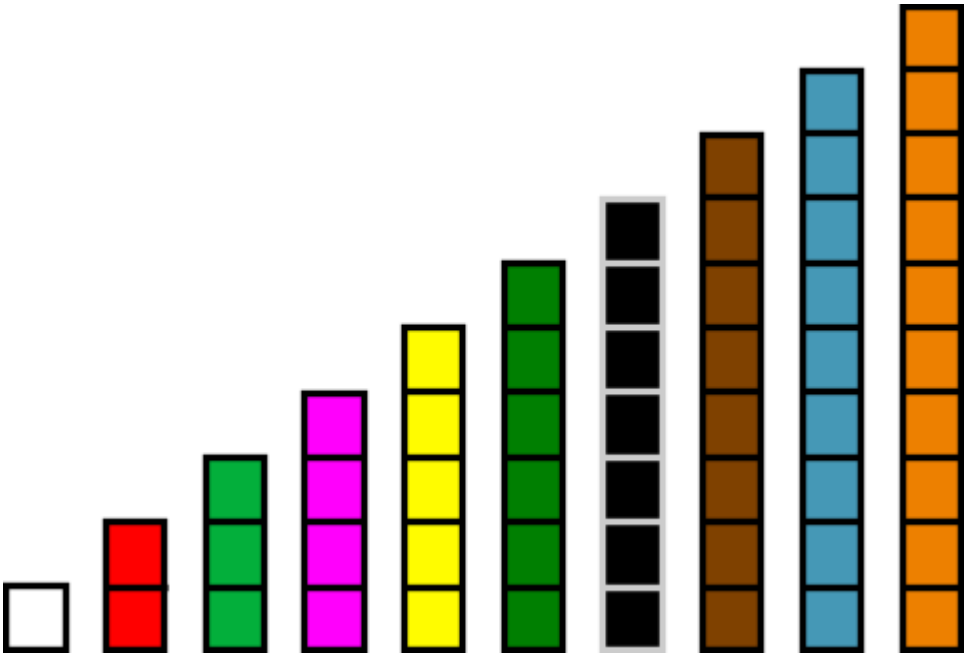
Maths to share – CPD for your school

Colour rods

Time to dust off those colour rods you have stored in the mathematics area! These are a wonderful resource, that were very popular in the latter half of the last century but seem to have fallen from favour with the increased use of ICT-based resources. Once you start to use them with the children you will quickly realise what an invaluable resource they are.

If you would like to lead a staff meeting about these, you will need to have plenty available for staff to work with so that they can clearly see the benefits of using them with the children in their class.

The rods are named after their inventor, Georges Cuisenaire (1891-1976), a Belgian primary school teacher, who published a book on their use in 1952 called *Les nombres en couleurs*. The use of rods for both mathematics and language teaching was developed and popularised by Caleb Gattegno in many countries around the world. Use of colour rods is also advocated by Professor Mahesh Sharma and Ronit Bird for supporting children with dyslexia and dyscalculia (see references at the bottom of the page).



Here is a taster of some activities to get you started with your staff, but for a full list of teaching activities and the theory behind the concept visit Arithmetic: A Teacher's Introduction To The Cuisenaire-Gattegno Methods Of Teaching Arithmetic. By: Caleb Gattegno (1960), which is now available completely free. You might find it helpful to have a quick look at this document before your meeting so that you can share the theory behind colour rods with everyone. Further references can also be found at the bottom of this article.

Try some of these ideas out with the teachers taking on the role of the children!

Supporting early number work

Early counting will start with developing an understanding of the relationship between the numbers and the colours.

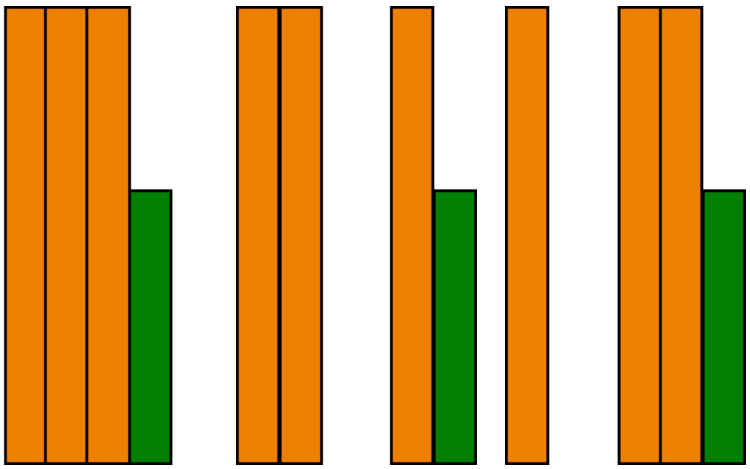
- ask the children to build a staircase as illustrated above and when they are confident remove a rod at random and ask them to identify which rod has been taken.
- this can be developed so that the children can discuss their answer using one more/one less e.g. the yellow rod is one more than the lavender rod or five is one more than four.
- comparative language can also be introduced which is larger/smaller, shorter/longer. Which rods are larger/longer than the yellow rod?

Colour rods are a fabulous tool to use when supporting the children in learning the number bonds to 10. Ask them to find as many different ways of recording what they have done?
For example O= B + G, B+G = O etc. As they become familiar with the rods they will be able to substitute with the numbers 10 = 7+ 3 etc.

This is a good opportunity to discuss the commutative law or addition e.g. 7+3 = 3 +7 and also the inverse operation 3+ 7 = 10 therefore 10 – 7 = 3.
It may also help the children to be systematic in recording their investigations.

Colour rods are a really flexible tool for developing the understanding that numbers can be portioned in various ways which support later calculation strategies of decomposition in subtraction and multiplication and division calculations.

Ask children to partition 36 in a variety of ways:

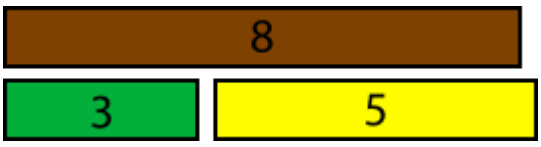


Calculation
Can you think how this could be used to support teaching and learning with addition and subtraction calculations? Discuss this with your teachers and then demonstrate the following ideas.

1. Begin by using colour rods to support bridging through 10.

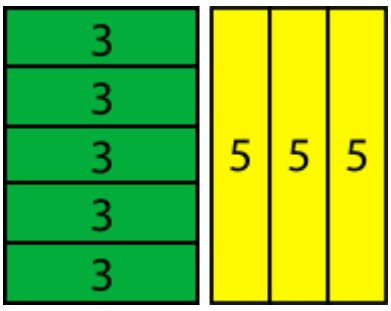
This is an example of calculating 8 + 6 = 8+ 2 + 4 = 10 + 4

2. Next, move on to finding the difference.
Colour rods are a particularly useful visual model to use to support the 'difference' conceptual structure of subtraction.



What is the difference between brown and green?

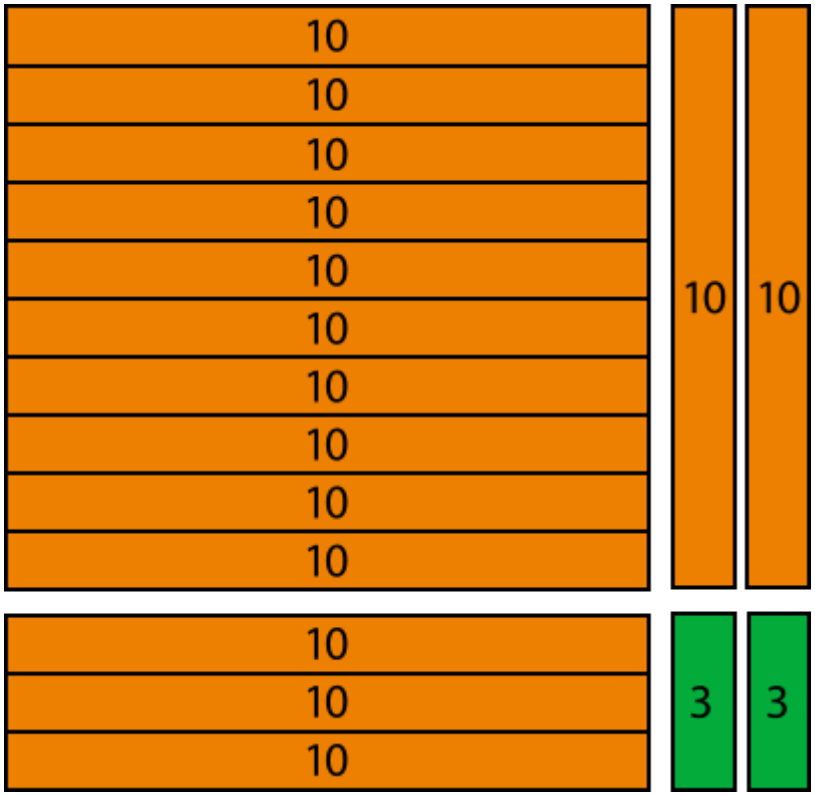
3. Now to support multiplication
To start, children can add rods to make a rectangles e.g. 3 + 3 + 3 + 3 + 3 = 5 lots of 3, thus multiplication calculations can be formed.



3 x 5 or 5 lots of 3 are equal to 5 x 3 or 3 lots of 5. The length of the rod is the constant.

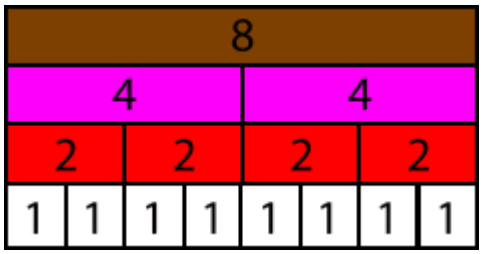
This method can then be used to explore different arrays and the commutative and distributive law of multiplication. Links to multiplication can be found in the Primary Magazine Issue 25.

Colour rods can be used to support multiplication calculations with larger numbers e.g. 12 x 13. This will support the use of Primary Framework 'grid' method.

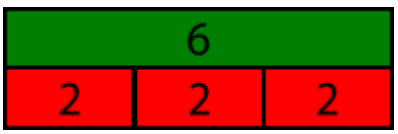


This strongly supports Harries and Barmby's model of using the array to understanding of multiplication.

4. Finally show how they support teaching fractions.
Ask staff to use the brown rod to represent one whole and then to explore eighths and their equivalences:



Colour rods can also support the understanding of fraction as an operator, for example finding 1/3 of 6.



Discuss how this can also support the understanding of decimals.

There are lots of 'rich tasks' to support learning and teaching of mathematics using colour rods on the NRICH website that you could explore during the meeting.

You could finish the session by asking staff to try doing some of these activities with their children over the next week or so.

We hope you realise what a flexible tool colour rods are and now feel inspired to use colour rods in your teaching!

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ICT in the Classroom - Using email

Audience and purpose are essential for good quality data handling enquiry and effective problem solving can rarely be separated from effective reasoning, so an efficient communication tool such as email should probably have a place in mathematics education. Writing electronic messages can have its limitations for young children due to typing speed and a lack of experience of appropriate writing styles, but can add an engaging dimension to their mathematics learning.

Using email with mathematical problems

A good place to start is to find a context where children are not expected to continue extended conversations. The "Submit a Solution" facility on NRICH creates a safe environment for children to type their ideas about their mathematics into a computer and possibly have it published and commented on by someone outside school. Imagine the children's reaction to reading:
"What fantastic work – I love the way you have begun to ask your own questions and explored things that interested you. You also worked very systematically to find all the possible combinations of totals on three dice, which is very helpful in answering this problem. It makes me wonder ... will a dice always have an opposite face, no matter how many faces it has?" (Response to a problem solved in the October 2010 issue).

For emailing within the class or school, consider children setting mathematical puzzles via email, sending solutions and thinking about what hints could be given. Try to develop a culture of: "I enjoyed this mathematical problem / puzzle, and thought you might too." In the same way that many people often send pictures and jokes.

One possible plan is to email children in the class one brainteaser-style puzzle for each group. They solve the problem and send a reply. Then the children choose someone else in the class or school to forward the puzzle to. Give children sentence templates to help them phrase their answers with an explanation e.g.

- "I think ... because ..."
- "It can't be ... because ..."
- "Some examples are ..."
- "... is ... and ... is ... so the answer must be ..."
- "I found the pattern ... so ..."

These could be copied onto card and stuck around the computer screen. Simply phrased statements could also be investigated in the same way, such as:

- the sum of three odd numbers is always odd.
- multiples of four must end in 0, 2, 4, 6 or 8.
- any odd number can be made by doubling a number and adding one.

Good places to find these types of problem are NRICH, brainbashers.com, and primaryresources.co.uk.

If the problem is embedded in the text of the email there are limited opportunities to provide an image or model to support understanding the problem or templates to help with recording. Consider putting links into emails for external sites, for example, this PDF file from primaryresources.co.uk uses a caterpillar to help children with their work.

Using email with 'real-life' problems

Communicating by email can become particularly inspiring when used to role play in an authentic context. If the children have set up an 'enterprise', then an adult in the guise of 'customers' or 'clients' can contact them with relevant questions and requests. The children can respond with calculated cost of products and solve the required problems.

Ask permission from parents and other stakeholders for children to email them with short surveys for use in school. The children may be interested in formulating a questionnaire based on something that the school leadership team want to find out about, for example, provision for pupils travelling safely to and from school. Questioning language has to be more precise in a survey that will be completed remotely, and children will need to discuss and manage decisions about what people will answer and how they might answer it. The nature of this type of data collection is that some of the responses may not be complete, or returned in a format that the children can easily use.

Liaising with another school can provide further opportunities for 'real-life' mathematics in comparing data from different localities. The same survey can be carried out at both schools, e.g. traffic survey at a particular time of day, rainfall data collection, preferences in foods or activities. In comparing the data between the two schools, the pupils can see the teacher realistically modelling how to draw conclusions or form further questions because they know that the teacher does not already know the answers.

Short mathematical activities using email

Transum suggests using email in this quick starter activity:

> In the first minute of the activity each person is to send an email to the teacher. The subject of the email must be "Number" and in the body of the email there must be a positive whole number (Natural Number). The winner is the person who emails the smallest number which nobody else has chosen.

Other lesson starter activities using email include asking students to type in the most:

- mathematical words beginning with the letter 'm'
- numbers in the 13 times table
- mathematical words which begin with the last letter of the previous word, beginning with the word 'subtract'
- famous mathematicians
- units of measurement
- things they have learned in maths this year.

And finally...

If I send an emailed puzzle to five friends one day, and they each send the puzzle to five different friends on the next day, and the day after those friends send the puzzle to five further friends each; how many people have the puzzle? (Hint - Don't forget "I"). If the pattern continues, how many days will it take for over 10 000 people to have the puzzle?