Primary Magazine

Issue 23

National Centre for Excellence in the Teaching of Mathematics

Welcome to the 23rd issue of the Primary Magazine. Our famous historian is Sir Isaac Newton, our focus is on postage stamps and our CPD opportunity aims to develop subject knowledge in the area of addition. We are also pleased to introduce a new series of articles on the use of ICT in the classroom.

Contents

Editor's extras

In this issue, we tell you about the Numbers Count strategy from a Numbers Count teacher, give some taster information about a couple of transition projects and tell you about some of the great workshops at the BCME conference.

It's in the News!

The feature 'Up2d8' has been replaced with 'It's in the News!' In this issue, as it is fast approaching, we feature the World Cup. The slides provide opportunities for work with such mathematical concepts as time and calculation.

The Art of Mathematics

The art of the Inuits: a culturally similar indigenous people who live in the Arctic regions of the United States, Canada, Russia and Denmark.

Focus on…

This year will mark the 170th anniversary of the release of the Penny Black, the world's first adhesive postage stamp. So, our focus is on…stamps!

A little bit of history

In this issue, we look at a potted history of Sir Isaac Newton, mathematician, physicist, astronomer, alchemist, philosopher and theologian, who is considered by many to be one of the most influential men in history.

Maths to share – CPD for your school

We continue our series on mathematics subject knowledge by exploring addition. For this session you may find it helpful to make the NCETM Self-evaluation Tools available for staff to use, and also download the full range of addition strategies from the Primary Framework for Mathematics for group discussion.

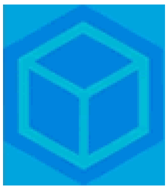
ICT in the classroom

In our first article featuring the use of ICT in the classroom we explore the use of the interactive whiteboard. Taking inspiration from archaeology, we suggest activities which involve measures, data handling and co-ordinates and make links to literacy and history.

From the editor

Are you a Year 6 teacher? Do you take part in any KS2/KS3 transition projects? If so, we would love to hear what you do and with whom. Please email us if you would be prepared to share what you do and we can publish your work in a future issue. Some years ago, London Challenge sponsored a transition project which took place in many of the London boroughs to varying levels of success. An evaluation was completed in 2005, but you might be interested to read the findings, which are still relevant in 2010!

These projects often start up in the summer term particularly after end of KS2 tests to help make the secondary transfer a more comfortable experience for children. But are they always worthwhile? The one that takes place each year in Ealing certainly is. You can find out more about their work in a Primary Teachers (Teachernet) article, available on the Ealing Grid for Learning site. In our next issue, we will be hearing directly from the people who have developed this project. We will also be hearing about another exciting transition project happening in the East Riding of Yorkshire. It would be fantastic to hear about yours!



During the Easter break, many people attended the BCME7 conference. It was a very successful event and some of us went to some great primary workshops which we will tell you about, very briefly, over the next couple of issues, just in case you want to explore these further. The first one I went to was delivered by Tandi Clausen-May who showed us some really effective ways of using tangrams and Multilink for data handling, algebra, perimeter, area, range, mode, median and mean – without numbers! She had some really good ideas. She has given permission for us to share her PowerPoint presentation which you can use in school, should you wish to (just enter *Tandi* in the search box).

In another workshop, Maths at the Movies, Emma Low, from the Essex Mathematics Team, shared with us some brilliant ways to develop mathematical activities in line with the National Strategies primary framework through watching popular children's film clips such as Wallace and Gromit, Shrek, Finding Nemo and Monsters Inc. For more information about this and the material they have created, visit their website. The third that we will mention in this issue was delivered by Liz Meenan who showed us an easy, effective and fun way into creative geometry through paper-folding to create tiles and polyhedrons, fantastic for links to art and RE! You can watch her on the University of Leeds LUTube site, and also find out more about the work she did for an NCETM project.

Numbers Count is a 12-week programme designed to help children in Year 2, who are working below age-related expectations. After 12 weeks of 30-minute lessons every day, it is expected that most children will return to their class as more confident and independent learners and go on to make good progress. The aim is for these children to achieve at least NC Level 2 at the end of KS1. The programme is currently being developed in schools as a part of the national Every Child Counts project. Katie, an experienced teacher, is in her first year of being a Numbers Count teacher and you can read her reflections on her 'new job'.

Finally, just a reminder about the funded projects known as MKNs (Mathematics Knowledge Networks). There are just a few more days left to apply should you be interested. Applications must be received no later than **noon on Monday 10 May 2010**. More information about these and how to apply are in the Teacher Enquiry section of the portal.

It’s in the News!

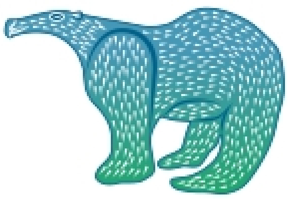
We look at the fast-approaching World Cup 2010 taking place in South Africa next month. You may wish to use the ideas on the slides to create a series of mathematics lessons around the World Cup or develop a cross-curricular project involving subjects such as geography, history, science and D&T – and of course maths! Whatever you decide to do, the slides provide ideas to use in the areas of measures, data handling and calculation.

You may find it helpful to refer to the FIFA website which has a wealth of information about the World Cup, the teams and the countries involved and could be a key site for the children to investigate to make the most of the suggested activities.

There are other sites with useful information, for example The Guardian and the South African World Cup. 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.



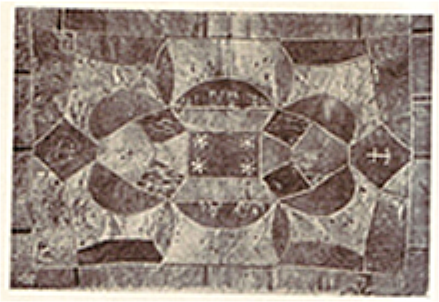
The Art of Mathematics
Inuit art

The culturally similar indigenous people who live in the Arctic regions of the United States, Canada, Russia and Denmark are known as the Inuit. Although the term 'Eskimo' is acceptable in Alaska, it is considered offensive outside of it.



Traditionally, the Inuit were hunters and fishers. They hunted sea animals and their diet was high in protein and very high in fat. Since plants cannot be cultivated for food in the Arctic, they gather the seaweed, berries, grasses, roots and tubers that occur naturally.

The Inuit environment inspired a mythology filled with tales of whale and walrus hunts. These tales, along with their oral history have been reflected in their artwork for 4,000 years. Small sculptures of animals and humans figures carrying out everyday activities such as hunting and whaling were carved from bone and walrus ivory. Everyday items such as harpoon heads and knife handles were decorated with animals and historical characters. Today, carvers tend to use softer stones such soapstone, serpentine or argillite. Art continues to play a large part in Inuit society. Printmaking with wood and lino are popular art forms, as are textiles such as tapestries, fabric collages, dolls and baskets.



The oldest art form of the Inuits is the inukshuk. An inukshuk is an Inuit land marker made from natural stones. These structures were found from Alaska to Greenland. Since these areas are above the Arctic Circle, there are few natural landmarks, so an inukshuk was probably used to give directions, as a marker for hunting grounds and to mark a food cache. When the shape of a cairn represents a human figure, it is called an inunnguaq. The name means 'in the likeness of a human'. They are usually found singly, but sometimes they are arranged in sequences spanning great distances or are grouped to mark a specific place. They may also stand as a memorial for a loved one, or mark a place of spiritual importance. Their deepest meaning, however, is as a symbol of human endurance and survival. Inuit tradition forbids the destruction of these sculptures. A familiar inukshuk or inunnguaq is a welcome sight to a traveller on a featureless and forbidding landscape. This type of structure formed the basis of the logo of the 2010 Winter Olympics designed by Vancouver artist Elena Rivera MacGregor.

The 2010 Winter Olympic inunnguaq is made from only five pieces. The real sculptures may be made from rather more stones.

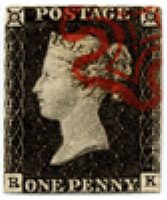
Watch Peter Irniq, Inuit cultural activist, explaining the meaning of an Inukshuk on YouTube: What is an Inukshuk?

Most of the following activities can be adapted for use across the early years and primary age range:

- carry out an internet search for images using the words inukshuk (or inuksuk) and inunnguaq. The former is likely to give the most results. Ask the children to count how many stones are used in each sculpture and draw a block diagram or graph of their results.
- challenge the children to build an inunnguaq from interlocking cubes or bricks, using the same number of pieces as the most popular number of stones. Extend the activity by giving each cube or brick a points value. The children could make sculptures of a particular value, or with the smallest (or highest) points value. For assessment, listen in to the discussions as the children calculate the value of their sculpture.
- outdoors, collect small stones and build a miniature sculpture park of inunnguaq. You could photograph the sculptures with play people and use the photographs to calculate how much bigger each stone would need to be to make the sculptures life sized.
- photograph individual sculptures and display with an information card showing its height and weight.
- collect boxes and construct an inunnguaq. Make more than one and use as signposts pointing to the classroom. Label the pointing arm with the distance to the classroom in metres and centimetres. Compare this sculpture with the miniature versions made from stones. How much larger is the box construction? How much might it weigh if it were made from stone?

These websites have further information and examples of Inuit art:

- The Eskimo Art Gallery
- Inuit Art Foundation
- Free Spirit Gallery
- Uqqurmiut Centre for Arts and Crafts
- Arctic Art Sales



Focus on…The Penny Black, the world's first adhesive postage stamp

This year will mark the 170th anniversary of the release of the Penny Black, the world's first adhesive postage stamp. It was on 6 May 1840, that the stamp was released in Great Britain. The previous year, the British treasury had held a competition to design the stamp, but none of the submitted designs was deemed suitable. The final image showed a representation of the profile of the reigning British monarch, Queen Victoria. This style continues today.

The Royal Mail, post offices and postage stamps can all provide a wealth of resources and inspiration for mathematical activities in (and out) of the classroom. From weighing packages to applying for passports, from measuring envelopes to exchanging currencies – the possibilities are almost endless!

Share some of these ten facts or the web links below with colleagues and pupils. Let us know of any mathematical activities they inspire:

- the Penny Black is not a rare stamp. In total, 286 700 sheets of the stamp were printed. This was 68 808 000 stamps in total.
- the Penny Black had to be cut from a sheet using scissors. Perforated sheets of stamps were not introduced until 1854.
- original Penny Black stamps are readily available on the collectors' market, for as little as £10. An example in mint condition can sell for as much as £4 000.
- British stamps are the only ones in the world that do not show the name of the country.
- the only images of living people to be shown on Royal Mail stamps are those of the British Royal Family.
- the glue on the reverse of a 'definitive stamp' (showing the Queen's head) has 5.9 calories!
- the first special Christmas stamps were produced in 1966. Now, more than 480 000 000 Christmas stamps are printed each year.
- in 1973, Bhutan in the eastern Himalayas, produced seven stamps in the shape of records – and they could actually be played on a record player!
- in the last 150 years, nearly 500 000 different stamp issues have been produced by more than 600 countries.
- the smallest dimensions for a card to be delivered by Royal Mail is 7cm x 10cm.

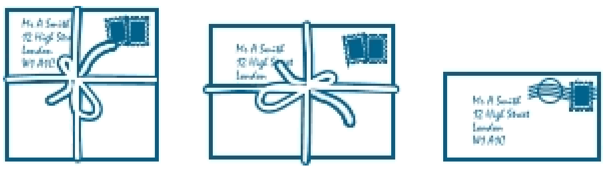
More interesting stamp facts can be found at Stamps for Kids, hosted by Royal Mail.

Wikipedia provides lots of interesting information relating to the Penny Black.

Royal Mail produces a range of teacher resources, freely available to schools. These include information, activities, DVDs and CD-Roms, aimed at supporting the whole curriculum, including mathematics.

The Times Educational Supplement hosts a range of resources shared by teachers. Role Play Resources linked to the Post Office are available.

Activities



Measuring Mass and Length

Show children a selection of parcels, varying in size and weight. Try to ensure that some of the smaller parcels are heavier than those larger in size. Ask pupils to order the parcels according to size. Can they tell which is the heaviest? What would they expect? Allow them to handle the parcels and then order them according to their estimated weight. Pupils can then use balance scales to compare the weights of parcels and check their ordering.
See Maths to Share in Issue 21 of the Primary Magazine for more ideas related to the teaching of mass and weight.

Allow older children time to weigh various objects using a range of scales. Ask them to also measure the objects in millimetres, and create their own table for recording all of the information. Use the Royal Mail Price Finder tables to find out how much it would cost to post their item in the UK. Use the Royal Mail 'weight comparison guide' to find the cost of sending a selection of pre-saved objects. Which objects are similar in weight to those being measured in the classroom? A good exercise in data handling as well as using units of measurement! The BBC website provides a clear interactive version of this activity, useful for use with the whole class.

You could ask the children to make envelopes of different lengths and widths and see if they pass the 'gap test' that they would have to go through at the post office:

Letter: *length: 240mm max, width: 165mm max*
Large letter: *length: 353mm max, width: 250mm max*
Packet: *length: over 353mm OR width: over 250mm*

For more details of sizings visit the Royal Mail website.

Arrays

Show the children a sheet of stamps. Can they estimate how many stamps in a sheet? Fold the sheet to create a smaller array of stamps. Explore the idea of rows and columns. Now fold the sheet along a different perforation (similar to a flip-flop). How many columns and rows now? How many stamps?

Tell the children that first class stamps are provided in sheets of 100. What might the sheet look like? How many rows? Columns? 480 million Christmas stamps were produced last year – how many sheets is that?

Using and Applying Mathematics
Explain to the children that new stamps are produced in these denominations:

1p 2p 5p 20p 32p

Challenge them to make all amounts up to 50p using the fewest stamps possible.
The Post Office decides that a maximum of 4 stamps per parcel are allowed. Which amounts can I make now?
What if the 1p stamp was discontinued – are all amounts still possible?

Show the children a sheet of twelve stamps (3 rows with 4 stamps in each). A friend has asked for four stamps, joined together (by at least one side – not hanging by a corner). How many different ways can you tear off the four stamps?
According to Henry Dudeney, there are 65 ways in total!

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A little bit of history
Famous Mathematicians – Isaac Newton (1643 - 1727)

Sir Isaac Newton is considered by many to be one of the most influential men in history. He was a mathematician, physicist, astronomer, alchemist, philosopher and theologian! We have neither the space nor the time to look at every aspect of his life, so here is a potted history outlining his major achievements!

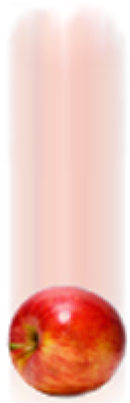
Newton is best known for his Three Laws of Motion and the Universal Laws of Gravitation. His book Philosophiae Naturalis Principia Mathematica (usually referred to as *Principia*), published in 1687, is thought to be among the most influential books in the history of science.

He was born on 4 January 1643 at Woolsthorpe Manor, Woolsthorpe-by-Colsterworth, Lincolnshire. At the time of his birth, England had not adopted the calendar we use today (Gregorian calendar), so his date of birth was recorded as Christmas Day, 25 December 1642.

His father was a wealthy farmer, also named Isaac Newton, but sadly he died three months before Isaac Jnr was born. He was a premature baby and as a child was small and sickly. His mother, Hannah Ayscough,reportedly said that he could have fitted into a quart-sized mug! When he was three, his mother remarried and went to live with her new husband Rev Barnabas Smith. Isaac went to live with his grandparents. He disliked his stepfather and was very cross with his mother for marrying him. Apparently, he wrote a list of the sins he committed up to the age of 19 and one of them was 'threatening my father and mother Smith to burn them and the house over them.' He didn't do it. Because he was so small and sickly he couldn't play with other children so he amused himself by making up games to play by himself and reading.

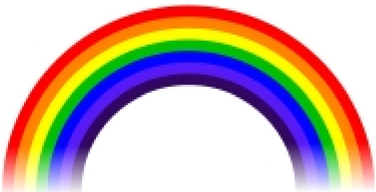
From the age of around 12 until he was 17, Newton was educated at The King's School, Grantham, where his signature can still be seen on a library window sill. At 17, his mother, now widowed for a second time, called him home to Woolsthorpe to help out on their farm. He hated farming and spent as much time as he could studying, writing poetry and making things such as little windmills that worked, kites that flew and clocks that could run on water power. Eventually, a teacher from his school managed to persuade his mother to send Newton back to the school to complete his education.

In June 1661, he went to Trinity College, Cambridge, where he became interested in philosophy, astronomy and mathematics and he began to develop a mathematical theory that would later become infinitesimal calculus.



In 1665, the college closed due to the plague and Newton returned home once more to the farm. It was at this time that he began to think about gravity: it became a bit of an all consuming passion for him. A popular story tells of when Newton was sitting under an apple tree – an apple fell on his head and he suddenly thought of the Universal Law of Gravity! It is probably not entirely true but it does contain elements of what actually happened and led him towards the thinking that the moon is caught between two forces, the first, gravity which pulls it toward the earth and the second, centrifugal force, caused by its rotating, which pulls it outwards. Since the moon is held by these two forces it cannot fly towards the earth and it cannot fly away, so it does the next best thing and moves in a curved path around the earth! He then reasoned that if this was the case for the moon then it must surely be the case for all of the planets and heavenly bodies in the solar system with the sun's force of gravity holding all these in their orbits.

Why not try out an experiment with the children to demonstrate these forces? Tie a piece of string to a ball or something similar and swing it in the air around you. This will demonstrate the centrifugal force pulling it away and your grip will demonstrate the force of gravity. His theory also explains how a space ship can orbit the earth – its motion will hold it away from the earth as the earth's gravity tries to pull it back. You could always ask the children to make a spaceship out of a cylinder and cone (to specific dimensions maybe) and repeat the ball experiment!



At around the same time, Newton began experimenting with prisms and proved that a beam of sunlight is made up from the six colours of the rainbow: red, orange, yellow, green, blue and violet. As we know, the rainbow has seven colours, apparently this is because in those days seven was a lucky number, so Newton invented indigo to make the six up to seven! If you haven't worked on this in science it is a fun and exciting thing to try with the children; you could also use it as an opportunity to reinforce angles. He also experimented with lenses and mirrors and made a new form of microscope. These experiments would eventually lead to his invention of the reflecting telescope which finally brought him to the attention of the scientific community.

In 1667, Newton returned to Cambridge where he became a fellow of Trinity College. Two years later he was appointed second Lucasian Professor of Mathematics. In 1672, thanks to his reflecting telescope he was made a fellow of the Royal Society. In 1703 he was elected their president, an office he held until his death.

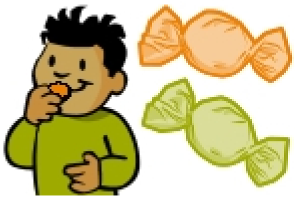
In 1696, Newton moved to London to take up an appointment as warden of the Royal Mint. He campaigned against the corruption and inefficiency that was found within the organisation at the time and also took charge of England's great recoinage, when England's silver coins, many of which were worn or clipped, were replaced by new, full-weight silver coins. If you are interested in the development of our monetary system, visit a little bit of history in issue 9 of the Primary Magazine. In 1699, he took up the very prestigious position of Master of the Mint, which, like his presidency of the Royal Society, he held until his death. He was knighted by Queen Anne in 1705.

Did you know that Sir Isaac Newton also invented the cat flap? Apparently, while he was working in his laboratory he was disturbed by unwanted light through a door which was continually pushed open by a cat. So he cut a hole in the door for the cat to use and attached some felt to make the first cat flap! Later, the cat had kittens so he cut some extra doors for them – mmm? Seems that no matter how brilliant your brain, logic can still be elusive – the kittens followed their mum so didn't use their little doors!

Newton was reported to be a difficult man to work with, was prone to depression and once had a nervous breakdown. He never married. Towards the end of his life he went to live with his niece and her husband in Cranbury Park near Winchester. He died in his sleep on 31 March 1727 and was buried in Westminster Abbey, an honour reserved only for the greatest men of England. The inscription on his tomb reads: "Let mortals rejoice that there has existed such and so great an ornament of the human race."

Information from these websites:

- BBC History
- Surfing the Net with Kids
- Wikipedia



Maths to share – CPD for your school

Addition

This issue of Maths to Share focuses on enhancing your individual subject knowledge – in this case, addition.

The Williams Review (2008) "subscribes to the view that broadening and deepening the mathematics knowledge of those who teach the subject [mathematics] is as valid for primary school teachers as it is for those in the secondary sector."(p.7)

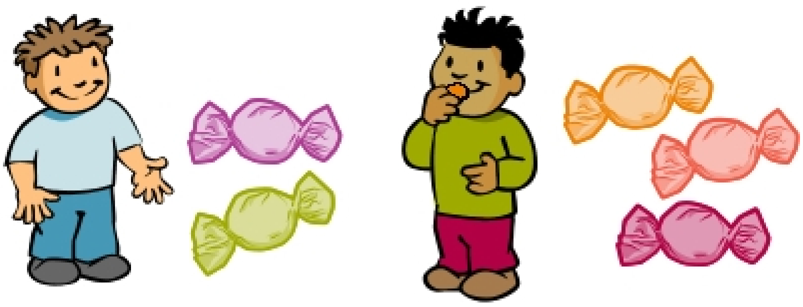
Shulman (1986, from Rowland et al. 2008) identified these three categories of content–specific knowledge essential for effective teaching of mathematics:

- subject-matter knowledge: concerned with the facts, concepts and processes of mathematics and the links between them
- pedagogical content knowledge: concerned with teaching methods, for example, what resources and models and images are used
- curriculum knowledge: concerned with knowing the curriculum and progression within it.

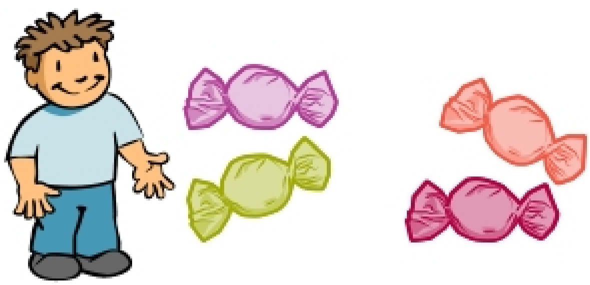
Consider your own knowledge of learning and teaching of addition in relation to Shulman's three categories of content-specific knowledge. You may want to use the NCETM Self-evaluation Tool to help you.

One of the ways children make sense of mathematical calculations is to understand the range of situations to which they can apply.

Consider these two questions:
Tom had two sweets and John had three sweets: how many did they have altogether?



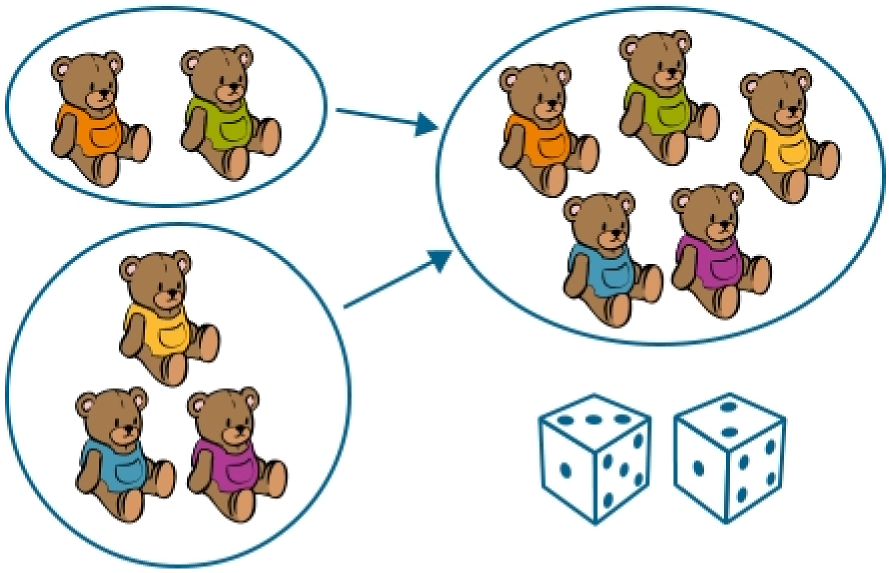
Tom had two sweets and bought two more. How many sweets does he have now?



Can you see the difference in terms of their meaning for children?

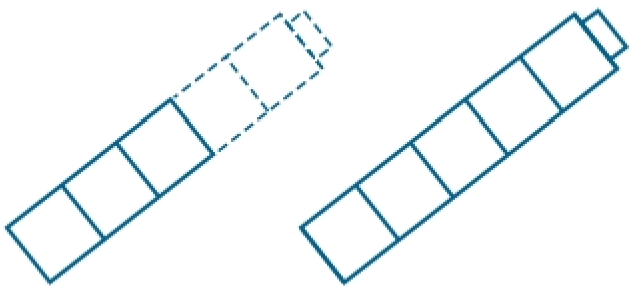
The first is an example of aggregation – combining of two or more quantities (How much/many altogether? What is the total?).

1. Combining two or more quantities



The second illustrates augmentation – where one quantity is increased by some amount (increase by).

2. Augmentation of one quantity



It is important that children experience both structures in a range of relevant contexts.

Think about your own planning and teaching and evaluate whether you consider the two conceptual structures when you are teaching.

It is important to remember that these addition structures have corresponding subtraction structures as inverse operations and it is important to teach addition and subtraction together as related concepts. Subtraction will be examined in the next issue of Maths to Share.

What other essential concepts support the learning of addition e.g. building on early counting? List as many as you can.

Discuss the importance of counting strategies for addition such as count all, count on. You might find it helpful to refer to a useful document from the Mathematics Education Research Journal Supporting Teachers in the Development of Young Children's Mathematical Thinking: Three Large Scale Cases.

Now consider the type of models and images you use to support addition calculations. Can you list five? Ask a colleague to do the same. Now compare your lists. How many more do you have now? For a full range of examples you could go to the Primary Framework for Mathematics.

The Primary National Strategy suggests that the progression in calculation methods should build on understanding rather than rote learning of methods. Do you agree with this statement? How can you support this process with the children in your class?

What do children need to be able to do to carry out addition calculations?

With a colleague, individually at first, calculate these calculations using mental calculation methods, but including the use of jottings if you wish. When you have both finished compare your methods.

50 + 643
360 + 360
324 + 58
3.2 + 1.9
1.5 + 1.6
27 + 36 + 13

Did you:

- count on from the largest number?
- re-order the numbers?
- partition the numbers into 100s 10s and ones?
- bridge through 10 and multiples of 10?
- add 9, 11 etc by adding a multiple of 10 and compensating?
- use near doubles?
- use knowledge of number facts?

These are all strategies that children need to be aware of when carrying out addition calculations.

For a full explanation of progression in mental calculation methods and ideas activities to support learning and teaching go to the QCA booklet Teaching Mental Calculation Strategies Key Stage 1 and 2.

How would you calculate the following: 346 + 187?
Did you carry '1'? Are you familiar with the expanded written methods suggested by the Primary Framework for Mathematics that support children's progression from mental calculation to written methods?

Guidance can be found in the Primary National Strategy Guidance Paper.

Have a look at this guidance with a critical eye. Are there any areas you disagree with? Does the empty number line really develop into partitioning or expanded written methods? Discuss this with one of your peers – you may be surprised at their argument.

Take a look at an insightful paper by Ian Thompson (2007), who shares his critical analysis of the Primary National Strategy guidance available with kind permission from the ATM, Deconstructing calculation methods – Addition.

What do you think?

For further guidance for teaching addition, look at Teaching Written Calculations Key Stage 1 and 2.

References

Rowland, T., Turner, F., Thwaites, A., and Huckstep, P. (2009) *Developing Primary Mathematics Teaching*. London. Sage.

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ICT in the Classroom
Interactive whiteboard archaeology

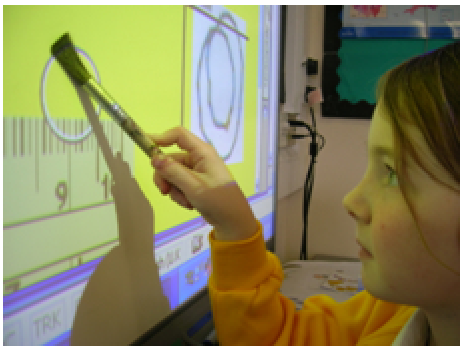
Taking inspiration from archaeology, this idea introduces activities that can be shared with children at many different levels. Covering aspects of measures, data handling and co-ordinates, it is perfect for a mini-project that crosses over from Block C to Block D of the Primary Framework. There are also opportunities for cross-curricular links with history and literacy.

Here's what to do...
Set up an interactive whiteboard page with a soil or sand background colour. Insert images of objects onto the background, fixing the objects in place, then paint over the whole page in a similar colour to the background. This becomes a patch of ground which archaeologists believe is filled with important artefacts. These artefacts, too fragile to be moved, must be revealed and catalogued before the site is covered over for future generations.

Allow children to start exploring the 'site' in a small group, with soft paintbrushes in place of the board eraser. Direct children towards considering what information should be catalogued about the artefacts. What information is needed for historians to understand the objects and the site? How can we let future archaeologists know where to find objects once they have been reburied? Depending on the age and experience of the children, choose suitable measures of length, decide how to divide up the site using grid lines and plot co-ordinates of objects. Collect information about the frequency of different materials or objects found, creating a database of artefacts. Once the site is covered over, use information from the database to make representations of the discoveries, draw conclusions about the site making reference to the data, and finally use records of position to check that the artefacts can be rediscovered.

Ideally make the activities richer through cross-curricular links to historical periods being studied in class. Otherwise, try inspiring interesting science-fiction genre writing by using unusual objects on a far-away planet, or drawing together a character portrait in literacy linked to the artefacts.

Although using real objects and a sand tray has many benefits, using the interactive whiteboard enables sharing a variety of images with the whole class, which should encourage collaborative reasoning and explanation with reference to the images. Using ICT enables resetting the images for testing children's ideas and allows the teacher to control the variables e.g. size, number and orientation of objects, to match their stage of development. Some children may need the experience of discovering and discussing objects in a sand tray first.



CPD and research
Reflect on the impact that shared problem solving on an interactive whiteboard has on the quality of pupils' reasoning, communication and accuracy of measurement. Explore other ways of providing

images to be manipulated by groups of children on the whiteboard, allowing children to explore which skills they need to develop to solve problems accurately.

For further reading about IWBs and mathematics visit the Collaborative Group for Research in Mathematics Education website.