Primary Magazine

Issue 4

National Centre for Excellence in the Teaching of Mathematics

Welcome to the fourth issue of the Primary Magazine. In this issue we explore the mathematical possibilities of winter.... another winter already, what happened to summer this year? This month's Interview is with the director of Primary Engineer, Susan Scurrock, who tells us how mathematics has influenced her life. Our feature A little bit of history looks at the Egyptian number system. In Starter for 10 there are suggestions for winter-style oral and mental starters based on the NSP strand numbers and the number system. Our CPD opportunity in Maths to share focuses on models and images. In this issue we are introducing something completely new - Up2d8 maths!

Contents

From the editor

Did you see the fascinating series of programmes on Mondays at 9pm (BBC 4) called The Story of Maths by Marcus Du Sautoy? If you missed it, click here to find out more about the series.

As always, it would be great to hear some feedback on how this issue's CPD on models and images went should you decide to use it. Please add any comments you may have to the Primary forum.

Have you considered lesson study in your school as a way to improve teaching techniques and children's progress? In simple terms, lesson study is when two or more teachers work together, developing practice in the classroom, focussing on the needs and learning of the children and trying to solve a teaching or learning problem which is affecting pupils' progress. Helena Hay, from Hexham Middle School, very successfully implemented this strategy in her school through peer coaching when the problem of children and their understanding of division cropped up. Click here to read her article.

Have you tried this or any other form of lesson study? If so we would love to hear of your experiences.

Up2d8 maths

Up2d8 maths is a completely new and exciting feature. It aims to provide ideas to develop with your class based around topical news items or with a seasonal theme. As the credit crunch is a major issue affecting most people at the moment, our first issue is based around this. It focuses on the problems surrounding buying and selling houses in the present climate.

Problems are presented on a PowerPoint using real life scenarios which the children are encouraged to discuss and then find evidence from which to draw conclusions. The mathematics involved in Credit Crunch include using and applying, analysing data and working with money. There are teachers' notes which give suggestions on what to do. They are not a step-by-step guide, so lessons need to be planned and mathematics needs to be taught. Credit Crunch gives sufficient information and guidance for a teacher to plan one or a series of lessons depending on how much detail they wish to go into. It also provides opportunities for the children to do their own research should they wish to dig deeper.

Credit Crunch could be used as a supplement within blocks A, C or E if you are following the NSP framework. It could also be used as a review or assessment opportunity. As well as being very topical and 'framework friendly' it also embraces elements of the pfeg's financial capability, as mentioned in the last issue of the magazine. Credit Crunch would be suitable for years 4 to 6 with appropriate differentiation.

Click here to download the Up2d8 maths resource - in PowerPoint format.

The Interview

How mathematics has influenced my life
Interview with Susan Scurlock

Susan is the National Director of Primary Engineer. She devised the Primary Engineer project, which was based on the work of her colleague David Jinks. Since his retirement, she has developed it to include the cross-curricular application of mathematics and science to design technology. The main aim behind her work is to encourage very young children to consider engineering as a career. In order to achieve this, the project offers teacher training, resources and national challenge activities for children in primary education. She feels privileged to have had the opportunity to work with a number of different subject specialists and coordinate their input into Primary Engineer. For more information why not visit her website: www.primaryengineer.com.

What were your memories of mathematics when you were at school?

It was a subject that I really enjoyed. I was good at physics too and both subjects just made sense to me. My mathematics teachers were quite formidable but I was a bit of a swot so homework and class work was always completed on time therefore I was never in too much trouble.

Have you always been a mathematician, or is it an interest that developed during your working life?

I would not consider myself a mathematician at all but I do use some form of it every day. I believe that a good understanding of mathematics helps you to think and approach problems in a certain methodical way – I do enjoy problem solving. I was a teacher for seven years, teaching art and ICT at secondary level. Teaching was hugely enjoyable and I relished the challenge of applying mathematics in the subjects I was teaching. However, I was quite shocked at the level of mathematics that my daughter has studied to in her GCSE's, gaining an A* – I am afraid I wasn't much help to her!

How did you get to where you are today?

I think that if you want to achieve anything you really have to just get on with it. If you enjoy what you do, work hard, be methodical, practical and do things to the best of your ability everything will work out fine. I took my degree as a mature student gaining a first class BA Honours in Graphic Design, spent time in industry and then a PGCE to teach art and later to become head of ICT.

I thoroughly enjoyed teaching and spent a great deal of time designing materials to help children of different abilities and ages to engage with the curriculum. I worked with David Jinks for many years and established Primary Engineer in 2005, I left teaching to lead the project. At the time it was a risk, but I also knew that I did not want to look back and consider that I had missed an opportunity to make a difference outside of my classroom.

Just before my father died he had said that engineering was so important that if I was ever given the opportunity to take Primary Engineer forward it was something I must do – so I did! Perhaps that is another important point – always listen to your Dad!

What is your most entertaining mathematics anecdote?
Measure twice cut once… well it would be!!

If you could phone anyone from your past to say thank you for what you have learnt who would it be and what would you say?
Mr Wroe, my physics teacher. He taught me not to be embarrassed at being the only girl in the class. In those days the option choices were physics or typing… didn't take me long to decide which I preferred! He gave me the confidence to put my hand up, to enjoy learning things that were difficult at the outset and to question – I think of him with great affection and thanks.

What do you think could be done to help inspire more young people to enjoy mathematics today?
I would suggest that giving them the opportunity to see mathematics in action, applying the theory and gathering an understanding of its importance.

When was the last time someone surprised you – mathematically speaking?
My daughter. Her teacher told me that when he presented a new topic he would watch her face drop, then she would quietly turn to friends, ask them to explain it, then, when she had all these different explanations, she would work away until she understood. Being able to plug away at something until you completely understand it is a very useful trait and I admire my daughter for her perseverance and dedication to understanding.

If you weren't working in a career that involved mathematics what would you be doing?
Illustration – I enjoy drawing by hand and on the computer, the finesse of line and the beauty of a curve in an illustration can make the difference between an ordinary drawing and something beautiful… well, something I can only aspire to!

And finally, if you lived in a world of fractions and decimals, which would you rather be? Why?
My perception of fractions and decimals would be that fractions have an old worldliness about them, decimals are quiet clinical. I would prefer the friendliness of fractions.

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Focus on winter

Are we nearly there yet? (At the start of winter, that is!)

Those warm, summer evenings are now a distant memory, and as we all find ourselves going to work in the dark and coming home in the dark… have we actually reached winter yet?

Celtic nations such as Ireland, who use the Irish calendar, claim that the winter season begins on 1 November, on All Hallows. Chinese astronomy dictates that winter starts on or around 7 November, while many mainland European countries tend to recognise St Martin's Day, on 11 November, as the first day of winter.

More generally, winter is considered as the season with the shortest days and the lowest temperatures, and if we are defining by the weather, then winter would be the whole of December, January and February in the Northern Hemisphere.

Whether we follow tradition, or look to the astronomical calendar where winter starts with the Winter Solstice (21 December this year), the fact remains that it's getting colder and wetter… a good excuse to cheer ourselves up with some mathematics.

All of this, along with the 'Did you Know' facts below, will certainly provide some interesting starting points for mathematical discussions and problems in your class.

Did You Know?

- The lowest temperature ever recorded was -129°in Vostok, Antarctica, in July 1983.
- The largest snow sculpture ever made was in December 2007, and was part of the annual Harbin International Ice & Snow sculpture festival in China. Six hundred sculptors used 3398m^2 of snow to create a French-themed landscape, complete with cathedral and ice maiden!
- It is too cold to skate in Antarctica… even under your own weight, the ice won't melt long enough to let the blades slip.
- The ice at the South Pole is about two miles deep.
- Salt is used on our roads in winter as it lowers the temperature at which water on the roads will freeze. Ice usually forms when the temperature of water falls to 0°Celsius. When salt is added (a 20% solution), ice doesn't form until the temperature falls to -16°C.
- The 'Spring Peeper' (a frog) can survive the winter season with 65% of its body water as ice.
- Uranus' winter season lasts the equivalent of 21 earth years.
- The Arctic Tern has the longest migration of any animal, and travels approximately 24,000 miles each year to escape the harsh winter weather.

Visit these sites to find out more facts that can be used during maths lessons:

- Winter Facts Scavenger Hunt

- Winter Fun Facts

- Winter Snow Facts and Records

A great deal of valuable mathematics can be gained through cross-curricular work focusing on the seasons and specifically a winter theme. The Science Standards Units provide many opportunities for measuring in context and obtaining real data and information that can be used in mathematics lessons. Examples might include:

Science Standards Unit	**Focus/detail**
1a	'Light & Dark'
2a	'Health & Growth'
2b & 3b	'Plants and Animals' & 'Helping Plants Grow'
3f	'Light & Shadows'
4c	'Keeping Warm'
5c	'Earth, Sun & Moon'
6a	'Interdependence & Adaptation'

Geography work looking at climate and temperatures around the world can be extremely rich in opportunities for mathematics, as can lessons when learning about other faiths and cultures and their different calendars of the seasons.

One children's text looking at mathematical concepts linked to the topic of winter is The Fattest, Tallest, Biggest Snowman Ever by Bettina Ling, published by Scholastic. It is a reading scheme book developed for the US that introduces the reader to the concept of measuring objects using non-standard units and instruments. The children in the story find that their arms are not long enough to measure around the snowmen to see whose snowman is biggest, and so they decide to use a string of paper clips to measure. The book goes on to suggest follow up measurement activities.

Starter of the month

Snowman Game

Explain to the children that they need to help dress the snowman. Click here for a snowman activity sheet showing the outline and items of clothing that can be cut out. This is also available in smart notebook. Click here to download the smart notebook file *(note: this file will only be recognised if you have smart notebook on your computer)*. Show them the table matching numbers 1-6 to the snowman's items. Roll a dice. Use a large dice that will be clearly visible, or an electronic flash animation of a random dice roll. Smart notebook has a good one built into its 'gallery'. Encourage the children to count the spots on the dice, and then find the matching numeral on the clothing list. Add the appropriate item of clothing to the snowman. How many rolls does it take to dress him? Children could then play the game independently.

KS1

Count on or back in ones, twos, fives or tens
Use this knowledge to derive the multiples of two, five and ten

Use pairs of mittens hanging on a washing line to support counting in twos. Ask pupils questions such as 'How many mittens are there in three pairs?' – reinforcing that three lots of two are six. Replace the mittens with fingered gloves, hung individually for counting in fives, and hung together in pairs for practicing counting in tens. 'How many fingers are there in four pairs of gloves?' 'How many pairs do I need for 50 fingers?'

KS2

Find the difference between a positive and a negative integer, or two negative integers, in context.

Present the children with a set of data showing temperatures in different cities around the world. Click here for a sample set. Cover the information in the first column. 'What might these values be?' 'What units are they presented in?' Reveal the information in the first column and discuss its meaning with reference to London. Ask the children questions focusing on the warmest/coldest cities, the difference between lowest and highest average temperatures, the difference in temperatures during our winter (December). Show the children the world map. 'Can we determine which star represents which city?' 'Which of the information is most useful?' 'What other information is needed? Why?'

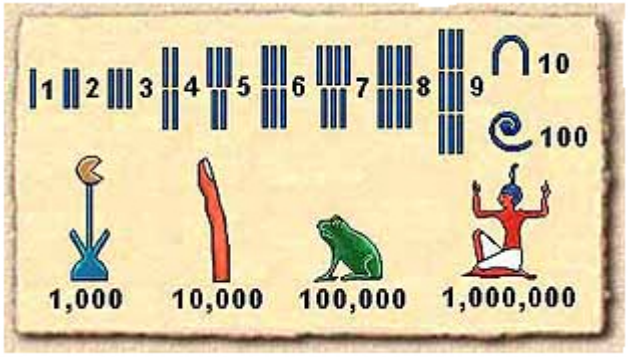
The data was taken from Qwikcast - a wonderful website where one can search continents and cities around the world, looking at high and low average temperatures, highest and lowest temperatures ever recorded, even the exact temperature in cities around the world at a precise moment in time.

A little bit of history - Egyptian numbers

We know about the language of Egyptian maths from the writings on the stones of the monument walls of ancient time. Numbers have also been found on pottery, limestone plaques, and on the fragile fibres of papyrus. The language is composed of hieroglyphs which are pictorial signs that represent people, animals, plants, and numbers. Using this system they were able to note whole numbers to one million. Like our system, it had a decimal base and in a similar way to Roman writing the symbols were written in groups of the same type.

Decimal Number	Egyptian Symbol	What it is supposed to be
1 =		staff
10 =		heel bone
100 =		coil of rope
1000 =		lotus flower
10,000 =		pointing finger
100,000 =		tadpole
1,000,000 =		astonished man

*This table and other symbols have been adapted from content **available here**.*



*This content is reproduced from content **available here**.*

To represent a number, the sign was repeated as many times as necessary. To make it easier to read the repeated signs they were placed in groups of two, three, or four and arranged vertically.

1 =		10 =		100 =		1000 =	
2 =		20 =		200 =		2000 =	
3 =		30 =		300 =		3000 =	
4 =		40 =		400 =		4000 =	
5 =		50 =		500 =		5000 =	

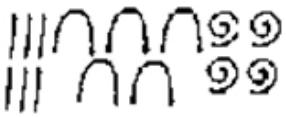
In writing the numbers, the largest would be written first.

The numbers were written from right to left for example:

46,206 = 

The methods for addition and subtraction used by the Egyptians are essentially the same as those used by mathematicians today. The Egyptians added by combining symbols. They would combine all the units together, then all the tens, then the hundreds etc. If the scribe had more than ten units, he would replace those ten units by a 10. He would continue to do this until the number of units left was less than ten. This process was continued for the tens, replacing ten tens with 100 and so on.

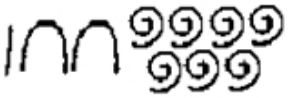
For example, if the scribe wanted to add 456 and 265, his problem would look like this:

	(= 456)
	(= 265)

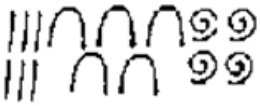
The scribe would then combine all like symbols to get something like the following:

He would then replace the eleven units with and  . He would then have one unit and twelve tens. The twelve tens would be replaced by two 10s and 100.

When he was finished he would have 721, which he would write as:



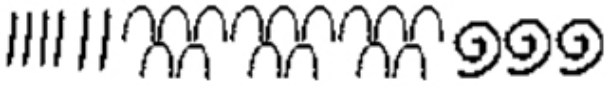
Subtraction was done much the same way as we do it using the expanded method for example:



456

265

If the scribe wanted to take 265 from 456, he would write the larger number something like this:



He would take the smaller away to give:

196

Egyptians' method of multiplication is fairly clever. This is how they would have multiplied 6 by 36. Begin with 36 and double it, then double again and keeping doing this, each time writing the number of 36s they have doubled:

1 36
2 72
4 144
8 288

They then chose the numbers that totalled 6 and add the multiples:
2 + 4 = 6 72 + 144 = 216 so 6 x 36 = 216

The way they did division was similar to their multiplication. For the problem 146 ÷ 12, they thought of this problem as 12 times a number equals 146. Again, the problem was worked in columns.

1 12
2 24
4 48
8 96

48 + 96 = 144 4 + 8 = 12 so 146 ÷ 12 = 12 remainder 2
These are great ideas to try with your class – great links to doubling and inverse operations.

Some of the information included came from these websites:
Number Systems
Ancient Egyptian Number Hieroglyphs

Something to share

Models and images - are you stuck in a rut?

Before the staff meeting:
Borrow a set of Japanese sorobans from either Japan 21 or the ATM. The ATM set includes 1 x large teaching Soroban, 10 small Sorobans and a book. Loan of the set costs £10.00 + VAT, plus postage for four weeks. The hirer must also return the set at their cost at the end of the hire period. Both sites offer advice and resources to support the use of the soroban. Japan 21 resources can be downloaded and ATM resources can be ordered online - click here.

Collect a range of models and images to bring with you to stimulate discussion. These might include a numberline, beadstring, 100 square, arrow cards, some cubes and counters and perhaps a pair of socks.

Obtain or locate (there is almost certain to be one somewhere in school) a copy of the Primary National Strategy DVD Models and Images and the accompanying leaflets. The pack can be ordered from the standards site - click here or download the leaflets from teachernet. Published in 2003, this resource is just as valuable today. Although the blurb says that this resource is for Years 1 to 3, it also includes examples of progression and application in Years 4 to 6.

Something to discuss:
Display the models, images and leaflets that you have brought with you, excluding the soroban. Ask your colleagues which of these models and images and others, such as the ITPs and spreadsheets from the library on the primary framework site, they have they used in the last week. Which ones have they never used? After a short discussion, break into pairs or small groups to consider current practice.

Something to consider:
Which models or images do you use most often in your class? What do you use them for? How do you actually use them – to demonstrate, or for the children to use as scaffolding? During which part of the lesson do you find them most useful? Is there a model or image that you never use? Why is that?

Ask each pair or group to report back briefly.

Use the right-hand pane of the Models and Images DVD screen to select a short clip using one of the models rarely used by your colleagues. Watch the clip and discuss. Ask your colleagues to consider how they might use the model or image in their class during the following week.

Something to try:
Introduce the Japanese soroban and show your colleagues how to use it. Allow plenty of time to have a go. The soroban is a particularly useful tool for embedding the image of '5 and a bit' and place value. Suggest when colleagues might use it and set a date for reporting back their experiences.

Alternatively, or at an additional meeting, use the Slavonic abacus. Download a Computer simulation, display cards and article from the ATM website.

Click here to buy copies of the slavonic abacus and find out more about it. Both of these models have much to offer. If you decide to use both, discuss when each might be best used.

Something to reflect upon:
Give colleagues copies of the articles 'Ways of working with a bead bar' and 'Ways of working with a 100 square'. As the author of both pieces says, 'It's not the device that teaches, but the sense the learners make of what they are doing.'

Supply copies of the Models and Images leaflets to those who do not have them (also likely to be in the back of a cupboard somewhere!), or a copy of the download for them to print out themselves.

Remind colleagues that the primary framework offers a Models, Images and Resources section for every block and year group on the framework site. Look in Planning, navigate to the appropriate year group and block. You will find the information by clicking on the Block X resources tab, part of the menu on the left-hand side of the page.

Next steps
During the reporting back session, consider the models and images used and discussed. If you have a budget available, which resources would it be worth investing in? Should the resource be available in every class, certain classes or would it be sufficient to have a class set available to borrow? Alternatively, plan when to borrow resources such as the soroban.

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