Primary Magazine
Issue 10

National Centre for Excellence in the Teaching of Mathematics

Welcome to the tenth issue of the Primary Magazine.
In **Maths to share – CPD for your school**, we are focussing on subject knowledge, particularly data handling. If you find this helpful and would like more CPD opportunities for teachers' subject knowledge, please let us know by commenting in the Primary Forum.
Our **Up2d8 maths** looks at opportunities involving position, direction and angles within the context of the launch of Google Street View.

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From the editor

Have you read the latest Ofsted report Mathematics: understanding the score? It focuses on findings in the context of rising standards over the last 10 years, the issues underlying the rises in results and the essential components of effective mathematics teaching. Should you wish, you can read comments about this report from the NCETM and various other websites here. You can see their key findings and recommendations here, but it is worth looking at the whole report, which emphasises what we all know:

- pupils are rarely given the opportunity to investigate open-ended problems which offer opportunities to choose which approach to adopt or to reason and generalise
- they are given too few opportunities to use and apply their mathematics and to make connections across different areas of the subject and across the other curriculum subjects
- they are not given the opportunity to use mathematical talk enough and therefore struggle to express and develop their thinking.

One of the fundamental areas for improvement is the subject knowledge of primary teachers. The NCETM has gone some way to help with this in the Self Evaluation Tools, which will shortly be improved with more in-depth study opportunities for subject knowledge and a wider variety of website links.

The MA and ATM conferences took place in April. If you attended either of them and are prepared to give us some feedback on how you felt they went, we would love to hear from you. Please let us know through the Primary Forum.

As this issue's Maths to share focuses on data handling, it would be relevant to flag up a Mathemapedia entry on the portal. Using real data implores us not to make data boring for pupils. Working with made up data, or data in contexts to which students do not see any point, means that students do often view data as 'boring'. Explore this entry for additional real life data that you could make suitable for use with your class.

You may also be interested in exploring these websites Poodwaddle and Breathing Earth, both of which give up-to-the-minute world population details. The information they show is great for exploring 'big' numbers with the children. On the first, you can stop the clock and find differences between male and female births and deaths, food production, time around the world or just read the 'big' numbers. On the second, you can click on a part of the world for similar data about particular countries and also their CO_2 emissions. It's worth a look, particularly if you are a Year 5 or 6 teacher.

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Up2d8 maths

Google Street View was launched in the UK in March 2009. There have been many comments on this latest contribution to the internet, both positive and negative. However you feel about it, Google Street View has provided us with some great mathematical opportunities for exploring position, direction and angles. This resource provides ideas which you can adapt to fit your classroom and your learners as appropriate.



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

- For FS and KS1 you could use a roadway play mat with cars and ask the children to make up routes around it using the vocabulary right, left, straight on etc.
- Using the second spread, ask the children what they can see if they were looking right, left, forwards, if they were facing up the road.
- Look for patterns in the buildings of spreads one and two and then look at buildings in the local area for patterns. You could use this idea for estimating and counting in twos for the numbers of windows they can see.
- This provides a strong link with geography: look at the differences between maps and street view, drawing/labelling buildings on an enlarged road map.
- You could link this with a topic on buildings or the local area, looking at areas involving shape and space and measurements through maps and photographs.
- You could look at other street maps and identify different routes that could be taken to get from place to place. You could work out distances according to the scale and also the time it might take to get from one place to another if following the speed limits on the different road types. This would be particularly good if you were going on a school trip.
- You could also cost the trip based on 4.5l per 100km at 90p per litre.
- You could extend the above idea to look at ways to get from one country to another.
- You could search for a school (just put in the word 'school' and the name of the city). How is it the same as yours? How is it different?


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

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

The Art of Mathematics

Pablo Picasso (1881 - 1973)

Pablo Picasso is thought by many to be one of the greatest artists of modern times. He lived in times of radical change in society and revolutionised painting, drawing, sculpture, and ceramics (pottery). His work has historical importance because of the way he experimented with different colours and methods.

Picasso was born in Málaga, in southern Spain. His father was an artist and art teacher. Picasso was a child prodigy, producing complex artwork at an early age. When he was 14 years old, his family moved to Barcelona and that was where Picasso went to art school. When he was 19, Picasso visited Paris and found inspiration from the work of the Post-Impressionists, especially Cezanne, van Gogh, Gauguin and Toulouse-Lautrec.

Picasso's work is often categorised by period:
His early paintings were melancholic and featured the colour blue, so this period is referred to as his 'blue period'. (1901 to 1904).
This was followed by his 'rose period' (1904 to 1906), during which he used warmer colours in his paintings.

After 1907, Picasso started working with his friend Georges Braque (1882 – 1963). The style they created shocked many in the art world – it was called Cubism. Their idea was to paint things as if they were being seen from many different directions. This often meant that the objects were difficult to recognise. The people and objects in these paintings looked quite flat and were represented by cubes, cones, and cylinders. In addition to this, only a limited range of colours were used, but they were used boldly. In later years, this style was further developed, in which cut paper fragments – often wallpaper or portions of newspaper pages – were pasted into compositions, marking the first use of collage in fine art.

During the 1930s, Picasso also experimented with surrealism (a dream-like style with unexpected juxtapositions), abstraction, mural painting, sculpture, and ceramics.

Information from *Introducing Picasso*, by Juliet Heslewood.

Display one of Picasso's cubist paintings, such as **Musical Instruments**.

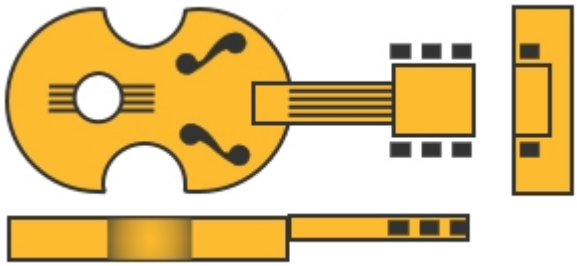
Give a short biography of Picasso.

Try to ascertain what children think about the picture on a conceptual and emotional level by asking, 'What do you think about the artwork that you've just seen?'
Encourage them to identify three things they like about the painting, and three things they don't.

Lead further discussion following these prompts:

- How do you think Picasso formed this painting?
- Can you see how Picasso has used mathematics as an inspiration for his work?
- Why do you think this art form is called 'Cubism'?
- How are 2D shapes used in cubist art?
- What shapes can you see?
- Why has Picasso formed that shape?

Discuss the fact that Picasso liked to view and draw his objects from different angles and then layer them over each other. If possible show this painting or one similar on the Interactive Whiteboard. Draw over one of the shapes with a pen e.g. the front triangle. Then move it over other shapes or rotate. Discuss translation, reflection and rotation.



Here are some suggestions for activities based on his cubist art. All these activities can be easily adapted and differentiated according to the mathematical ability of your class or group. They will cover aspects of the National Curriculum Programmes of Study for Shape, Space and Measure (Ma3) and the Primary Framework objectives for shape.

You will need:

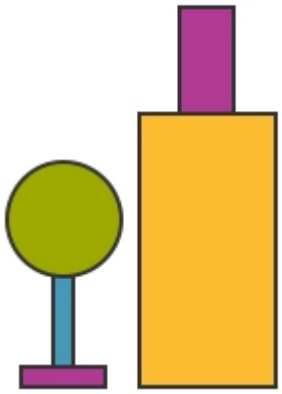
- examples of Picasso's cubist art
- a selection of coloured paper
- pastels
- crayons
- charcoal
- gluesticks
- scissors

Activity One
This has been adapted from ideas which can be found at www.artblock.org.uk.
Place three objects on a table.
Ask the children to draw the outline of the three objects on three pieces of different coloured card. Next ask the children to cut each picture into three pieces, thus leaving nine pieces of card. Take the opportunity to discuss properties and names of the 2D shapes they have now made.
Now ask the children to rearrange the fragments onto a large piece of card. Ask them to try to fit the pieces together looking for straight lines and corners but mixing the colours.
Ask the children to add more colour using pastels and chalks – identifying any 2D shapes as they go.

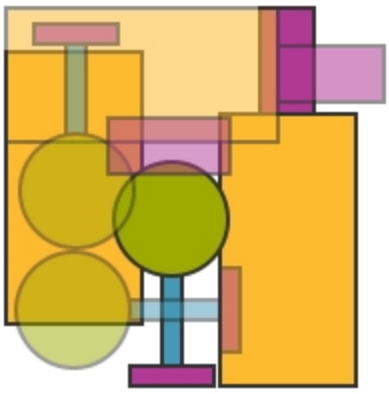
Activity Two

Arrange a simple still life on a table with objects that interest the age group. Discuss what 2D or 3D shapes they can see in the objects and ask them to describe each to a partner. You may want to build a similar image next to the original using 3D shapes if you want to support lower attaining pupils.

Ask the children to draw the still life either from the original formation or from the 3D shape image (if they require support). Colour each shape in a different colour, for example a bottle could become a cylinder or two rectangles.



This provides a good opportunity to discuss how we draw 2D images of 3D shapes with younger pupils. With older pupils, you could discuss how 3D images can be represented on paper. The shapes could then be overlapped, rotated etc.



An extension activity could be to use 'Paint' to create the masterpiece. You could ask children to ensure that they include:

- a polygon with no lines of symmetry
- two congruent figures with at least two lines of symmetry
- or any other shape or property of shape.

Activity Three
Place three objects on a piece of card on a table so they can be rotated. Ask one pupil to describe what they see. Demonstrate or ask another pupil to turn the objects 90˚. Ask the observer "Is the image the same?" Repeat until the objects have been rotated four times. Ask the observer what they notice from each angle?

Ask the children to repeat the exercise in small groups, drawing on a piece of paper what they see each time. To help the children see in 2D, it may help if they close one eye when viewing the objects. You could use tracing paper so the children could draw an image from each viewpoint and layer. Some pupils may be able to overlap their images on paper. After four rotations they should have one image of the objects from four view points. Then ask the children to identify the 2D shapes and colour them using crayons, charcoal, pastels or paint, in bold colours as Picasso did.

Once children have completed their pictures they could reproduce their image using 'Paint'.

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Focus on healthy eating

The '5-a-day' message has been well publicised and many people achieve their target. However, not everybody does and some people are not quite sure why they should. Fruit and vegetables help to keep you healthy. They are packed with vitamins and minerals and are an excellent source of fibre and antioxidants. They help to reduce the risk of heart disease, strokes and some cancers. With our improved links across the world, there is always a huge variety to choose from. To get the best health benefits, we should all eat five portions of fruit or vegetables a day. If you can give yourself a 'rainbow' plate, then so much the better.

This topic is rich with mathematics. Perhaps the best way to approach it is to take a 'bite' of information and see what you can do with it. Here are some ideas, but I'm sure you'll have many more.

Provide children with a sheet of paper and some colouring pencils or felt pens. Ask them to draw a large bowl. When everyone is ready, describe what must be in the fruit bowl, for example 2 green apples, 5 bananas and 4 satsumas or 3 red apples, 4 oranges and 6 plums. Have some plastic or real fruit on the table for support. This is a good way to check understanding of number.

Do some fruit and vegetables times tables. Draw each table using the appropriate fruits. For example, use 'pairs' of cherries for twos; three plums for the threes; four tomatoes on a vine for fours; a bunch of five bananas for fives; bunches of 10 grapes for tens and so on.

Calories are commonly used to refer to units of food energy. For the technically minded, a kilocalorie is the amount of energy required to raise the temperature of a litre of water by one degree centigrade at sea level. Growing children get their food energy from a variety of sources. For those aged 7 to 10, a girl needs around 1 740 kcal, a boy around 1 970. If a child is eating a total of five portions of fruit and vegetables a day, what percentage of their calorie intake will be fruit and vegetables? Go to the fruit and vegetable calorie chart at caloriecounting.co.uk to find out the calorific values of most fruit and vegetables. Be careful of the portion size quoted.

Around 25 000kg of strawberries will be eaten at Wimbledon this year. They are the only fruits to have their seeds on the outside – one strawberry can have as many as 200. Using this information, create a problem to solve, for example:

- How many bowls of strawberries would that be?
- How many seeds will each person eat?

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

First you need to decide your unit, that is, your bowl of strawberries. Using real strawberries and a dessert bowl, agree what this might mean. Allow for the fact that we are talking about Wimbledon and they are not likely to be very generous as they will need to try and keep the cost down. Weigh the strawberries. Can the children now use the information provided to answer the questions? If strawberries are not around or are very expensive when you do this activity, use the information that an average portion of fruit is around 80 grams. You would need to estimate how many strawberries this might be in order to answer the seeds question.
Continue the problem by asking a question such as:

- If the caterers charge £3 a bowl, how much money will they raise?

You could also work out the original cost of the strawberries and calculate the gross profit. All that from the weight of strawberries sold at Wimbledon!

Take a look at the eat well plate, it is almost a pie chart. Download the pdf of the plate to measure and use the information to create a matching pie chart. What proportion of each food group should you eat each day? Convert this to calorific values.

Look at the simple fruit salad recipe in the Key Stage 1 starter. Where is each fruit likely to have come from? How far away is each place? Calculate the food miles travelled by one portion of fruit salad. Write your own recipe, including your favourite fruits. Calculate the food miles travelled. Information on how far particular food items may have travelled can be obtained from Harlow Council and Nuffield Citizenship. A food miles calculator can be found at Organic Linker. Alternatively, for £12.50, you can buy the UK Food Miles Calculator from Carbon-info.org.

Friday 15 May 2009 is Fruity Friday, organised by the World Cancer Research Fund as an annual awareness and fundraising campaign. You can order or download an information pack. There is loads of useful information and although there are few mathematical activity suggestions, as soon as you begin to read the fascinating facts you can quickly adapt the information to provide many rich and stimulating activities of your own.

Other useful sources of information and games include:

- The Great Grub Club
- Food - a fact of life
- Food Standards Agency
- The British Nutrition Foundation
- NHS 5 A DAY
- Welltown

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Starter of the Month

There are many fun mathematics activities based around healthy eating. Here are some fruity questions, though I am sure you can think of many more… try changing everything to vegetables and vegetable soup instead.

EYFS

Most Foundation Stage settings have a time during each session where they share fruit and practitioners often make good use of this time to focus on counting activities. During a focus on healthy eating, introduce a daily fruit bowl. Vary the contents each day. Fill the bowl with fruit and choose a child to name a piece of fruit they can see. Count how many apples, pears, satsumas, bananas etc. as each fruit is named. Set out the fruit in rows in front of you as you count. Then count how many pieces of fruit altogether. Make sure everyone can see the fruit as you ask questions such as *Which fruit have we got the most of? Have we got more apples or pears?* And so on.

KS1

Write a simple fruit salad recipe on the whiteboard.

For example: ½ banana
1 satsuma
3 strawberries
4 cherries
5 grapes

Explain that this is one single serving for one person. Ask questions such as:

- How many cherries would I need for four people? 6 people? 8 people?
- How many bananas for 3 people?

Give the children mini whiteboards to use to help them work out the answers to questions such as:

- How many fruits make enough fruit salad for two people? 5 people?
- How did you work that out?
- Is it better to work out how many fruits for one serving and then multiply by 5 or multiply each type of fruit by 5 and add them all up?
- Did you use a different way?

Invite a child to ask the class a question based on the recipe.

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KS2

Pose questions such as:

- One portion of fruit is approximately 80 grams. If you eat five portions of fruit in a day, what weight of fruit will you eat? In a week? In a month?
- One full glass of pure fruit juice (juice only counts as one portion per day, no matter how much you drink) is about 150 ml. If fruit juice is one of your 5-a-day, how much will you drink in a week?
- If there are three of you in the family, how many 1 litre cartons should Mum buy for a week? A month?
- If one of your portions of fruit a day is fruit juice, now what is the weight of fruit you might eat in a week?

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A little bit of history

The history of length
The history of how we got our system of measuring length is a fascinating one dating back to 1700BC. Here is a brief outline of how it happened…

Most of the ancient civilisations used parts of the body to measure with. Some also used items found in nature such as shells or sticks as measuring instruments. Early records from Babylonian and Egyptian times and also those written about in the Bible, suggest that length was first measured using parts of a human arm.

The earliest form of the measurement of length discovered dates back to the ancient Egyptians and is called the **Egyptian cubit**. It was used for measuring in agricultural and construction work and also to record the annual flooding of the River Nile.

Did you know…
The flooding of the Nile was very important to the ancient Egyptians as it brought fertility to their land enabling them to grow crops. How much it flooded determined the amount they would be able to grow. It therefore became very important to measure its height so that they could make predictions of plenty or famine. They measured using a method known as the **Nilometre**. This was constructed in one of three different ways: a slab or pillar, a well or a series of steps as the pictures below show. They were all calibrated using the cubit and parts of the cubit for really accurate readings and they all measured the maximum height of the Nile when it was in flood. Click here for further details.

The **cubit** was the length of the forearm from elbow to the tip of the middle finger. This cubit was divided into **half a cubit**, which was the span of an open hand from the tip of the little finger to tip of the thumb. It was also divided into sixths, which was measured by the width of the hand, and twenty fourths measured by the width of the middle finger.
Try measuring these on yourself:

Can you fit two hand spans into the length of your forearm to the tip of your middle finger?
What about six hand widths…?
…24 middle fingers?

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This is a fun activity to do with your class and can be developed into an activity that explores different body ratios. For example, you could try investigating how many foot lengths equal the height of a person, whether their foot is the same length as their forearm, how many circumferences of their head equal their height.

The Egyptians also measured using the length of their feet and the length of a pace. The Greeks and Romans took on the Egyptian method of measuring, possibly developing it to use other body parts.

The first standardised measuring system to be discovered was that of the ancient Indus Valley civilisation:

While excavating in the archaeological site at Lothal, located in the modern state of Gujarat, archaeologists discovered ivory tools for measuring length which they believed to have been used for construction purposes. These tools were the first standardised ones to be found; they had sub-divisions equivalent to about 1.7mm for accurate readings.

The Babylonians also had standardised units of length. These were based around the **kus** which was about 530mm and known as the **Babylonian cubit**. The Babylonians also measured in a unit called the shusi which was 1/30 of a kus and was equal to about 17.5 mm. The **Babylonian foot** was 2/3 of a kus.

Our imperial units of **inch**, **foot** and **yard** evolved from these units, although no one really knows how. We do know that the Romans took on the Egyptian method of using feet. The **Roman foot** was divided into 12 **unicae** which became our 12 inches.

When they occupied England they introduced the **Roman mile**, which was 1 000 paces, each pace being five Roman feet.

This seems quite a straightforward measurement but for some reason Queen Elizabeth 1, during her reign from 1558 to 1603, changed the Roman mile from 5 000 to 5 280 feet.

You could ask the children to research this and see if they can find out why.

The yard as a unit of length came later than the mile and its origin is not really known. With the yard came the parts of one: **half-yard**, **span**, **finger** and **nail**, again based on body proportions. There were also lines, links, chains, furlongs, rods, poles and perches. What a complicated system we were gradually developing!

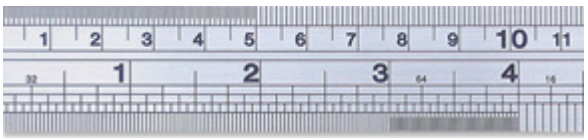
These are the common units used up until the metric system came along in the 1960s. Some of these we have kept and some have been discontinued:

- 12 lines = 1 inch
- 12 inches = 1 foot
- 3 feet = 1 yard
- 1 760 yards = 1 mile
- 100 links = 1 chain
- 10 chains = 1 furlong
- 8 furlongs = 1 mile
- 4 inches = 1 hand
- 22 yards = 1 chain
- 10 chains = 1 furlong
- 3 barleycorns = 1 inch (Anglo-Saxon measurement)

...and so it goes on!

Imagine having to teach these to your children and imagine them having to learn and remember them all!

Problems arose because the inch was measured in different ways in different countries: there wasn't any standardisation. Everyone's inch was slightly different.



The metric system, which began during the French Revolution, spread widely during the 19th century, bringing a uniformity to units of measure. Today most countries measure in these consistent measures. Britain resisted this system initially and introduced imperial units in opposition to the metric.

The USA still uses imperial and the UK and Canada use a mixture of both. In the UK, it is required that all measuring equipment used in trade or retail must show metric measures as well as imperial.

Many imperial measures for length are rarely used these days but a few are still in official use: road signs must be in miles; clearance heights, for example for bridges, must be in feet and inches; and speed limits must be in miles per hour.

For further information look at these links:

- Primary Magazine Issue 5 Up2d8 - Imperial or metric or both? This looks at two news stories from the latter part of 2008, the first about distance signposts put up in Sandbach, a town in Cheshire, using kilometres instead of miles and the second about a trader in east London who faced prosecution for using imperial weighing scales. It gives ideas for exploring imperial and metric measures.
- James Calvert on the Denver University website
- UNRV History website

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Maths to share – CPD for your school

Mathematics Subject Knowledge - Data Handling

Before the session, ask colleagues to access the Self-evaluation Tool on the NCETM web portal, and complete the questions related to 'Handling data' for the phase in which they teach. Click the relevant phase below to access the data handling pages of the Tool. You may wish to ask them to complete the questions for all of EYFS, KS1 and KS2.

In June last year, the final report from Sir Peter Williams was released, following the independent Review of Mathematics Teaching in Primary Schools and Early-Years Settings. The report commented on the immediate need to address gaps in teachers' mathematical subject knowledge. The Self-evaluation Tool on the NCETM portal is an excellent starting point for identifying teachers' needs and providing signposts to materials which could help address them.

Data handling is an area of mathematics that can provide the focus for highly engaging, interactive lessons at all levels, challenging the pupils' reasoning and communication skills as well as their ability to interpret and present data. Unfortunately, it is the latter, the presenting of data, that is all too often seen as the main focus, with little progression of skills throughout the primary years. Jenni Back and Liz Pumfrey comment:

> *Analysis is often confined to identifying the most popular or least popular item. These limitations tend to restrict the interest and variety of the contexts that are explored, and fail to engage children in any significant mathematical thinking.*

For further details of enriching data handling lessons, and some wonderful activity ideas, click here for the full article by Back and Pumfrey cited on the NRICH website.

Start by allowing colleagues some time to consider the following question...

How long should the school summer holidays be?

Discuss the outcomes of their discussions. What key points do they include in their arguments? Now show them the five stages of the data handling cycle.

1 **Specify the problem:**
Formulate questions in terms of the data needed and the types of inferences that may be made from them.

2 **Plan:**
Decide what data should be collected, including sample size and data format, and what statistical analysis needs to be carried out.

3 **Collect data:**
Obtain data from a variety of sources, including experiments and surveys, and primary and secondary sources.

4 **Process and represent:**
Reduce the raw data into summary information, including lists, tables and charts, to provide insight into the problem.

5 **Interpret and discuss:**
Relate summarised data to the initial question(s).

Ask colleagues to relate these to the question previously posed relating to the length of the school summer holiday. Are their discussions now more structured? Are they now considering factors which were not discussed previously? Does this affect the decisions that need to be made? What are those decisions? Allow time for discussion and feedback.

Suggestions for decisions to be made might include:

- What data should we collect?
- Will the data consist of measurement or opinions?
- How should we collect the data – by counting or measuring?
- Whose opinion should we ask – everyone with an interest or just a sample
- How do we ensure that our samples are representative?
- Should the opinions of some groups have a weighting, or should all opinions have the same value?
- How should the data be analysed?
- How should results be presented? Does this influence how we should collect the data?
- What else needs to be considered?

These questions are also available as a separate handout.

Data handling can be an aspect of the mathematics curriculum that causes difficulties in the classroom, and anxiety among teachers. Ask colleagues to consider the problems or difficulties that might arise (or have arisen) when collecting, organising and handling data. Suggestions and contributions might include management-related problems (practical collection of data too chaotic or time-consuming), lack of ideas, or the concern that the skills emphasis is always the same (e.g. children generating bar charts and answering questions).

Explain to colleagues that you will now consider the progression in data handling skills. Ensure they each have a copy of Progression through data handling. This gives eight objectives from the Handling Data strand of the Primary Framework for Mathematics, showing expectations for year groups 1 to 6. Allow colleagues time to discuss and try to identify the year groups from which each is taken. Click here for the solution.

Now ask colleagues to cluster similar objectives, e.g. those relating to probability. Do they consider some aspects of data handling more difficult to teach than others? Is this reflected in the results from using the Self-evaluation Tool? Are there common threads throughout the staff group?

One common question from teachers is related to the presentation of data, and to what extent pupils should be required to produce their own presentations. There is no doubt that pupils can learn a great deal from deciding how to present their data: selecting the most appropriate format, choosing scales and groupings, being accurate in their drawings and annotations. However, there is little value in spending lesson after lesson producing perfectly coloured bar charts – other than to create an eye-catching display!

ICT can be used very effectively to support the data handling process, quickly producing clear, accurate displays of results, allowing pupils time for reflection and interpretation. There are a wide range of programs available, both from publishers and as free downloads on the internet. Teachers will appreciate time to familiarise themselves with the various software available or simply play!

- The set of Interactive Teaching Programs (ITPs) produced by the National Strategies includes two programs useful for data handling. The first of these, Data Handling, allows pupils to enter up to ten fields of their own data, and quickly produce a horizontal or vertical bar chart as well as a pie chart. There are also eight sets of preloaded data to use in the same way.
- The second interactive teaching program is Line Graph which allows pupils to enter continuous data into a table, and see the line graph being formed simultaneously. The scale of the graph changes according to the data entered, and provides a useful starting point for discussions focusing on the appropriateness of scale. As with *Data Handling*, there are sets of preloaded data which can be used as a starting point. This has real potential for supporting children in understanding why and how data is presented in different ways.

- The use of line graphs to 'tell a data story' is a useful way of linking Ma4 (Data Handling) with Ma1 (Using & Applying Mathematics). Click here for a set of five line graphs: 'Room Temperature', 'Level of water in a rain barrel', 'Mass of an elephant', 'Electricity usage in a town' and 'Height of plant'. Once the title is selected, a line graph appears (which can be changed at random), yet there are no axes values. Once it has been modelled by the teacher, even young children enjoy adding their own 'story' to match the data and justifying their decisions. Show the teachers one of the line graphs and ask them to tell a colleague their 'story'. Once familiar, pupils can be given a story and asked to represent it as a line graph.
- A wonderful example of this is Archimedes' Bathtime, a web-based simulation which draws a 'real time' line graph of the water level in Archimedes' bath. The pupils are required to change variables such as the strength of the water flow into the bath, turning the tap on or off, putting the plug in or out, as well as instructing Archimedes himself to get in or out of the bath. A real hit with children and teachers!

- Pie Chart is an Excel spreadsheet produced by the National Strategies, which allows the pupils to really focus on the structure of a pie chart and use their problem-solving and reasoning skills to interpret the data it represents. A random pie chart is first created on screen, and then pupils select which values to reveal, in order to calculate other values. This also links well to fractions and percentages work.
- 'Furbles', a set of mathematical characters that can be used for data handling, first hit the world of education in 2003. The Furbles can be customised by changing the number of eyes they each have, their colour and their shape. They can then be reorganised into bar and pie charts, showing that vital link for pupils between the raw data and the final presentation of results. The early version of the software can be accessed here, although it is currently being updated with additional features. A demo version of the updated software can be viewed here.

- The Census at School site provides a wealth of real data for use by teachers and pupils in data handling activities. There are many different resources, ranging from those based on fairly common data sets such as 'Number of cars in a household' and 'Favourite pets', to those which support data handling skills in the classroom such as 'Cleaning up your data' (encouraging

children to check data for obvious errors) and 'Do we need to ask everyone?' (aimed at teaching the skill of appropriate sampling).
- Stats4Schools provides teachers with data handling lesson ideas and large sets of data, which can then be used for comparison with pupils' own data based on similar variables.

With a little imagination, and a clear understanding of the skills needed to be developed by the pupils, data handling can be a truly exciting aspect of the mathematics curriculum. There are real opportunities for using and applying mathematics and linking work from across the primary curriculum. Enjoy!