Primary
& Early Years
Magazine 55

National Centre
for Excellence in the
Teaching of Mathematics

Welcome to Issue 55 of the Primary Magazine. We hope that you have had a great summer and are feeling refreshed for the new academic year. In this issue, The Art of Mathematics features the artist Henri Toulouse-Lautrec. A Little Bit of History continues its series on inventions: this time, we look at pencils. Focus on... explores another mathematics trail, and Maths to Share looks at some more research by a Mathematics Specialist Teacher.

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Editor's extras

The National Curriculum

Last term, we published a new 'Essentials' page for implementing the National Curriculum. Implementing the new curriculum is a 'one-stop shop' with links to resources on the NCETM portal that will be helpful to subject leaders who are beginning to consider how to support teachers in readiness for the new programme of study. We have also launched a webpage that will keep you up to date with relevant news of the new curriculum as it becomes available.

As part of this support we have produced a suite of 16 videos focusing on calculation and the associated skills and understanding (for example, the concepts of place value and exchange). The videos seek to demonstrate how fluency and conceptual understanding can be developed in tandem. One of the aims of the new National Curriculum, that children should 'reason mathematically', is demonstrated throughout. Each set of videos has an accompanying presentation to stimulate thought and discussion about teaching and learning. We hope you enjoy the videos and find them helpful in supporting teacher professional development. We'd be delighted to receive your feedback, and to learn how you use them (either by commenting below or emailing us at info@ncetm.org.uk). In the near future this suite will include videos focusing on fractions, algebra and division. So keep a look out for these!

The NCETM Professional Development Lead Support Programme (PDLSP)

We are continuing our programme of free national face-to-face events for CPD leads working within and alongside the school system. These events are for:

- Specialist Leaders in Education (SLEs) and other colleagues from Teaching School Alliances charged with organising and running mathematics PD opportunities;
- teachers based in schools with a remit for supporting colleagues in their own and other schools, such as Mathematics Specialist Teachers (MaST) and ASTs;
- other teachers who are charged with organising and running mathematics PD opportunities;
- mathematics and/or numeracy advisers and consultants from Local Authority teams;
- independent Mathematics consultants and organisations offering Mathematics PD;
- colleagues from HE institutions offering PD.

This programme consists of four elements:

- an initial 24-hour residential development day, beginning at 17:30 on the first evening and ending at 15:30 on the second day;
- planning, execution and evaluation of an interim task based on input offered in the first residential;
- a second 24-hour residential (with timings the same as the first);
- a commitment to plan and offer future PD opportunities drawing on the input, discussions and experiences gained during the programme and to offer periodic feedback regarding reach and

impact for at least a year following accreditation (a re-accreditation process is offered after one year).

Colleagues completing this programme will be accredited by the NCETM to provide professional development in the priority areas of arithmetic proficiency in primary schools and algebraic proficiency in secondary schools and colleges.

Accredited PD Leads will:

- receive a certificate indicating their status as an 'NCETM Professional Development Accredited Lead';
- be entered into a directory of Accredited PD Leads on the NCETM website;
- receive an 'NCETM Professional Development Accredited Lead' logo which can be used on any relevant documentation to signal their accreditation.

There is no cost attached to attendance at the two residentials: accommodation and meals are included, but please note that travel and supply costs, if appropriate, should be met by those attending.

Colleagues who have completed the first cohorts have said about the programme:

'I really valued the input from experienced colleagues and the diversity of viewpoints was very refreshing.'

'One of the main criteria for successful PD is that is stimulates new thinking – it certainly did that for me.'

'The course is definitely impacting on my daily work.'

If you would be interested in participating, please go to the PDLSP microsite for more information, including dates and details of how to book your place.

New microsite for subject leaders to support high attainers in mathematics in primary schools

Have you seen the microsite which aims to support schools in evaluating and supporting their provision for high attaining pupils in mathematics in primary school? High Attaining Pupils in Primary Schools will help subject leaders, senior leaders and teachers to identify and support pupils who are attaining higher than expected standards in mathematics not just in Year 6 but from the time they begin school.

The teacher as researcher/teaching as researching

Have a look at the research of Caroline Ainsworth on the use of colour rods, which can be found on the microsite The teacher as researcher/teaching as researching. It is well worth exploring and trying out in your classroom.

DfE Key Stage 2 tests consultation

The Department for Education (DfE) is holding a consultation on its proposals to change the way Key Stage 2 tests in maths and English are reflected in a national accountability system, and how a separate measure of each pupil's progress is designed. Views can be submitted in a number of ways before **11 October**. More information is here.

And finally…

Do pupils in your school have access to iPads or other tablets? The developers of SlateMath, a series of maths apps, are interested in running a few pilots in London primary schools. They are offering free software and training for teachers. The pilots can begin anytime during the school year.

The first app in the SlateMath series, which supports Reception and Year 1 mathematics can be downloaded free from Apple's app store. The complete series of apps from Reception to Year 6 will be available in March 2014.

If you're interested in taking part in a pilot, please email Professor Shimon Schocken.

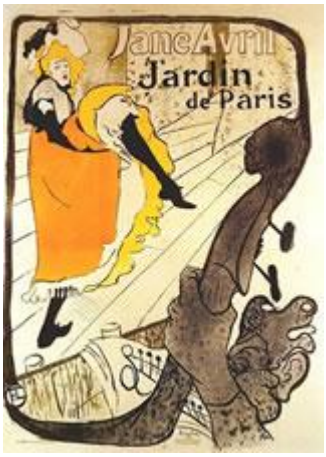
The Art of Mathematics
Henri de Toulouse-Lautrec

Henri Toulouse-Lautrec is known, along with Cézanne, Van Gogh, and Gaugin, as one of the greatest painters of the Post-Impressionist period. Throughout his career, he was very prolific creating 737 canvases, 275 watercolours, 363 prints and posters, 5 084 drawings, some ceramic and stained glass work, and an unknown number of lost works!

He was born Henri Marie Raymond de Toulouse-Lautrec-Monfa on 24 November 1864, in Albi, a town in the Midi-Pyrénées region of France. He was the first-born son of an aristocratic family who were descendants of the Counts of Toulouse. His parents were Comte Alphonse and Comtesse Adèle de Toulouse-Lautrec. In previous generations there had been some inbreeding and Henri's parents were actually first cousins. This could have been the cause of Henri's congenital health problems. When he was 13, he fractured his left thigh bone and when he was 14 he broke his right. The breaks did not heal properly and as a result his legs didn't grow. When he was an adult he had an adult torso and child sized legs. He grew to the height of 1.54m (5ft 1in) with legs that were only 0.7m (just over 2 feet) in length.

Henri had a younger brother who was born on 28 August 1867 but he died the following year.

Due to his size he was unable to participate in most of the activities typically enjoyed by men of his age, so, he immersed himself in art. He lived in Montmartre which was an area of Paris famous for its Bohemian lifestyle and also as the place where many artists, writers and philosophers spent much of their time. Many of his paintings reflected this way of life.



Jane Avril at the Jardin de Paris

He is possibly best known for the series of posters that he was commissioned to paint by the Moulin Rouge cabaret club. After he had painted these, the club permanently reserved a seat for him. They also displayed some of the other paintings that he created. He regularly painted the singers and dancers at this and other Parisian nightclubs, including the dancer Louise Weber who made up the famous French dance, the 'Can-Can'.

Henri spent much of his time in brothels, where he was great friends with the prostitutes and madams. He often made these brothels his home and lived there for weeks at a time. He spent many an hour painting and drawing the ladies at work!

Henri was an alcoholic for most of his adult life, and was placed in a sanatorium shortly before his death. He died, shortly before his 37th birthday, on 9 September 1901, from complications related to his alcoholism, and syphilis, which he allegedly picked up at one of the brothels he frequented. He is buried in Verdelais, Gironde, a few kilometres from the Château of Malromé, where he died.

After Henri's death, his mother and his art dealer, promoted his art. His mother contributed funds for a museum to be built in Albi where his works are displayed. Some of his works have been known to sell for millions of pounds.

Information sourced from The Toulouse-Lautrec Foundation.

Now for some mathematical ideas…

Show Central Park

Ask the children to describe what they think is going on in the painting. You could count the different things featured in the painting, for example, the horses, the carriages, the wheels on the carriages. This could lead into opportunities to practice counting in fours or doubling and doubling again. You could ask problems relating to multiplication and division, for example, six carriages how many wheels? 32 legs, how many horses?

You could ask them to estimate the number of people and discuss why it is difficult to count them accurately.

Ask them to identify and count the shapes that they can see in the painting, for example the circles made by the wheels and also the wheel hubs. You could ask them to identify all the rectangles they can see, not just the obvious ones but also those made up by two or more rectangles that are side by side. Discuss the properties of these shapes, including symmetry.

You could ask the children to draw a carriage. Encourage them to draw accurate circles as described in *The Art of Mathematics* in Issue 50. You could give them different sizes of radii to practise first.

Show Yvette Guilbert 2

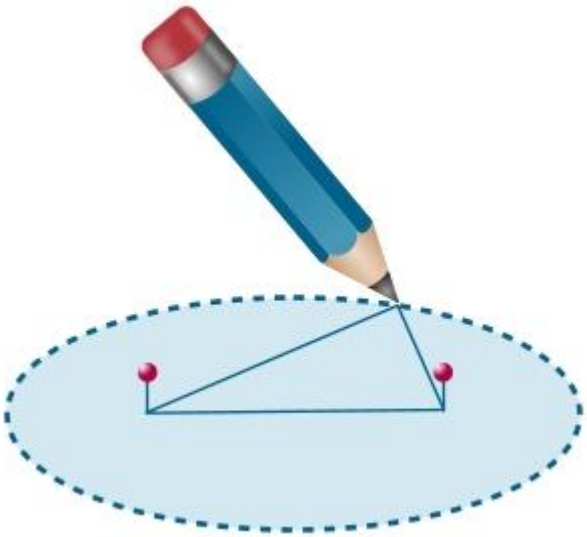
You could use this painting to explore angles. Ask the children to identify the names of the different angles they can see on the body, for example, her waist, where her arm is bent. Can they see any acute angles? What about right angles, obtuse angles and reflex angles? You could ask them to identify different angles in the classroom.

You could ask them to estimate the sizes of these angles and then demonstrate how to find the actual size. If you can print out copies of this picture, give the children copies and protractors so that they can measure them.

You could ask them to stand in different poses, make angles with their arms and legs and name them. They could then draw stickmen which show a variety of angles. They could measure these and then order the sizes of the angles from smallest to largest.

Show Portrait de femme

Ask the children to identify the shape of the frame. You could then ask them to draw one. To do this place two pins onto a piece of paper. The paper could be placed on cardboard, or something similar, to secure the pins. Put a loop of thread or string over the pins as in the diagram. Place a pencil inside the thread and tighten it. Finally draw in a circular motion and you should get an ellipse!



Once they have their ellipse, ask the children to draw a portrait of their friend inside. They could then stick this on another piece of paper and decorate the 'frame' with a mathematical theme.

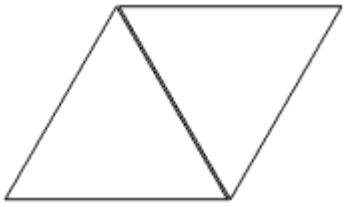
Show La passagère du 54

Ask the children to describe what is happening in the picture. Agree that there is a lady sitting on a deckchair on the deck of a boat. Ask the children to imagine where she might be going. They could explore maps of Europe and find the distances from chosen ports across the English Channel or the Mediterranean Sea. They could find the distances on the map and convert to real distances in kilometres or miles using the scale on the map.

Focus on the shapes that can be seen on the frame of the deckchair. Can they see the right angled isosceles triangle? Use this as an opportunity to rehearse the different types of triangles: equilateral, isosceles and scalene. They could describe their properties and practice drawing them and measuring their angles. You could carry out angle investigations by giving one angle of an isosceles triangle and ask them to find the other two and two angles of a scalene triangle and ask them to find the third.

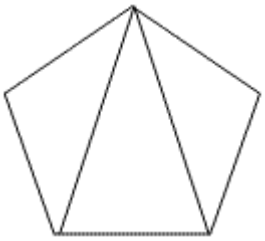
You could ask them to investigate the statement, 'If I know that the angles inside a triangle total 180°, then I can work out the total number of angles in any polygon.'

You could begin by inviting the children to draw one diagonal line inside a quadrilateral to make two triangles as in the diagram below. They could then explain how knowing that the internal angles of a triangle add up to 180° will help them to work out the internal angles of a quadrilateral:



They could investigate different parallelograms on geo-boards or on dotted paper and measure the angles with a protractor to confirm this is always the case.

The children could then investigate the angles inside a pentagon in the same way:



They could then continue with regular hexagon, heptagon and octagon. Can the children work out how this works and figure out a formula that they can use for any sided shape?

Show Children by a Window 1900-1902

You could ask the children to count the jars and bottles on the shelves in the room through the window. How many small squares can they see in the large window? Expect them to use multiplication to answer this, point out the array they make.

As described in the ideas for Central Park, the children could work out how many rectangles there are in the whole window. Encourage them to look for patterns and extend this for larger windows.

If you haven't done the investigation in Issue 52 for Johannes Vermeer's 'The Little Street' you might like to try it.

They could draw their own window and divide it into small squares and then work out the number of small squares there are. They could then make up their own picture of children looking in a window with interesting shapes on the shelves.

The ideas here are just to give you a taster of the mathematical activities that could be involved when looking at artists such as Henri Toulouse-Lautrec. We know you can think of plenty of others! If you try out any of these ideas or those of your own, please share them with us!

Explore further!
If you've enjoyed this article, don't forget you can find all the other *Art of Mathematics* features in the archive, sorted into categories: *Artists*, *Artistic styles*, and *Artistic techniques*.

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Page header: La Goulue arrivant au Moulin Rouge courtesy of Wikimedia Commons, in the public domain
Jane Avril at the Jardin de Paris (poster) 1893 courtesy of Wikimedia Commons, in the public domain.

Focus on…
Mathematics trails

In this issue of *Focus On...* we share a mathematics trail designed by another three students at Kingston University, Georgina Lay, Kenyeh Kawa and Hannah Lawrence.

Their trail is aimed at children in Key Stage 2 but the activities can be differentiated to suit different age groups. It can also be adapted to most railway stations in the country!

As suggested in the article about the mathematics trail for Legoland in Issue 52, there is always plenty of mathematics involved in planning a trip to such a place, for example:

- using calendars to plan the date
- finding a suitable way to get to the station, working out how long it will take and the cost
- working out what time to leave school, what time you will return and the total length of the trip
- considering the amount of spending money the children might like to take.

The train at platform 2

Back to the mathematics trail…

The activities in this trail meet many aspects of the Mathematics National Curriculum and can be adapted to suit both Key Stage One and Key Stage Two. These include:

- Money
- Time
- Estimating
- Data handling
- Measurement.

The second slide has some money-related questions. You could ask the children, before a visit to a railway station, to make up some of their own questions which they could answer when they are there.

The third slide has two questions involving time. You could search the internet to find timetables of trains that finish their journey at Waterloo or the station you might visit. The children could then plot, onto a map of England, the different towns where the journeys begin and work out some of the lengths of these journeys. They could also makeup questions relating to journey times from one town to another to ask the class.

Slides five and six give a suggestion for a data handling activity. You could adapt this to involve other ways of representing the information, for example, a pie chart or a pictogram. You could ask the children to carry out a survey whilst on the trip, for example the number of men, women and children getting on a certain train, and record using a tally.

Problem Solving is a component of the trail, with all of the activities containing an element of this. The trail also puts mathematics into context and allows children to recognise that maths is incorporated into numerous aspects of everyday life.

Have fun exploring the mathematical possibilities of Waterloo Station!

Explore further!
If you've enjoyed this article, don't forget you can find all previous *Focus on...* features in our archive.

A little bit of history – Pencils

In this issue of the Primary Magazine we are continuing our short series of articles on inventions. We are looking at one of the most used pieces of equipment in the classroom…

Along with Post-it Notes, Blu-Tack and scissors, the pencil is another invention that we cannot do without, especially in the classroom!

Pencils are used on most days by most children inside and outside of school, but do they know where they come from? They might find the history of this commonly used writing and drawing implement interesting. You could then try out some or all of the suggested activities at the end. They can fit in with many areas of the mathematics curriculum.

Pencils date back to an ancient Roman writing instrument called a stylus. These were thin metal rods used by scribes. They used them to leave light but readable marks on papyrus, which was an early form of paper. Other early styluses were made of lead. We often call pencils today lead pencils. In fact they are really made of graphite.

Graphite came into widespread use following the discovery of a large graphite deposit in Borrowdale, Cumberland, England in 1565. It was said to be a lead coloured material which was greasy to touch and easily stained the fingers. It was originally known as 'black-lead'. It left darker marks than lead and these marks could easily be rubbed out. In the late 18th Century, Swedish chemist Karl Wihelm Scheele identified the 'black-lead' as a crystallised form of carbon and named it graphite from the Greek word for writing, 'Graphein'. The graphite was soft and brittle and the sticks that were made from it needed holders so that they didn't snap. Originally, the sticks were wrapped in string, later they were put inside hollowed wooden tubes. In 1662 mass-produced pencils were made in Nuremburg, Germany. In 1761 cabinet maker Kaspar Faber moved near Nuremburg and began making his version of a simple pencil. He cut the graphite into narrow sticks and glued them between two pieces of wood and so the wood-cased pencils we know and love were born and the family dynasty of Faber-Castell pencil makers began!

The world's oldest pencil

Shortly after Faber-Castell began producing pencils, Lyra, Staedtler and other companies were established and an active pencil industry developed throughout the 19th Century.

In 1794 the Graphite-Clay process was invented. Powdered graphite was mixed with clay, shaped into thin rods then fired in a kiln at high temperature. The greater the graphite content the softer and darker the lead. The greater the clay content the harder and lighter the lead.

In 1839, Lothar Faber, the great grandson of Kaspar Faber, mechanised pencil production, using first water, then steam power. He achieved a production rate and consistency of quality previously unheard of. He invented the hexagonal prism shaped pencil and created standards for the pencil size and grades of hardness still in use today. His products were marked A.W. Faber and labelled with the grade of hardness. These were the first brand-name writing products in the world and the grading is still used today. This diagram shows the different grades and how they appear on paper.

Today, the Faber-Castell Group produces around 1.8 billion wood-cased pencils per year and is the world's largest pencil manufacturer. The company's latest pencil innovation is the Grip 2001 Triangular pencil with its non-slip 'grip zone'. This pencil has won six international design awards.

The first mass-produced pencils were natural and unpainted to show off high-quality wood casings. By the 1890s, many pencil manufacturers started painting pencils and imprinting them with brand names.

In America, early settlers depended on pencils from overseas until the war with England cut off imports. William Monroe, a Massachusetts cabinet-maker, is credited with making America's first wood pencils in 1812. Towards the end of the 19th Century, New York and New Jersey had several factories established by prominent German pencil manufacturers, including Faber-Castell, Eberhard Faber, Eagle Pencil Company (later Berol) and General Pencil Company.

Eagle Pencil Co's round and hexagon gold 2½ pencils

American pencils were first painted yellow. Apparently the reason for this was that the best graphite in the world came from China and American pencil makers wanted a special way to tell people that their pencils contained Chinese graphite. In China, the colour yellow was associated with royalty and respect. So American pencil manufacturers began painting their pencils bright yellow to communicate this regal feeling and association with China! Today, many writing pencils are painted yellow and what was once thought of as 'regal' has now become 'common'.

Today the production of pencils is a global industry increasingly concentrated in Asia.

Information sourced from:

- Faber-Castell
- Studio 602.

Now for some mathematics!

Ask pairs or small groups of children to make a collection of classroom pencils. They could order them from shortest to longest and then estimate and measure their lengths.

You could decide on a 'minimum length' of pencil in use in the classroom. Ask the children to measure their pencil to check whether it is longer than the minimum length or could be thrown away or put in the emergency pencil box.


Coloured pencils in a tub

They could make a random collection of coloured pencils and make a pictogram, bar chart, bar line graph or pie chart to show the numbers of these colours.

They could sort a collection of pencils according to their shape. What is the ratio and proportion of hexagonal prisms to cylindrical and triangular prism shapes? Of course you would need to discuss the properties of each type of shape first!

The children could make repeating patterns using the ends of their pencils and paint.

If the pencils in your class are all the same shape the children could find out the possible shapes from the internet.

They could join the Great Debate on the shape of pencils!

The children could arrange their pencils in order of the grade of thickness and then draw lines with each one. Can they see the difference in the thickness of the lines?

You could print out the information from Pencil Anatomy and ask the children to compare their pencils with the information it gives about, for example, diameters, shape. They could then sort them using these criteria.

The children could look at the work of Jessica Drenk, who carves pencils into shapes. Can they use their pencils to make shapes and abstracts (without the carving!)?

The children could create symmetrical patterns using their pencils. Ask them to explore how they could do this across horizontal, vertical and diagonal 'mirror' lines. They could also experiment making symmetrical patterns in the four quadrants. They could draw around one and then rotate it in turns of 90° or 45° and draw around them in each position to make a rotational pattern.

The children could explore Total Merchandise and pick their top ten favourite pencils. They could then sort these into a Carroll or Venn diagram according to their own criteria. They could then order their prices from least to most expensive prices on an appropriately-sized number line.

They could explore the prices of packs of pencils on Amazon and work out how much one pencil would cost using their preferred method of division.

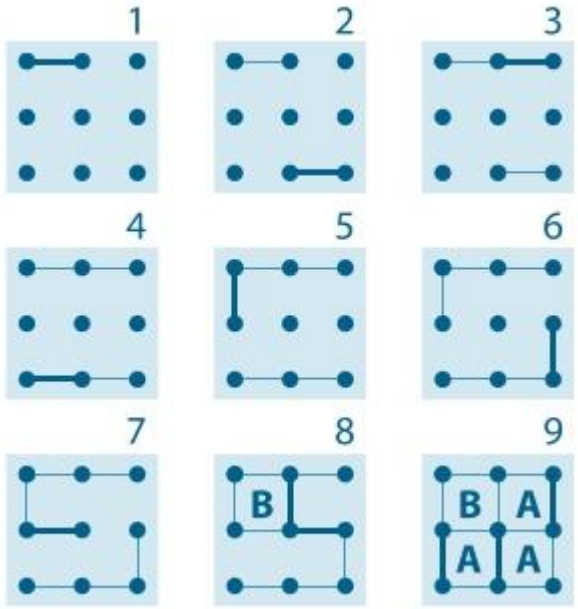

New pencils

The Pencil Pages has a list of pencil manufacturers. The children could find the places where they are located on a world map. They could then find out the distance these countries are away from where your school is. They could measure the distances using a ruler or piece of string and scale them up using the scale on the map. They could then convert these measurements to miles or kilometres as appropriate. They could choose some of these places and make up mathematical factfiles for them with information including population, rainfall, temperature and currency. They could then represent this information using charts and graphs. They could also make a simple currency converter. This would be good practice for scaling up and down and linking to ratio.

wildaboutmath.com has some fun pencil and paper strategic mathematical games. Here is one of them:

Dots and Boxes

Use graph paper, dotted paper or draw dots on plain paper. Each of two players takes turns to draw line segments connecting two adjacent dots. The goal is to make boxes. The player who is able to make the most boxes wins. The game is easy to play and a little bit of strategy goes a really long way.The example given is simple. This can be extended by using more dots:



Other pencil and paper games can be found at The Pencil and Paper Games blog, and Pencil and Paper Games.

We hope that this article has inspired you to make a more mathematical use of your classroom pencils! If there is any area of history that you would like us to make mathematical links to, please let us know.

Explore further!
If you've enjoyed this article, don't forget you can find all previous *A little bit of history* features in our archive, sorted into categories: *Ancient Number Systems*, *History of our measurements*, *Famous mathematicians*, and *Topical history*.

Maths to share – CPD for your school

In *Maths to share* we look at research undertaken by Mathematics Specialist Teacher, Peter Jones. Peter has recently gained the status of Mathematics Specialist Teacher (MaST) from Edge Hill University, Ormskirk. He has completed the two year MaST programme, which is designed to help teachers to develop a deep understanding of a range of approaches to the teaching and learning of mathematics across key stages, helping them to become 'champions of mathematics' who will work to change attitudes towards the subject, making it more accessible and relevant to children. The following article discusses the use of structured shapes to enhance understanding of division amongst a target group of Year 5 pupils.

It would be helpful to print out copies of Peter's report to give to colleagues. Ask them to read it before the staff meeting and to be prepared to discuss how his work might make a contribution to the way mathematics is taught at your school in the future.

The focus of Peter's work was division. A group of under-attaining pupils in Year 5 in his school were assessed on their understanding of this area of mathematics. Peter says that their results suggested they viewed the concept of division as being primarily about sharing. It revealed they needed to develop an integrated meaning for division – to understand it as sharing as well as grouping, repeated subtraction, ratio and the inverse of multiplication.

Begin the session by discussing what division is as a concept and what it is that children need to understand to be successful.

- what do colleagues think are the 'big ideas' in division?
- you could ask them to make a mind map as suggested in *Maths to Share* from Issue 27. You could ask colleagues to consider:
    - vocabulary
    - key ideas, i.e. the processes or concepts involved
    - children's prior knowledge
    - what connections there are to other areas of mathematics, e.g. subtraction, inverse operation of multiplication
    - common misconceptions
    - models and representations to support learning
    - how examples you choose to use could hinder/enhance learning
    - assessment for learning opportunities.

Ask colleagues to refer to Peter's summary:

> *'Throughout my case study, I refer to theories of learning and explore the notion put forward by Utall et al (2009: 156) that children acquire much of their mathematical knowledge by manipulating concrete objects; and that children must be able to connect concrete to more symbolic representations as they advance through school. He suggests that the importance of physical apparatus is often over looked in Key Stage 2, with many teachers of the opinion that such resources are unnecessary. This research contends that, in contrast, the more challenging a concept such as division becomes, the more understanding is needed and to achieve this, more and not less resources need to be used.'*

Consider the use of concrete objects, or manipulatives, in your school.

- do colleagues agree with the research? Do they make regular use of manipulatives in KS2? If so, is this used for every child or is it limited to the lower attaining children?
- together, make a list of possible manipulatives that children could use throughout primary school to enhance a deeper understanding of division.

Peter found that in his school, division has been considered a weak area of the curriculum among the low achieving pupils.

- is this the case in your school?
- if so, where do any problems first arise?
- does this have implications for earlier years? What are they and how can they be addressed?
- how is division taught in your school? Peter focused on grouping. Is this a common method in your school?
- is there a clear progression in the development of a conceptual understanding of division throughout your school? It might be a good idea to make a progression map of this to ensure consistency of approach.

Anghileri (2001) argues that division is more complex than addition and subtraction, because it requires knowledge of multiplication facts, the ability to estimate, as well as being able to use addition and subtraction within the solution.

- how are multiplication tables taught in your school?
- at what age do the children begin to learn them? Do they start by counting in steps of different sizes and then link these to the multiplication facts?
- what strategies are encouraged for children who find it difficult to recall these facts quickly? It might be a good idea to explore possible strategies, for example:
    - double 2s to get 4s
    - double 4s to get 8s
    - learn your 3s and then double these to get 6s
    - 9s are one multiple less than 10s
    - learn the square numbers
- you might like to show colleagues the ATM video of Jill Mansergh (Bath Spa University) teaching a group of trainee teachers their 17 times tables. Would her strategies work for the multiplication tables that the children in your school find difficult?
- are the children able to estimate when calculating? What opportunities are they given to encourage and develop this skill?
- are the children shown the importance of addition and subtraction within division? It might be worth exploring the importance of these during the meeting.

Peter was influenced by the social constructivist model of learning. Are colleagues familiar with this? You might need to remind some that it is a model where children are active learners who seek to make sense of their world and try to build on what they know and believe when presented with new mathematical experiences (Dunn et al, 2010).

Peter specifically discusses the use of a manipulative that supports conceptual understanding of multiplication and division.

- do you have any manipulatives in your school?
- if so, what are they, and how widely are they used across the school to teach multiplication and division?

It might be worth spending some time considering other resources that you have that could be equally helpful, for example, bead strings, colour rods.

Peter states that along with the manipulative, success was also due to scaffolding and the mathematical language provided by the teacher and collaborative support from peers. He cites Pritchard (2008) who argues that the discussion between pairs and in groups and between teacher and pupil is 'essential for the effective development of understanding'. Would colleagues agree?

Peter concludes by saying:

> *'For this potential to be realised, it needs to be embedded across the school and in particular, in Years 3 and 4. Teachers need to make the time to experiment with resources and consider how these meet the needs of all their learners. After all, as in all teaching, the success depends on how the resources are used, not just on the resources themselves (Dunn et al, 2010).'*

Peter's point about embedding across the school is important. Sometimes resources are used well in one class and then never see the light of day again! It might be worth spending some time focusing on one resource that you have in school and working out how it could be used effectively in each year group. An example could be bead strings. These are often used for counting, one more/less, number pairs to 10 in EYFS and KS1. Could this be developed as a resource to help the conceptual understanding of division in Years 3 and 4 and then adding and subtracting decimals (where each bead represents 0.01) in Years 5 and 6?

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