Primary
& Early Years
Magazine 71

National Centre
for Excellence in the
Teaching of Mathematics

Welcome to another issue of our new-look and more compact Primary Magazine. This magazine has been serving primary practitioners for 70 issues with a varied collection of different articles related to maths education and mathematics professional development, which are accessible through the Primary Magazine Archive.

Contents

In each issue we have a selection of interesting and useful articles. New National Curriculum in Focus is dedicated to unpicking the new curriculum and how to understand and develop the requirements of the new programmes of study. This issue focuses on *fluency, reasoning and problem solving in Measurement in KS2*.

Where's the Maths in That? shares ideas for ensuring that mathematics is taught and experienced across the curriculum. In the coming months, this series of articles that will explore opportunities for mathematics and mathematical thinking within the new science programme of study. This month the theme is *Sound for Y4*.

Finally, Maths in the Staff Room provides simple plans for CPD meetings in your school to be led by a member of staff. These are short meetings that can be used exactly as indicated or adapted to meet the CPD needs of the school. In this issue we explore the importance of counting.

But first, we have a News section, bringing news from the NCETM and beyond to keep you up to date with the fast-changing world of mathematics education.

News

Reports on textbooks and teaching

- The NCETM has published new guidance on what it considers the essential components of high quality mathematics textbooks. The principal intention is to help authors and publishers in the design of textbooks, in particular to support teaching in line with the new National Curriculum and new GCSE qualifications. But the guidance will also be of use to primary and secondary schools when making decisions about the choice of textbooks for use by teachers and pupils.

  The guidance coincides with, but is not directly linked to, a trial of two textbooks, and associated teacher professional development, about to start in 68 primary schools, as part of the Maths Hubs programme.

- You might also be interested in a separate report by Tim Oates on the use of textbooks, Why Textbooks Count, which was published late last year. Tim Oates explores the varied quality of textbooks across a number of jurisdictions and considers why the quality of textbooks have 'fallen behind the times' in England; maths textbooks feature prominently in this report.

- The report, Exploring Effective Pedagogy in Primary Schools, written by Professor Iram Siraj and Dr. Brenda Taggart of London's Institute of Education (IoE), uses data from the EPPSE (Effective Pre-school, Primary, and Secondary Education) study, which monitored the academic attainment and socio-behavioural development of more than 3 000 children from the age of 3 to 16 in England, to identify the characteristics of "excellent," "good," and "poor" school teachers. The report identifies characteristics of 11 different indicators, including making links between learning, dialogic teaching (the use of open questions to develop deeper level learning) and the fostering of collaborative learning. Although the report is not subject specific, it will be worth considering the implications of these findings in the specific context of mathematics.

- The Sutton Trust has also published a report, What makes great teaching? This report was written to set the scene for a summit held over two days in early November 2014 in Washington, DC. The summit brought together 80 school leaders and teachers from a range of countries, including Australia, Canada, Finland, Holland, Hong Kong, Singapore, the UK and the US, to consider the latest research evidence on professional learning and share their practical tools and strategies for using observation and feedback, with the aim of creating a practical guide to support the effective professional learning of teachers.

  The findings resonate with the IoE report, but also make reference to the importance of a teacher's deep knowledge of the subjects they teach and how this impacts on pupil achievement. This observation is particularly pertinent for mathematics.

Maths Hubs

Two new Maths Hubs have been established: the Kent and Medway Maths Hub is led by The Sir Joseph Williamson's Mathematical School in Rochester, and the East Midlands South Maths Hub is led by Beauchamp College in Oadby, Leicestershire. They bring the total of hubs currently in the programme to 34.

Two videos have been published showing how the first wave of Shanghai teachers got on in English primary schools, and how their English counterparts found the experience. The second wave of teachers from Shanghai arrives at the end of February, to teach in 20 different schools.

London Mathematical Society CPD Grants

Did you know that the London Mathematics Society (LMS) provides opportunities for schools/ teachers to bid for grants of up to £400 to support teachers with maths-specific CPD? There are certain conditions that need to be met and application deadlines for grants are 31 August, 30 November, 31 January and 30 April each year. These grants are available for all teachers.

NCETM National Curriculum support

Have you explored our National Curriculum Planning Tool yet? This interactive tool will support you in the following ways: your subject knowledge; making connections within and across the primary curriculum; suggest helpful papers, pupil activities, exemplification of expectations, and links to the suite of NCETM videos. There are also sections on the Bar Model, Teaching Fractions, Progression in Reasoning, and Developing a Scheme of Work - all accessible via buttons on the main National Curriculum information page.

Mathematics CPD

Don't forget that if you are looking for high quality providers of maths CPD in the next academic year, use our Professional Development Directory to find CPD Standard Holders (gold rosette) or Accredited Professional Development Leads (purple rosette).

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New National Curriculum in Focus

New National Curriculum in Focus is dedicated to unpicking the new curriculum and how to understand and develop the requirements of the new programmes of study for mathematics

Fluency, Reasoning and Problem Solving in Measurement in KS2

While there is a great emphasis on arithmetic in the new curriculum, the remaining programmes of study still retain an important feature of a broad and balanced curriculum. In this section we will explore some suggestions for activities in the new National Curriculum for KS2 in Measurement; suggest how to refresh subject knowledge for this area of the curriculum, and provide some suggested activities.

The new programme of study requires the following for Y3, 4, 5 and 6:

Y3

Pupils should be taught to:

- measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml)
- measure the perimeter of simple 2-D shapes
- add and subtract amounts of money to give change, using both £ and p in practical contexts
- tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks
- estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes and hours; use vocabulary such as o'clock, a.m./p.m., morning, afternoon, noon and midnight
- compare durations of events [for example to calculate the time taken by particular events or tasks].

Y4

Pupils should be taught to:

- convert between different units of measure [for example, kilometre to metre; hour to minute]
- measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres
- find the area of rectilinear shapes by counting squares
- estimate, compare and calculate different measures, including money in pounds and pence
- read, write and convert time between analogue and digital 12- and 24-hour clocks
- solve problems involving converting from hours to minutes; minutes to seconds; years to months; weeks to days.

Y5

Pupils should be taught to:

- convert between different units of metric measure (for example, kilometre and metre; centimetre

and metre; centimetre and millimetre; gram and kilogram; litre and millilitre)
- understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints
- measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres
- calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes
- estimate volume [for example, using 1 cm3 blocks to build cuboids (including cubes)] and capacity [for example, using water]
- solve problems involving converting between units of time
- use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling.

Y6

Pupils should be taught to:

- solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate
- use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places
- convert between miles and kilometres
- recognise that shapes with the same areas can have different perimeters and vice versa
- recognise when it is possible to use formulae for area and volume of shapes
- calculate the area of parallelograms and triangles
- calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [for example, mm^3 and km^3].

Subject Knowledge

Firstly KS2 teachers must be confident in their own subject knowledge; not just for KS2 but also for KS1 and KS3 in order to understand how the subject progresses and to ensure that the foundations that are laid in KS1 enable a seamless journey through the measurement curriculum to avoid building misconceptions early that may cause difficulties later. The Self-evaluation Tools for measurement in KS1, KS2 and KS3 are useful ways to monitor and develop teacher subject knowledge.

Throughout the KS2 programme of study there is an increasing emphasis on conversions between standard units in the varying contexts of measurement. Understanding why and how to convert from one unit to another depends on pupils' grasp of multiplicative relationships. i.e. understanding that numbers are related through multiplication. This concept should be developed through children's deeper understanding of the decimal place value system (and other non-decimal scaling such as in the context of time or Imperial measures). Understanding the 'why and how' of conversions also relies on pupils' conceptual understanding of equivalence, for example that finding a conversion between units is finding another way to represent the same quantity.

The challenge with measures is also that it becomes more challenging to visualise or experience measurements of extremely large or small quantities. For example, pupils are likely to be able visualise a litre of liquid (through their experience of buying / using drinks bottles/ cartons) but unlikely to visualise

size of a swimming pool that contains 2.5 million litres. Similarly it would be impossible to determine whether an ant or a grain of sand were heavier by direct comparison.

Our measurement system is established from the SI (Système Internationale) system, which is an internationally agreed system to ensure that measurements remain accurate and commonly accepted. All measures are ratios of other measures but some ratios are interesting and maybe not commonly known. For instance $1cm^3 = 1ml = 1g$ (based on pure water at 4°C). This document provides further information about all SI units, prefixes and abbreviations.

You may also find it useful to read the Subject Knowledge section of Measurement in KS1 in Issue 70 of the Primary Magazine.

This area on Nuffield's Key Ideas in Mathematics Education (9-19) on Measurement and Decimals is also a useful area to deepen teacher subject knowledge.

Activities for Fluency, Reasoning, and Problem Solving in Measurement in KS2

In order for pupils to be fluent with using measurement they will need to become increasingly familiar with and confident in using accurate vocabulary. Below is a list of suggested key vocabulary to introduce across Y3/ Y4 and Y5/Y6 in addition to the vocabulary already in use in Y1/2 (see Issue 70).

Y3/4

Length: *millimetre (mm), kilometre (km), distance, breadth*

Area and perimeter: *perimeter, area, space, covers, edge*

Money: *value, more expensive, cheaper, decimal point*

Time: *calendar, duration, Roman Numerals (X, I, V), am, pm, 24-hour, 12-hour, noon, dial, analogue, leap year, date of birth, decade*

Other general vocabulary: *approximately, scale, mixed units, convert.*

Y5/6

Length: *mile*

Capacity (and volume): *1 cm^3, cubic metres, m^3, km^3, mm^3*

Area and perimeter: *composite shapes, scale drawing*

Money: *value, more expensive, cheaper, decimal point, sale, discount, reduction*

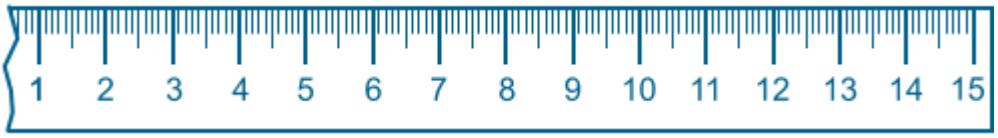
Other general vocabulary: *metric, imperial.*

Using the above words, you could play a *'Just a minute'* type game so that the children become familiar with the vocabulary related to measurement. Write a selection of words on pieces of card. Children play in pairs or small teams of two or three. Take turns to describe the word without saying it and the other then have to work out as many of the words on the cards within a fixed time.

The activities below relate directly to the statutory requirements of the mathematics programme of study for measurement in Y3-Y6. The measurement of angle is also a feature of the Geometry programme of study. The use of measurement lends itself to cross-curricular opportunities particularly in science (further ideas can be found in the 'Where's the Maths in That?' features in the Primary Magazine Archive (Issues 64 to date)) where other forms of measuring may occur i.e. measuring temperature, light and sound. You may also be able to include measurement into a history theme. See this article from Issue 10 on the history of length, which incorporates ideas for Ancient Egypt and the Indus Valley; Issue 11 on the history of weight; Issue 12 on the history of volume and capacity, and Issue 13 on the history of time.

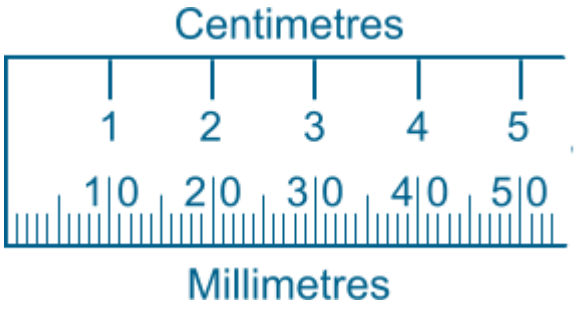
Length

Ensure that pupils have plenty of opportunities to measure lengths using appropriate range of tools/ equipment. Using this equipment requires pupils to know that any measuring of length begins with 0, i.e. the origin. Ask pupils to compare the two images below:



Ask the pupils to say what's the same, what's different. Ask pupils to consider how they would find the length of something (i.e. a pencil) using the first ruler, then the second ruler. What happens to the length of the pencil? Provide a similar conflicting image of a ruler/ length measurer that is shorter than the object (a wall) that needs to be measured. Ask children to discuss how this might still be used to find the length of the wall.

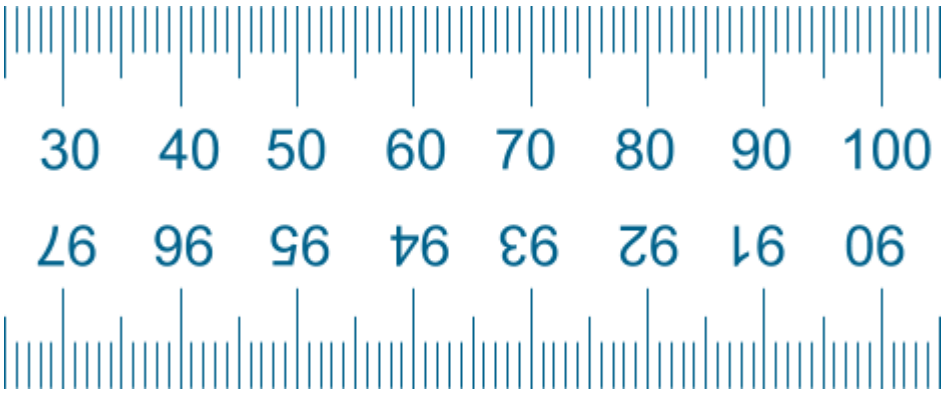
Use the image below to stimulate a discussion. Ask the pupils…What do you notice? (encourage as many observations as possible). You could encourage pupils to work collaboratively to come up with an observation that no-one else in the class has identified. (i.e. Classroom *Pointless*). Can anyone suggest what is missing from the ruler? What will the next numbers be? Can pupils explain the relationship between the numbers on the top in centimetres and along the bottom in millimetres? (e.g. for every 1 cm there are 10 millimetres). Are there other ways of expressing any relationships? Encourage pupils to extrapolate the generalisation to work out the numbers that represent 1 metre (m) or fractions of centimetres e.g. 4 ½ centimetres.



Use this Smile workcard (1768) to stimulate discussion about which line is the longest, explaining their reasoning. Ask children to use similar paper to make different lines of equal length.

This Smile workcard (0896) encourages pupils to explore how to measure very thin objects/ materials e.g. a 1p piece, by stacking 1p pieces up to measurable height and then divide by the number of 1p pieces that were used to find the thickness of a 1p.

Some rulers have different units of measures on either side where the zeros are at opposite ends. Look at an example of this type of ruler. Ask the children to reason about how long this one is.



Using scales on a street map is a great way of measuring using centimetres and scaling up for actual distances of familiar routes that children may use. Making scale maps from measurements taken in a familiar setting will also enable pupils to scale down measurements taken. E.g. a classroom furniture plan or designing the summer fayre indoors in case it rains.

Mass

Use balance pan scales to explore equivalences of 1kg using smaller masses to deepen pupils understanding of equivalences before moving on to conversions between kgs and grams and dial scales.

Using digital weighing scales that convert between different units of measure is a helpful way of introducing conversions between grams and kilograms. Use a visualiser or provide two images of an

identical item weighed on electronic scales using grams or kilograms as the unit of measure. Ask the children to say what they notice. Draw attention to observations that are the same and those that are different when comparing both scales. Repeat with different objects, logging the weights in grams and kilograms until children are able to begin to make generalisations about the patterns they are seeing with the weights given in grams and kilograms and are able to articulate that there are 1000g for every 1 kg. They should then be able to apply the generalisation to practicing increasingly complex examples.

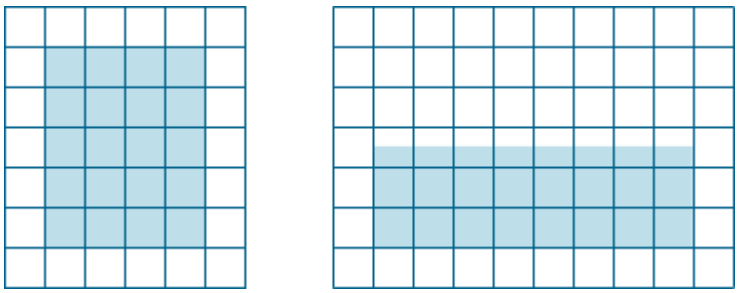
Play a 'Guess Who?' type game: provide pairs of pupils with six weights in kg and g and a base board with the same measures on. Pupils will also need counters. Each pupil identifies one weight on their base board and writes it down on a blank card so their partner can see it. They then take it in turns to ask questions to identify the weight written on their partner's card. The winner is the first person to identify that weight.

Area and perimeter

Area and perimeter are often confused by children when they are learning about these definitions. This can happen when children are introduced to a procedural way of finding out the area or perimeter of a 2D shape. To grasp how area is linked to multiplication, children should be exposed to plenty of opportunities for covering rectilinear shapes (experiencing transformations) with non-standard and then standard units, including 1cm x 1cm squares (Cuisenaire blocks are 1cm x 1cm x 1cm) before moving to drawn shapes on squared paper. Pupils will then be able to form connections to enable them to see areas of rectangles as related to the array representation for multiplication.

Measuring of any kind relies on a secure understanding of ordinal number. Where the measurement begins with the origin, 0. Limiting area and perimeter to a counting exercise may lead to conceptual understanding of these ideas being lost.

Help pupils to develop an understanding of the conservation of area (see Issue 70) through partial transformations. For example, by looking at these two examples, what do they see? What is the same/ different about these shapes?



Attention can be drawn to both area and perimeter. Some pupils will be able to articulate that the second image is simply the top image bisected and placed to the right of the remaining half. Pupils can then explore other dissections of the shape to discover how parts of squares can be recombined to make a whole square.

Provide opportunities for pupils to compare areas and perimeters of shapes by identifying shortest perimeter but with largest possible area or vice versa.

Volume/Capacity

Children will have begun to build their understanding of measuring capacity in KS1. Capacity is the measurement of the amount of liquid that a container can hold and is measured in millilitres or litres. Volume is different and represents the amount of space that an object takes up and is measured in cm^3 and m^3.

Multilink cubes can be a useful way of exploring different shapes of equal volume. Using eight interconnecting cubes, how many different solid shapes can be made? Each shape will be a volume of eight cubes. Ensure that pupils explore whether they have all unique shapes. This activity leads on to further work on finding volumes of shapes. Pupils should use $1cm^3$ cubes to build shapes that occupy space and then apply this to the space taken by simple rectilinear shapes. Children should be encouraged

to identify how the shape occupied by $1cm^3$ cubes might be dissected/ partitioned in order to calculate the volume more efficiently, leading to knowledge of the formulae for the volume of a cuboid. Encourage pupils to use such generalisations to calculate compound rectilinear shapes or to design their own of a given volume.

Use an image such as this to stimulate discussion:

Ask pupils to comment on what they notice. Ask the children to conjecture what would happen if the jug got taller – what measurements could be labelled? What if the jug got wider? What would happen to the measurements? Ask pupils to generalise about the relationship between litres and millilitres. They should be able to articulate that there are 1000 millilitres for every 1 litre. Use the ratio scale on the measuring jug as a tool for reading scales in ml and l, encourage pupils to articulate their reasoning for the equivalent answers they have found.

Use this interactive traditional three-bucket problem for pupils to solve a problem involving capacity. Challenge pupils to solve this in the fewest number of moves.

Money

Pupils should be comfortable with the concept of paying and receiving change from coins by the time they reach KS2. Activities such as this one from BEAM will encourage pupils to solve problems whilst retaining constraints to what can be used. Activities such as these will develop pupils' problem solving skills and improve their fluency in calculating with money.

This suite of resources from pfeg has lots of imaginative suggestions for developing financial capability of KS2 pupils with applications for understanding money.

Time

There is a great emphasis on the theme of time in Y3, along with the introduction of Roman Numerals. Roman numerals are a great way of demonstrating the efficiency of the base 10 number system. This interactive resource will provide an opportunity to practise making numbers from Roman Numerals with occasional challenges to make the highest possible number from the Roman Numerals available on screen.

Reading an analogue clock involves interpreting two scales on the same device. This is a complex activity. In reality the minute hand is not essential unless one needs an accurate time in order to, for example, catch a train. Provide clocks without minute hands showing so that children can interpret the approximate time based on where the hour hand is pointing. Geared clocks are an essential resource in order for pupils to understand that the hour hand moves in a constant ratio with the minute hand.

Further links:

- NCETM National Curriculum Y3 Measurement
- NCETM National Curriculum Y4 Measurement

- NCETM National Curriculum Y5 Measurement
- NCETM National Curriculum Y6 Measurement
- National STEM Centre eLibrary Y3 & 4 Measurement
- National STEM Centre eLibrary Y5 & 6 Measurement
- SMILE Measurement
- BEAM Money and Measures Lower KS2
- BEAM Money and Measures Upper KS2
- NRICH Estimating, Comparing Measures KS2
- NRICH Time KS2
- pfeg.

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Primary
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Where's the Maths in That? – Maths across the curriculum

*In this section of this Primary Magazine we explore how mathematics can be embedded into other subjects in the context of the new curriculum. The subject in this new series is **science** and over the next few months we will explore the different themes for the KS1 and KS2 science programmes of study and how maths can be embedded in and enhance understanding of scientific ideas.*

In this edition we look at the theme of **Sound** for Y4 and how a scheme of work for this might incorporate mathematical skills.

The statutory requirements for **Sound** in the Y4 programme of study are:

Pupils should be taught to:

- identify how sounds are made, associating some of them with something vibrating
- recognise that vibrations from sounds travel through a medium to the ear
- find patterns between the pitch of a sound and features of the object that produced it
- find patterns between the volume of a sound and the strength of the vibrations that produced it
- recognise that sounds get fainter as the distance from the sound source increases.

This theme will provide opportunities for plenty of mathematical work. Below are some ideas for incorporating maths into this science theme.

Ask the children to listen to a selection of different musical instruments (played individually). Ask the children to write down which instrument they hear each time, recording on different pieces of paper for each sound. Ask children to consider how these instruments might be sorted, i.e. by how they make their sound: blowing (wind), banging or shaking (percussion), and bowing or plucking (strings). Create a class or whole school survey about what instruments they are having lessons for by asking the question *Do we have enough musicians to make an orchestra?*

String instruments have strings of different length (and sometimes, thickness). Demonstrate how when tightening strings on a guitar that the sound changes. Ask the children to describe how the sound changes? Can anyone hypothesise why the sound changes? Ask a group of children to investigate the sounds of different lengths of wire or plastic strings. Measuring the length of the string between two fixed points. Observe the difference as the strings get longer or shorter. The pupils should be able to articulate a generalisation such as the longer the string the lower the sound. Ask the children to compare this generalisation with a xylophone. What do they notice?

Using identical glasses containing different levels of water will also illustrate another example of how pitch changes. Ask the children to fill each glass with a difference of 25ml (or other small amount) per glass in eight glasses. Ask them to play the different glasses by tapping them gently with a pencil. What do they notice?

Collect data using a data logger to measure the loudness of different parts of the school at the same time each day or the same location at different times of the day. Use the data to answer the questions of the form *Where is the noisiest part of the school? When is our classroom noisiest?* Transfer the data to a graphical representation. Discuss why different types of representation might be needed. i.e. using a bar chart to answer the first question but to use a line graph to answer the second. Use the line graph plotted with time against dB (decibels) to discuss what affected the line at certain times of the day.

Datalogging in the Environment and Sound Survey from the National STEM Centre eLibrary describe how a sequence of activities might develop.

Suggested Links:

National STEM Centre eLibrary – Y4 Sound.

Maths in the Staff Room – Short Professional Development Meetings

This section provides suggestions and resources for a professional development meeting for teachers that can be led by the maths subject leader or another person with responsibility for developing mathematics teaching and learning in the school

The Importance of Counting

Meeting Aims

- Understand the importance of counting in developing number sense

Timing

- 1.5 hours

Resources

- Every Child Counts video clip
- Subitising slide
- 1-10 Tens Frames
- Downloaded copies of these videos:
    - Lydia
    - Jaiman
    - Charlotte
    - Harjeev

1. Setting the scene: Experiencing what it means to learn to count (10 mins)

Share the aim of the professional development meeting. Emphasise that although counting may seem like an EYs/ KS1 theme that it is also relevant to all pupils in primary schools and in particularly to those who are struggling with number sense in KS2.

Explain that there is going to be a new number system and that the new number names for 1 to 9 are going to be i h g f e d c b a. Keep these new numbers up on a visible screen for a short while and ask the group to try and learn the new number sequence off by heart. Hide the new numbers and ask if anyone is able to recite the new names. Then ask them to say the new number names aloud together forwards and backwards, then one after the other going around a group. Ask the teachers to show with their fingers the new number j, a, b, h. Ask them to calculate "I added to h" insisting that they don't convert back to the 'old' number system. Calculate "c subtract g". Use this experience to discuss what it feels like to be insecure in a number system. Teachers will rely heavily on their fingers, using counting all strategies and counting at all stages. They will feel how it slows them down.

2. Understanding the complexity of counting (30 mins)

Ask the staff to discuss what skills someone needs in order to count reliably. When you have gathered some ideas watch this clip up to 8:47, which is taken from a BBC *Horizon* programme in 1985. Explain that although this is an old clip it is still relevant today. The clip talks about Gelman and Gallistel's (1978) five principles of counting:

1. One-One Principle – a unique number assigned to an object/ item being counted
2. Stable Order Principle – the order of the number names remains the same

3. Cardinal Principle – the final item counted gives the total number in the collection
4. Abstraction Principle – that the above principles apply in all contexts of counting
5. Order-Irrelevance Principle – that the total number counted will remain the same even if the order that the items changes.

After discussing the features of the clip which elicit the complexities of counting, recap on the above principles and compare to contributions made by the teachers before the clip was viewed.

Take time to reflect on the impact that the lack of one or more of these principles would have on the progression in mathematics.For example, pupils may not be able to find addition facts that have the answer 10 (understand that number is structured as relationships between part-part-whole) if they have not grasped the Order-Irrelevance principle. Or that pupils will be able to count on or back if they have not fully grasped the abstraction principle. i.e. by being able to count non-tangibles, for example, counting jumps or bangs on a drum.

3. Identifying counting strategies that pupils need to develop

Subitising (10 mins)

Use this slide (3) to introduce the idea of subitising by first telling the teachers that you are going to reveal some objects very briefly that they should write down how many they see. Repeat with the second slide (7). Ask what happened when the first slide was revealed (they are likely to say they just saw 'three'. For the second slide they are likely to have partitioned. In the first example the teachers used perceptual subitising (Clements, 1999) i.e.could see how many without needing to use another mathematical process. In the second example the teachers are most likely to have used conceptual subitising (Clements, 1999) i.e. in this case they are likely to have subitised two or more parts and then recombined. Explain that research has shown that this skill of conceptual subitising has a major influence on the development of number sense (see Sayers et al, 2014).

Reveal slide 3 which demonstrates how a 10s frame can be used to support conceptual subitising. What do teachers see? 4 and 3? 5 & 2? 3 missing? Hand out this set of 1-10 frames cut up into 10 separate frames and muddled. Ask the teachers to try and sort them in order from 1 to 10 using conceptual subitising.

Identifying Counting Strategies (30 mins)

Watch each of the following video clips and ask teachers to identify the counting skills and strategies that the pupils are using. Discuss how secure the pupils are in demonstrating their capability and what might be done next to move the children's strategies along.

- Lydia – is using counting all strategies and needs opportunities to use count on and develop her many-to-one correspondence counting skills. i.e. assigning a cardinal value to one object that represents many. (i.e. knowing that a 5p is the same as 5 1ps).
- Jaiman – is using counting a range of counting on strategies in certain contexts but not in all. Discuss the different counting strategies that are needed to solve each of the problems he is presented with.
- Charlotte – has a grasp of many-to-one correspondence but needs to develop her knowledge of recall of counting sequences for 2s.
- Harjeev – is working on multiplication but is still using a one-to-one approach rather than grouping to count the stars in the array.

Conclusion and Reflection

Reflect on children in your own class. Which children do you think may not yet have a fully developed a suite of counting principles and skills. What might you do to find out? What will you do to support that child in moving on? (10 mins)

Teachers may also wish to read this article and accompanying resources that has just been published in Primary Mathematics Spring 2015 Volume 19 Issue No 1 by The Mathematical Association about counting and subitising. This article has been kindly made available by The Mathematical Association which teachers can join. Primary (personal) membership of the Mathematical Association is £45.00 per year; Primary (institutional) membership of the Mathematical Association is £55.00 per year. All Primary members receive MA News, Mathematical Pie (including its Teachers Notes and Newsletter), conference information, details of new publications and other general information, in addition to three issues of *Primary Mathematics* per year.

- Find out more about the Mathematics Subject Associations.