



Welcome to another issue of our new-look and more compact Primary Magazine. This magazine has been serving primary practitioners for 71 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 Statistics in KS1.

[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 Plants for Y2.

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 representations for number.

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.

Image credit

Page header by [Pixel Addict](#) (adapted), [some rights reserved](#)



News



Maths Hubs

Year 1 teachers from 68 primary schools across England have recently begun a research project in which they will trial the use of one of two Singapore-style maths textbooks in their classrooms, and the associated areas of professional development. At the start of this term, all of the teachers attended two or three days' training in the use of the textbooks, given by the two publishers concerned: Oxford University Press and Maths No Problem. The research project, which will last the rest of the school year, is one of [three national collaborative projects](#) at the centre of the [Maths Hubs programme](#).



Ofsted School Inspection Handbook

The [most recent guidance](#) for Ofsted inspectors was published in January which provides non subject-specific advice about the quality of teaching and learning that will be looked for during an inspection. We will explore this in *Maths in the Staffroom* in an upcoming edition of the Primary Magazine along with the recent reports from Pearson and the Sutton Trust, mentioned in the news section of [Issue 71](#).



Conferences

It's conference season again. Have you booked yet for any of the subject associations' spring/ Easter conferences?

- NAMA Conference: [STEM: A Place for Mathematics?](#) (5 - 7 March, National STEM Centre, York)
- ATM Conference: [Thinking Mathematically](#) (30 March - 2 April, Staverton Park Conference Centre, Daventry)
- MA Conference: [Fluency and Understanding - A Mathematically Balanced World](#) (8 - 10 April, Keele University).

Also, on 9 and 10 March, a two-day conference, [Moving Forward: Mastering Mathematics](#) run by a not-for-profit collaboration of the Gateway Alliance (20 schools in Warwickshire) and The Elliot Foundation. The NCETM's Director for Primary, Debbie Morgan, will be speaking.



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).

Image credit

[Page header](#) by [NS Newsflash](#) (adapted), [some rights reserved](#)



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. You can find previous features in this series [here](#).

Fluency, Reasoning and Problem Solving in Statistics in KS1

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 KS1 in Statistics; 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 Y2 (there is no statutory specification for Y1):

Y2

Pupils should be taught to:

- interpret and construct simple pictograms, tally charts, block diagrams and simple tables
- ask and answer simple questions by counting the number of objects in each category and sorting the categories by quantity
- ask and answer questions about totalling and comparing categorical data

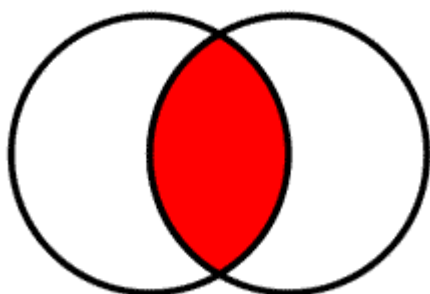
Subject Knowledge

The emphasis on the types of data that pupils in KS1 will collect and interpret is on categorical data. Data can be classified into two different types: categorical or numerical. Categorical data is data that can be sorted into groups and then the number in that group is counted. e.g. sorting people by hair colour, a packet of sweets by colour or flavour etc. Numerical data can be ordered and averages can be found for numerical data. E.g. heights of everyone in class, the time taken to run round the playground or the number of brothers and sisters each person has in a class.

Depending on the type of data – i.e. categorical or numerical - depends on how the data can be represented. Categorical data can be represented with Venn or Carroll diagrams, tally charts, pictograms, block diagrams, bar charts, pie-charts or frequency tables. Numerical data can be represented using histograms, scatter plots or line graphs.

Venn Diagram

A Venn Diagram sorts categorical data. This is presented using two or more rings to contain the classifications of some data within a defined space that represents the universal set (i.e. anything that cannot be included in the rings). The rings can also be over-lapped to include data that matches both classifications.



Carroll Diagram

A Carroll Diagram (named after the *Alice in Wonderland* writer, Lewis Carroll, who was also an accomplished mathematician) sorts data according to whether it does or does not meet certain criteria.

	Even	Not even
Multiple of three	6, 12, 18, 24, 30	3, 9, 15, 21, 27, 33
Not multiple of three	2, 4, 8, 10, 14, 16, 20, 22, 24, 26, 28, 32	1, 5, 7, 11, 13, 17, 19, 23, 25, 29, 31

Tally Charts

Tally Charts are used to collect data as it is being counted or created. i.e. when logging the number of cars, lorries, buses passing the school between 10.00am and 10.15am. The tallies are grouped in ones and fives to make it efficient to count once the data collection is complete.

Vehicle	Tally Marks	Number
Cars		10
Lorries		4
Buses	I	6

Pictograms

A pictogram is a chart with images to represent a particular number of categorical data. Suitable pictures, symbols or icons are used to represent objects. For large numbers one symbol may represent a number of objects and a part symbol then represents a rough proportion of the number. The pictures used can be presented in tabular, vertical or horizontal form.

wellies she needs to buy? This places a context around finding out the shoe sizes of the pupils in the class. Or we are going to have a class party: we don't want to waste food. How can we find out what sandwich fillings we need so that there is choice for everyone? It is very likely that there are more meaningful data collection activities to be created through other curriculum subjects. Our [Where's the Maths in That?](#) series in this magazine will help you find examples in science.

Data *collection* is but one part of mastering statistics. However, what is more important is understanding and applying how to represent data so that conclusions that can be drawn to find the answer to the original question.

When designing lessons around statistics, decide whether the focus of the lesson is going to be about collection, representation or interpretation.

Collecting Data

Having decided on a meaningful focus question for the whole class to find the answer to, ask the pupils to suggest ways that the data might be collected. Pupils could work in small groups and plan how to collect the information. Use the fact that young learners often find it difficult to organise the data they have collected to reflect on how they could better organise the information they have. Towards the end of the lesson, gather pupils together as a whole class and compare how groups have collected the data, drawing out the key teaching points associated with collecting categorical data: making (vertical) lists or recording numbers, tallies or using a table.

Representing Data

Pupils will need to have practice in representing data that they or others have collected. Building the representations of the data will enable pupils to gain a deep understanding of how to interpret the information once it is in a useful format. Pupils need to be taught about the features of different representations of data (see the *Subject Knowledge* section above). They will then need to consider which representations are most appropriate for different types of data. Provide pupils with an opportunity to compare representations of the same data. What's the same? What's different about the representations? This might be particularly helpful in moving learning on with pictograms when a picture is used to represent 1 or 2 or another amount. Keep the data the same but represent this differently.

Encourage reasoning: by presenting a collection of categorical data and ask children "how could you sort these items?" Providing images of multiple items such as a photo of a family of father, mother and three children and ask how many different ways could this family be sorted? Eye colour, hair colour, gender, glasses/ no glasses, clothes worn. When children have experienced this with smaller amounts of data, do the same as a group or whole class activity outdoors or in a large space. Missing out data on the different representations. What's missing? Where will this go in this representation?

The NRICH activity [Beanbags](#) involves arranging beanbags in intersecting hoops to match the given information:

Using two hoops as in the picture, place the eight bean bags into the hoops so that there are four in the blue hoop and four in the red hoop. How many will need to overlap?

Use this problem to start and then consider what the data the beanbags might represent. E.g. it could represent eight children: four wearing trousers and six wearing something blue. Collect other examples of different contexts using the same data. Re-word the original problem.

Retain eight beanbags and reorganise the bags. Describe how many beanbags are in each hoop and return to the questions generated previously. How will the numbers change in each problem?

Look for opportunities to include representations of data in other areas of maths. E.g. using a Carroll diagram to identify the properties of numbers up to 20 that are/are not multiples of 2 and are/are not multiples of 5:

	Multiples of 2	Not multiples of 2
Multiples of 5	10, 20	5, 15
Not multiples of 5	2, 4, 6, 8, 12, 14, 16, 18	1, 3, 7, 9, 11, 13, 17, 19

Organising the information this way will help children to identify patterns and generalise about the common multiples of 2 and 5.

Interpreting Data

When interpreting data, it is important to refer back to the original question or problem that needed to be solved. *Does the data we have collected and represented help us to answer our question?* Encourage pupils to make other interpretations of the data by comparing the different information in the representations. E.g. *What other questions might this data also give us answers to?* Draw out any generalisations that can be made from the representation of the data. e.g. in the above Carroll diagram ask *What do you notice about the numbers that are multiples of 2 and 5?* Invite pupils to respond in full sentences to express these generalisations. E.g. All multiples of 2 and 5 are also multiples of 10. When a generalisation has been made, use this to consider further data and where this might be included. E.g. *Can anyone suggest where the number 90 will go? Etc.*

Use representations of data to practise and develop fluent mental calculation skills either as part of a mental/ oral starter or at other times in a school day when mental calculations are practised.

Further links:

- National STEM Centre eLibrary: [Y2 Statistics](#)
- BEAM: [Data Handling for KS1 \(1\)](#)
- BEAM: [Data Handling for KS1 \(2\)](#)
- NRICH: [Statistics KS1](#).

Image Credits

[Page header](#) by [Nina Matthews](#) (adapted), [some rights reserved](#)
[Venn diagram](#) courtesy of Wikimedia Commons (adapted), in the public domain



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. You can find previous features in this series [here](#).

In this edition we look at the theme of **Plants** for Y2 and how a scheme of work for this might incorporate mathematical skills.

The statutory requirements for **Plants** in the Y2 programme of study are:

Pupils should be taught to:

- observe and describe how seeds and bulbs grow into mature plants
- find out and describe how plants need water, light and a suitable temperature to grow and stay healthy.

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

Sort a variety of seeds by looking at their sizes and characteristics. Pupils could lay out seeds in order of length – remember to use beans and bulbs to show that not all seeds are very tiny.

Use the seed packets to find out further information about the seeds and the plants they grow in to. Ask pupils to choose their own way to sort the seeds or the seed packets, based on the information they have interpreted – e.g. plant height, sowing month, flowering month, colour etc.

Counting tiny seeds is a good way to reinforce the need to use grouping so that it is less easy to lose count. The seeds might have been collected from a plant by the children. The children can then explore which flowers generate the most seeds. Ask the children to consider how they might find out how many seeds there are in different seed packets. Do you always get the same number of seeds in a seed packet?

Use the seed packets to work out and measure the distances between the seeds or the seedlings to be planted out. Ask children to explain why some seeds can be sown close together and others need to be sown far apart.

Reinforce the learning of the months of the year by creating a large class plant calendar to illustrate which plants flower outside in different months or which seeds to sow in each month? The children could draw or paint the flowers and add them to the display. [This website](#) identifies which seeds to plant in each month.

When seeds are planted in school, keep a growing diary so that pupils can record what they did to look after the seeds, amount of water given and any measurements of height taken. Pupils can also record the change in height from one period to the next to practise finding a difference. Pupils can take time-lapse pictures of their growing plant, print off the picture and write the date below to make a picture diary, or assemble the photos to make a time-lapse movie.

When investigating conditions for plant growth, ensure that measuring skills are practised by the children – amounts of compost, temperature of the room, amount of water used and height of the growing plant.

Suggested Links:

- National STEM Centre eLibrary: [Y2 Plants](#)

Image credits

[Page header](#) by [Steven Depolo](#) (adapted), [some rights reserved](#)



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. You can find previous features in this series [here](#).

The Importance of Counting

Meeting Aims

- Understand the importance of using visual and concrete representations to develop conceptual understanding of mathematical ideas

Timing

- 1.5 hours

Resources

- [The importance of using representations to help primary pupils give meaning to numerical concepts](#) Tony Harries, David Bolden, Patrick Barmby, Durham University (UK)
- [National Curriculum Programme of Study](#)
- 10s frames, Numicon (if available in the school), coins, straw bundles, Dienes (place, value), place value counters, Cuisenaire/ coloured rods staircase, number lines, 100 squares, dice, dominoes, etc

1. Setting the scene: Why should we use representations?

Prior to the staff meeting ask the teachers to read [this short article](#) by Harries et al, which explores some reasons for using representations, supported by research evidence.

Share the aim of the professional development meeting. Emphasise that there are many occurrences of *representing number* in the new [programmes of study](#). Ask colleagues to scan through the programme of study to identify where these occurrences are, including drawing attention to this statement from the Purpose of Study:

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. (p3)

Y1

- *identify and represent numbers using objects and pictorial representations including the number line*

Y2

- *identify, represent and estimate numbers using different representations, including the number line*

Y3

- *identify, represent and estimate numbers using different representations*

Y4

- *identify, represent and estimate numbers using different representations;*
- *read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value.*

Y5

- *read Roman numerals to 1000 (M) and recognise years written in Roman numerals*

Ask the teachers to draw or make visual and concrete representations for 5. How many different representations of 5 have been found?

e.g. 1 hand, coin, clock-face, 5 counters, 5 Numicon shape, 5 interconnected cubes, the numeral, dice arrangement of 5 etc.

Discuss which representations are currently used most in their classes.

2. Understanding the mathematical properties of different representations

This session draws from the work of John Mason (2005, cited in the Harries et al paper that was read prior to the meeting).

Mason suggests interrogating a representation in the following ways:

- gazing (looking at the whole)
- discerning details,
- recognising relationships,
- perceiving properties,
- reasoning on the basis of the properties

These might be seen as hierarchical because it is unlikely that pupils are unable to reason about a property of a representation unless they have had time to identify that property in the given representation through gazing/attending to the representation.

Allow teachers time to compare the range of representations that were identified, by considering the following set of questions.

What mathematical ideas do these representations help pupils to attend to? This might be any of the following:

- *cardinal or ordinal property of 5*
- *5's odd-ness*
- *part/part/whole relationships (i.e. parts that combine to make 5)*
- *place value (i.e. 5 tens in straw bundles/Dienes/place value counters).*

Then focus on these questions to interrogate the representations:

- *What is the same about the different representations?*
- *What is different about the representations?*
- *What are the particular characteristics of the various representations?*
- *How might we move from one representation to another?*
- *What are the most useful characteristics of a particular representation?*
- *When would you use certain representations/ when wouldn't you? Why?*

3. Conclusion and Reflection

Consider which representations will form the **core** representations across the school to ensure consistent exposure by pupils of these and when they should be used to ensure that the representations are meaningful in drawing out the properties you wish pupils to attend to.

Image credit

[Page header](#) by [Pin Sherbet Photography](#) (adapted), [some rights reserved](#)