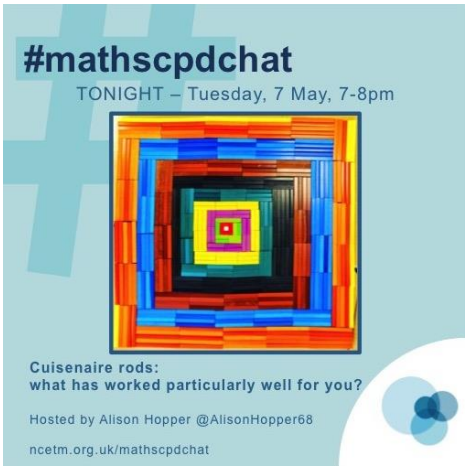
National Centre for Excellence in the Teaching of Mathematics

#mathscpdchat 7 May 2019

Cuisenaire rods: what has worked particularly well for you?

Hosted by Alison Hopper

This is a brief summary of the discussion – to see all the tweets, follow the hashtag ***#mathscpdchat*** *in Twitter*



Some of the areas where discussion focussed were:

- when pupils learn their first language they speak it before they write it … Cuisenaire rods enable pupils to do mathematics before speaking and writing about it … they **'start mathematical thinking off'**;
- teaching with Cuisenaire rods is making use of children's (people's) **natural inclination to play** … young learners bring the same playfulness to their experimentation with the rods as they have done with simple building blocks;
- how Georges Cuisenaire found that students who had been taught traditionally, and were rated 'weak', became 'very good' at traditional arithmetic **when they were allowed to manipulate the rods**;
- **any rod can represent any number** … the significance for Georges Cuisenaire of the 'colour families' … taking the white rod as representing 1 unit, the colour families

are … the ‘reds’ (2, 4, 8), the ‘blues’ (3, 6, 9), the ‘yellows’ (5, 10), black (7) and white (1) … whether difficulties with colour perception might compromise the use of the rods;

- **laying rods side-by-side or end-to-end comes easily to young learners** because they have experienced more play and experimentation with informal measure (eg stepping, reaching, building, arranging …) than with counting;
- pupils seeing **in a single arrangement of rods** how numbers are related by both addition and subtraction … an arrangement revealing naturally **three interchangeable ways of seeing a relationship** … for example, seeing (all-at-once) that red + green = yellow, yellow − red = green and yellow − green = red;
- the value of the ways in which by manipulating Cuisenaire rods learners see/focus-on number-relationships **using length comparisons without having to count component units** … for example, not having two lots of things to count makes grasping the concept of multiplication more manageable;
- by placing rods end-to-end and alongside each other **pupils see relationships very directly** … they can create their own equations, and check them themselves without need of verification from an ‘authority’;
- using Cuisenaire rods to see and practise **number-bonds** (eg number-bonds to 10);
- **representing multiples of numbers** by placing same-length rods one-below-the-other (rather than end-to-end);
- why Georges Cuisenaire’s suggested **arrangement of two rods to indicate a product of two numbers** is as it is;
- using Cuisenaire rods to see and understand **times-tables**;
- using Cuisenaire rods to explore, see and understand **remainders in short division**;
- using Cuisenaire rods to develop pupils’ conceptual understanding of **fractions**, particularly of **equivalent fractions** … the ‘whole’ can be defined in so many different ways;
- how using Cuisenaire rods to explore multiples can lead to finding **fractions-of-numbers** … eg using rods to find ¾ of 8;
- using a **‘hundreds mat’** … a 10-by-10 grid of squares marked on a square carpet … placing/making a different arrangement of Cuisenaire rods in each square;
- how fitting (with no gaps) Cuisenaire rods into square trays can help pupils see how **square numbers** can be built;
- making, in many different ways, **10-by-10 arrangements of Cuisenaire rods** … for example, arranging ten rods each representing 9 units one-below-the-other, placing

another rod-representing-9 along the side of the 'stack', then placing a single-unit-rod to complete the square … making and exploring 'borders' of square arrangements;

- using Cuisenaire rods to **explore area** … eg the 'Five Rectangles' problem from Gary Antonick's 'Numberplay' in the New York Times: create a set of five different rectangles that have side-lengths that are in the list 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 units … pupils investigate the areas covered by their rectangles;
- using Cuisenaire rods to **build concepts of measurement in 1, 2 and 3 dimensions** … using the rods to aid learning about **volumes and surface-areas of cuboids** … building Cuisenaire-rod-cuboids in order to find, given n, possible values of a,b and c if a×b×c = n … finding (and representing using rods) **factors and prime-factors** of n;
- finding that after using the rods KS3 pupils have fewer problems with **'collecting like terms' in algebraic expressions**;
- using Cuisenaire rods as an aid in **forming equations**, and in **expanding and factorising quadratic expressions**;
- using Cuisenaire rods to explore **triangle-numbers**;
- using Cuisenaire rods to explore number patterns found in **Pascal's Triangle**;
- finding and forming **Pythagorean triples** with Cuisenaire rods;
- arranging Cuisenaire rods to create an **informal proof that the sum of two consecutive triangle-numbers is a square number**;
- using Cuisenaire rods to **derive an expression (formula) for the sum of the first n consecutive natural numbers, $T_n = \frac{1}{2}n(n + 1)$**;
- Georges Cuisenaire's 'cardboard materials';
- that a **whole class needs a lot of Cuisenaire rods** … how to get the most out of a few sets used with a whole class … **online Cusenaire environments**!

In what follows, click on any screenshot-of-a-tweet to go to that actual tweet on Twitter.

An interesting 'conversation' of tweets, about some characteristics, of both Cuisenaire rods and (young) learners, that contribute to the power of the rods as effective learning aids, followed from this tweet by Alison Hopper:

including these from Simon Gregg:

Simon Gregg @Simon_Gregg · 18h

Replying to @AlisonHopper68

There's a number of things. The first thing is that it represents numbers without units. Students get to know them from the colour and length comparisons and relationships and have a direct handle on them as numbers, without having to count component units. #mathcpdchat

Simon Gregg @Simon_Gregg · 18h

So in @Coley44's tweet, we don't have to count within the nines, we just count how many nines there are. Not having two lots of things to count makes multiplication more manageable. #mathscpdchat

Simon Gregg @Simon_Gregg · 18h

Another thing is that because numbers are represented by lengths, instead of just sounds, we can place them alongside each other and see their relationships very directly. Students can create their own equations, check them themselves without need for verification. #mathscpdchat

these from Alison Hopper and Heather Scott:

Alison Hopper @AlisonHopper68 · 18h

This turns things on their head in terms of what we perhaps perceive that young children can understand about number. Just learning the names seems rather restrictive in this light **#mathscpdchat**

Heather Scott @MathsladyScott · 18h

#mathscpdchat maths learning is different to English learning - in English you speak and then you write -in Maths you can do maths and then later you can write/speak about it - The doing with Cuisenaire helps to start things off in a way that improves conceptual understanding 🤔

these from Simon Gregg and Gillian Mathewson:

Simon Gregg @Simon_Gregg · 18h

Length as opposed to counting is something children have so much experience with, be it stepping, reaching, building, arranging. They have done so much more play and experimenting with informal measure than with counting. Laying rods side-by-side comes easily. #mathscpdchat

Simon Gregg @Simon_Gregg · 17h

As a play-thing, they're similar to the blocks they've built with, and, if allowed, they will bring the same playfulness to their experimentation with them. #mathscpdchat

Simon Gregg @Simon_Gregg

We had 20 minutes playing with Cuisenaire rods and square trays.

Show this thread

Gillian Mathewson @gmathewson1 · 16h

Replying to @Simon_Gregg

Did you make the trays, or are they available to buy?

and these from Heather Scott and Simon Gregg

(to read the discussion-sequence generated by any tweet look at the 'replies' to that tweet)

Among the links shared were:

Cuisenaire - from Early Years to Adult, Book and Download which is an ATM (Association of Teachers of Mathematics) 'Number 1 Best Seller' written by Helen Williams, Mike Ollerton, and Simon Gregg. It illustrates how you can use Cuisenaire rods with your learners whatever their age may be. It was shared by Simon Gregg

Cuisenaire Environment which is a very useful interactive NRICH environment, in which users can manipulate (move, rotate, and arrange) any number of images of cuisenaire rods on a square grid. It was shared by Alison Hopper

The Cuisenaire Company: Cuisenaire Rods which is an illustrated part of the Cuisenaire Company's website containing historical and pedagogical information, including some suggested ways of using Cuisenaire rods. It was shared by Alison Hopper

Now Johnny Can Do Arithmetic which is a book by Caleb Gattegno, in which he examines obstacles that many pupils encounter in mathematics. He shows how working with coloured

rods can make arithmetic visible, tangible and rewarding for learners. It was shared by Laura Drexler

Focus on ... numbers in colour which is an article in the *NCETM Secondary Magazine 60, May 2010*. It is an illustrated description of all the Cuisenaire materials (the rods and the cardboard materials), with suggested ways of using them. It was shared by Mary Pardoe

Cuboids: a context for learning which is a blog (March 2019) by Gerry McNally in which he describes in detail (with beautiful illustrations) how his 12-year-old learners used Cuisenaire rods to explore, grasp and apply the concept of volume. It was shared by Gerry McNally

Five Rectangles which is a blog by Simon Gregg in which his Year 4 pupils look at a puzzle, taken from Gary Antonick's 'Numberplay' in the New York Times. They explore the puzzle using Cuisenaire rods. It was shared by Simon Gregg

Cuisenaire Book 1 – Familiarisation with Cuisenaire Rods which is the first of three books by Heather Scott that provide tasks using Cuisenaire rods. The tasks are designed to help pupils understand and use specific mathematical concepts. It was shared by Mary Pardoe

Number Rod Trays which are square trays into which Cuisenaire rods will fit exactly (as illustrated in tweets by Simon Gregg). The trays can be purchased in sets of trays of increasing size and various colours. It was shared by Simon Gregg