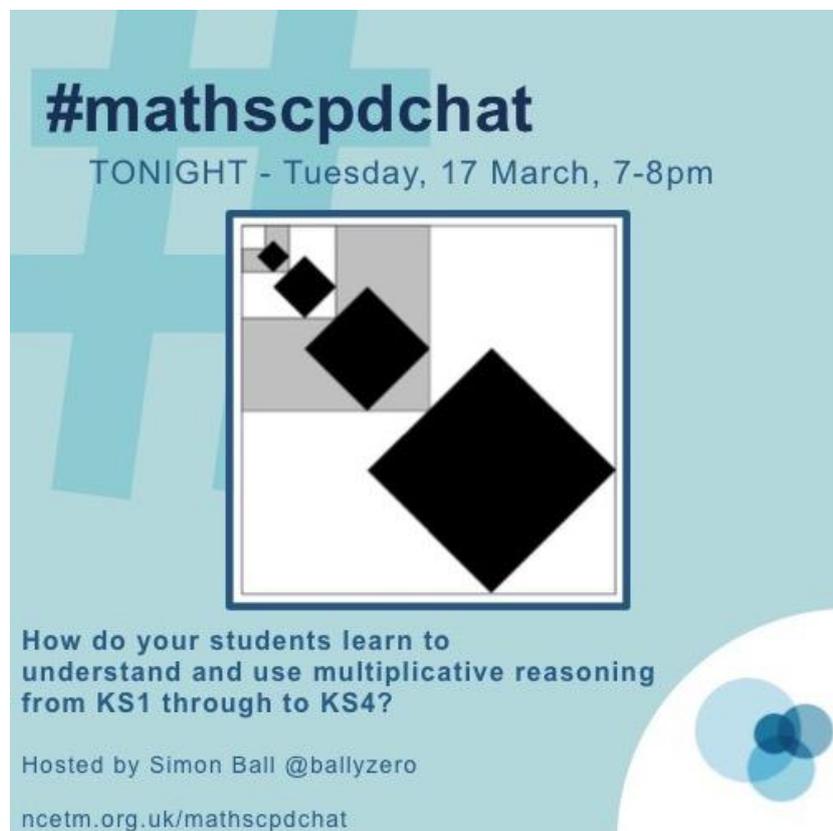


#mathscpdchat 17 March 2020

How do your students learn to understand and use multiplicative reasoning from KS1 through to KS4?

Hosted by [Simon Ball](#)

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



#mathscpdchat
TONIGHT - Tuesday, 17 March, 7-8pm



How do your students learn to understand and use multiplicative reasoning from KS1 through to KS4?

Hosted by Simon Ball @ballyzero
ncetm.org.uk/mathscpdchat

Some of the areas where discussion focussed were:

where and how multiplicative reasoning 'features' in the mathematics teaching of contributors to the chat:

- 'in primary school we **look at it each year**';

- as an aspect of teaching about **fractions, ratio, enlargement, scales, place value** ... that very young children, and adults in an Amazonian tribe, **naturally compare numbers in accord with their ratios** rather than their intervals, leading to scales representing those ratios, rather than linear scales (as shown on ordinary rulers, measuring-sticks etc.) ... that most people using a 'rule of thumb' to compare quantities naturally compare them multiplicatively (e.g. as '10 times greater') ... that the phrase 'rule of thumb' is derived from the use of the thumb as a unit of measurement;
- that **students working on A level maths** often 'default' to comparing numbers and quantities linearly (using addition/subtraction) when the numbers are clearly related multiplicatively ... how to combat this tendency? ... **in earlier Key Stages** using **scaling/stretching images** to represent multiplication ... **'banning' the use of all formula triangles** (science and maths teachers collaborating to achieve this) ... **using 2-by-2 'proportional rectangles'** to represent multiplicative relationships showing multipliers across rows and down columns;
- if A is related multiplicatively to X in the same way as B is related to Y using 'multiplicative matching' to find one unknown (for example, if 12 is 'matched' to 14, what is 30 'matched' to?) ... that pupils struggle to identify 'matching pairs' of side-lengths when similar triangles are 'stacked inside each other';
- that researchers found that in 2008/9 more than **80% of 14 year-olds were unable to solve simple problems that required them to reason multiplicatively;**

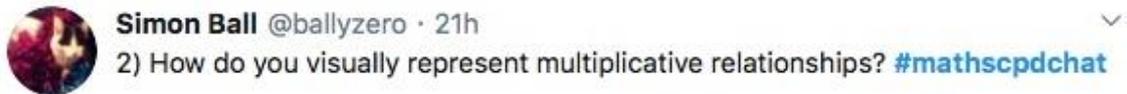
visual representations of multiplicative relationships:

- using **line graphs** in KS5;
- using **two parallel number lines** to help pupils understand and use ratios;
- using (in KS1/2) **rectangular arrays of 'objects'** to represent multiplication of positive integers ... that focussing on numbers of rows and columns in such rectangular arrays helps to establish the commutativity of multiplication ... that moving-on from using rectangular arrays of objects to using **areas of rectangles** enables the representation of products of numbers other than integers;
- inviting pupils to **draw their own diagrams to represent products such as '12 × 3'** ... that such challenges (combined with other challenges such as 'write a story to fit the expression') can reveal whether or not pupils are developing the understanding of multiplication on which ability to reason multiplicatively can later be built;
- that pupils who can **recall fluently times-tables facts** learn to reason multiplicatively with more ease than those pupils who can't;

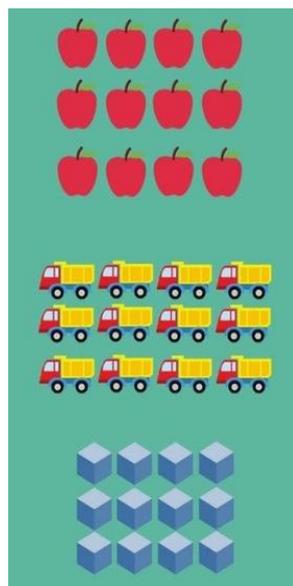
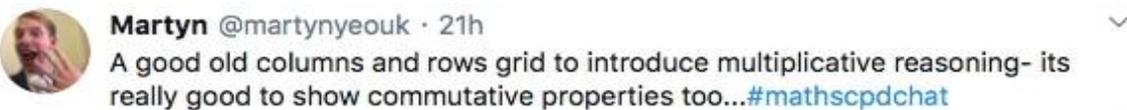
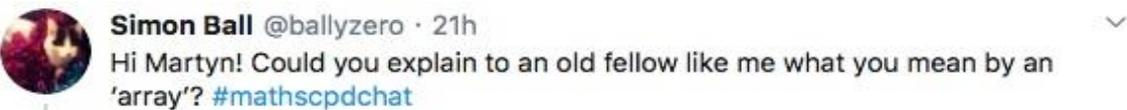
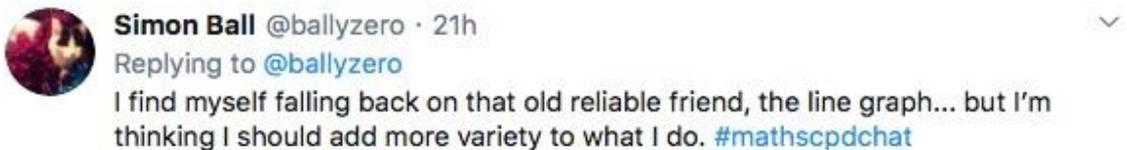
- that encouraging, and allowing plenty of time for, students to **reflect on their successful use of multiplicative reasoning** when 'dealing with' direct proportion helps them learn (work out by themselves?) how to cope with inverse proportion.

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

This is a part of a conversation about two ways to represent a product and one way to represent a multiplicative relationship. The conversation was generated by this tweet from [Simon Ball](#):



and included these from [Simon Ball](#), [Martyn Yeo](#) and [Mary Pardoe](#):

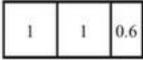
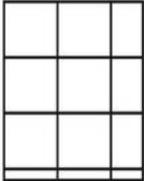




Mary Pardoe @PardoeMary · 21h
 Replying to @martynyeouk and @ballyzero

Yes ... and areas ... that can be extended beyond whole numbers!
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3.2 rows of 2.6 unit squares

This is a unit square: 	This is a row of 2 unit squares: 	This is a row of 2.6 unit squares: 	Here are 3.2 rows of 2.6 unit squares: 
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How many unit squares are there altogether in 3.2 rows of 2.6 unit squares?

Figure 9. The task involving 3.2×2.6 as 3.2 rows of 2.6 unit squares

these from [Martyn Yeo](#), [Professor Smudge](#), and [Billy](#):



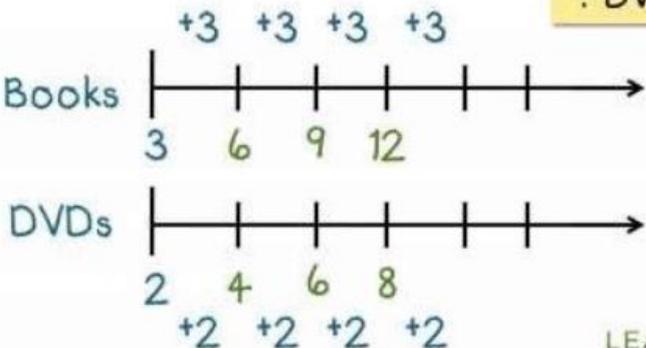
Martyn @martynyeouk · 21h
 Replying to @ballyzero

I was shown by @TrishaHenley how to use 2 parallel number lines to help pupils with ratio - it blew my mind!
 #mathscpdchat

Core Lesson

Books to DVDs
 3 to 2

15 books
 ? DVDS







Simon Ball @ballyzero · 21h
 Replying to @martynyeouk and @TrishaHenley

It's blowing my mind as we speak! What a simple but beautiful way to look at things - thank you for sharing that! #mathscpdchat



Professor Smudge @ProfSmudge · 17h
 Replying to @martynyeouk @ballyzero and @TrishaHenley

Include the 0s ?



Billy @billycubed · 17h
 And unitary ratios?



Professor Smudge @ProfSmudge · 8h
might not work in this context!



Billy @billycubed · 8h
2/3 : 1 and 1 : 3/2



Professor Smudge @ProfSmudge · 8h
I'm worried about cutting up the books or the dvds...

and these from [Lisa](#) and [Simon Ball](#):



Lisa @Elsie2110 · 21h
My wonderful colleague introduced me to parallel or double number lines for multiplicative relationships and they make so much sense! [#mathscpdchat](#)



Simon Ball @ballyzero · 21h
Replying to @Elsie2110
Agreed - that's going straight into my practice! [#mathscpdchat](#)

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

Among the links shared were:

[Slide Rule Sense: Amazonian Indigenous Culture Demonstrates Universal Mapping of Number onto Space](#) which is an article about spacing numbers on a scale according to their ratios rather than their additive differences. It was shared by [Sharon Malley](#)

[Learning Experiences Designed to Develop Multiplicative Reasoning](#) which is a useful document by Margaret Brown, Jeremy Hodgen and Dietmar Küchemann. It was shared by [Mary Pardoe](#)