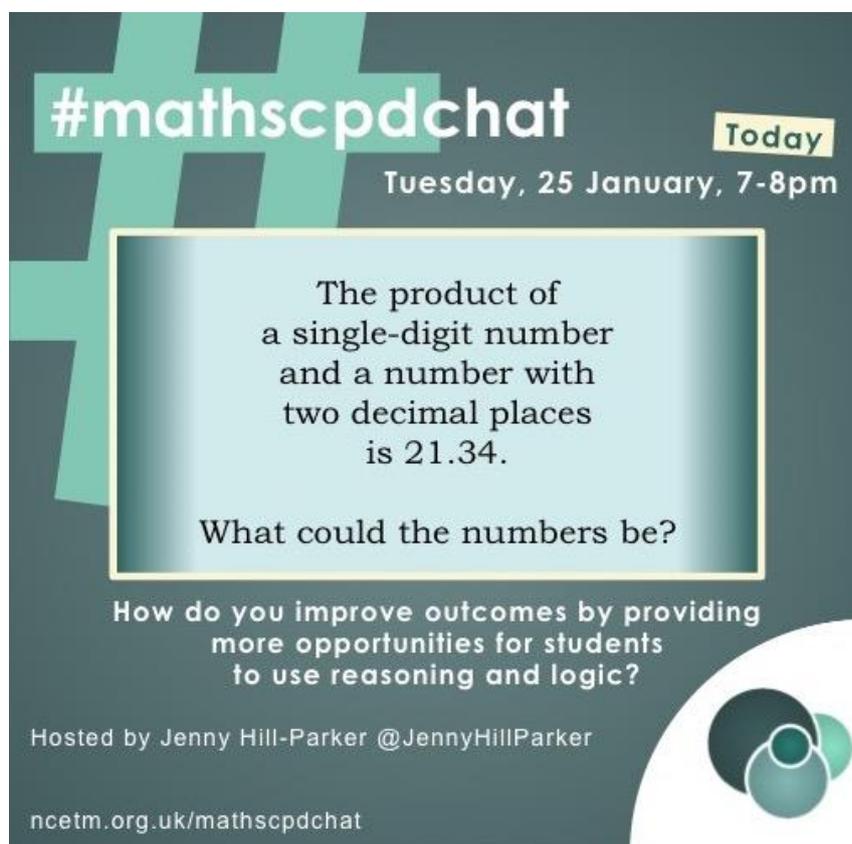# #mathscpdchat 25 January 2022

How do you improve outcomes by providing more opportunities for students to use reasoning and logic?

Hosted by Jenny Hill-Parker

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

The links shared during this discussion were:

NRICH which is a large website containing material created collaboratively by maths-education specialists from both the Mathematics and Education Faculties at the University of Cambridge. It focuses on problem solving and on creating opportunities for students to learn maths through exploration and discussion. It was shared by Jenny Hill-Parker

5 ways to share math with kids which is the video of a TED talk by Dan Finkel in which he conveys some useful messages about mathematics learning. For example, 'Mathematics is not mainly about

following rules, it's about playing – and exploring, fighting, looking for clues, and sometimes even breaking things!' It was shared by [Jenny Hill-Parker](#)

[Problem Solving](#) which is from [Craig Barton](#)'s website in which he provides links to a few sources of research that support his views (briefly described) about the teaching of 'problem solving' in mathematics. It was shared by [Jenny Hill-Parker](#)

[Goal Free Problems](#) which is a website that has been set up to allow teachers to access and share goal-free problems created by [Peter Mattock](#) and other teachers. It was shared by [Jenny Hill-Parker](#) and [Catherine Edwards](#)

[Goal free!](#) which a collection of goal-free problems on the Jaggers Maths website. Each 'goal-free problem' consists of some information, which may include an image or diagram. Students can be challenged to deduce new/more 'information' from that which is given. They may also make up/ask their own questions/problems that can be answered/solved using the information. It was shared by [Catherine Edwards](#)

[Bowland Maths](#) which are resources that aim to make maths engaging and relevant to pupils aged 11 to 14, with a focus on developing thinking, reasoning and problem-solving skills. It was shared by [Catherine Edwards](#)

[Mr Southern Maths](#) which are free A level Maths and Further Maths resources designed and presented by [Rob Southern](#) on his website. It was shared by [Rob Southern](#)

[Frayer-Model.co.uk](#) which is a website from which you can download fully-editable examples of Frayer Models. It was shared by [Alice Ward-Gow](#)

[Thinking Mathematically Every Day book series](#) which is a set of books from the ATM. This book series contains sperate books for each of Years 1 to 6, written to inspire teachers to embed reasoning, problem solving and conceptual fluency in to all their lessons. It was shared by [Tazreen Tershanah](#)

[Using Questioning to Stimulate Mathematical Thinking](#) which is an NRICH article by Jenni Way. The author explains, with many examples, what effective questioning in mathematics lessons looks like. The article looks at different types of questions that stimulate pupils' mathematical thinking and provide information about their strategies and knowledge. It was shared by [Tazreen Tershanah](#)

[I See Problem-Solving - UKS2](#) which is an eBook designed to help children learn how to solve multi-step maths questions. It was shared by [Tazreen Tershanah](#)

Badger Learning Problem Solving which are books intended to support learning in Key Stage 2. They contain 'useful advice, starter activities, and a host of creative ideas'. It was shared by Tazreen Tershanah

If you can't reach them you can't teach them which is a blog about the book of the same name by Kevin Hewitson, which offers teachers 'guidance for pedagogical self-improvement'. It was shared by Kevin Hewitson

Using Rich Tasks in an Objective Led Culture which is an NRICH article by the NRICH team. The article shows how a team of teachers, including Steve Wren, worked on a project initiated by NRICH in which they used NRICH tasks in a way that improved the quality and range of mathematical discussions in their classrooms. The article includes many examples of how these teachers worked in their lessons. It was shared by Steve Wren

Key Ideas in Teaching Mathematics which is a book by Anne Watson, Keith Jones and Dave Pratt. It contains research-based guidance for teachers of mathematics working with students aged from 9 to 19. There is an associated website which contains many links to useful tasks that provide opportunities for pupils to develop and improve mathematical reasoning abilities. It was shared by Mary Pardoe

ICCAMS Maths which is where you can find teaching material and detailed research reports related to ways of raising students' engagement with mathematics. It was shared by Mary Pardoe

Algebradabra which is a book from the ATM by Dietmar Küchemann. It is a collection of twenty sets of five related algebra tasks to help students develop a better feel for school algebra. The tasks provide excellent opportunities for students to build on their natural reasoning abilities and so learn to reason mathematically. It was shared by Mary Pardoe

Algeburble which is another book from the ATM by Dietmar Küchemann. The tasks also provide excellent opportunities for students to build on their natural reasoning abilities and so learn to reason mathematically. It was shared by Mary Pardoe

Noticing and Attention - with John Mason which is an ATM video in which John Mason looks into the role of noticing and attention in the mathematics classroom. It was shared by Mary Pardoe
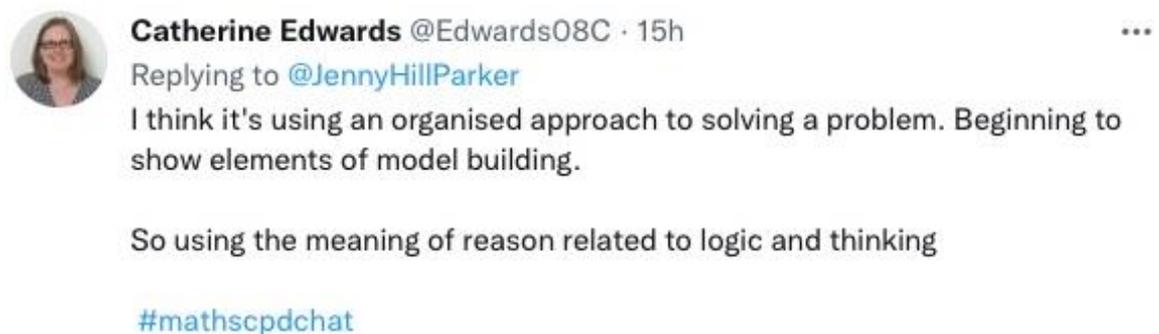
A full illustrated summary of the discussions in this #mathsCPDchat follows.

The screenshots below show conversations generated by questions from the host that probed into contributors' understandings of the nature of mathematical reasoning, and their views about ways of 'teaching problem-solving'. Thoughts expressed by teachers about the latter covered a range of beliefs, from the view that problem solving is best taught after students have acquired appropriate knowledge and techniques, to the belief that students become competent by trying to solve many problems while reflecting on and discussing their various methods. **Click on any of the following screenshots-of-a-tweet to go to that actual tweet on Twitter.**

The following first set of replies and conversations were generated by this question from Jenny Hill-Parker:

> **Jenny Hill-Parker** @JennyHillParker · 16h   ···
> Let's go!!
> First point to consider; what does Maths reasoning mean? #mathscpdchat

The challenge of trying to think of an answer this question suddenly at the end of a working day was accepted by Alice Ward-Gow, Catherine Edwards, Simon Ball and Anna Pandrich, and shown in these single replies:

> **Miss Ward-Gow** @mcwardgow · 15h   ···
> Replying to @JennyHillParker
> To explain or show why something is correct or incorrect? 🤔 #mathscpdchat

> **Catherine Edwards** @Edwards08C · 15h   ···
> Replying to @JennyHillParker
> I think it's using an organised approach to solving a problem. Beginning to show elements of model building.
>
> So using the meaning of reason related to logic and thinking
>
> #mathscpdchat

> **Simon Ball** @ballyzero · 15h   ···
> Replying to @JennyHillParker
> Oh, boy. I've not thought about this in depth before. I would say it's the ability to consider a problem and apply the correct mathematical techniques to it. #mathscpdchat

> **Anna Pandrich** @AnnaPannaTW · 15h   ···
> Replying to @JennyHillParker
> Selection of appropriate methods to meet the requirements of the problem?

There was a short discussion between Mary Pardoe and Jenny Hill-Parker:

Mary Pardoe @PardoeMary · Jan 25 · · ·

Replying to @JennyHillParker

In my opinion this book is a 'must read' in order to get a good idea ... for all teachers of maths to pupils aged 9 to 19!

nuffieldfoundation.org/students-teach...

#mathscpdchat

> nuffieldfoundation.org
> **Key Ideas in Teaching Mathematics | Resources | N...**
> These online resources accompany the book Key Ideas in Teaching Mathematics. Organised around ...

Jenny Hill-Parker @JennyHillParker · 15h · · ·

What makes it so valuable @PardoeMary? I'll have a read later!

#mathscpdchat

Mary Pardoe @PardoeMary · 16h · · ·

Replying to @PardoeMary and @JennyHillParker

Contents!

#mathscpdchat

CONTENTS   Research-based guidance for ages 9-19

Abbreviations

1 Introduction to key ideas in teaching mathematics

2 Relations between quantities and algebraic expressions

3 Ratio and proportional reasoning

4 Connecting measurement and decimals

5 Spatial and geometrical reasoning

6 Reasoning about data

7 Reasoning about uncertainty

8 Functional relations between variables

9 Moving to mathematics beyond age 16
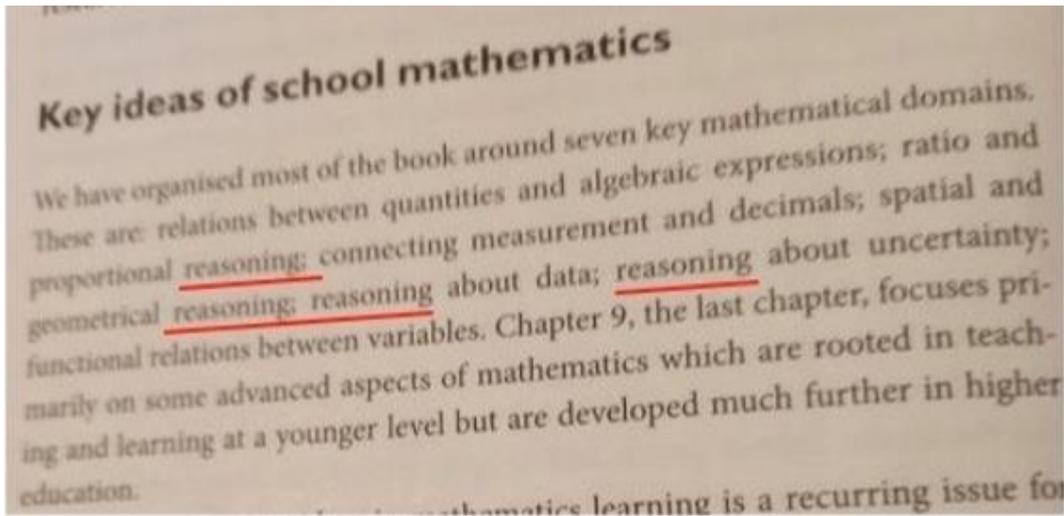
Jenny Hill-Parker @JennyHillParker · 16h   ···

Looks great @PardoeMary! Does the book delve into the prerequisites required in order to give the students a good framework for problem solving? #mathscpdchat
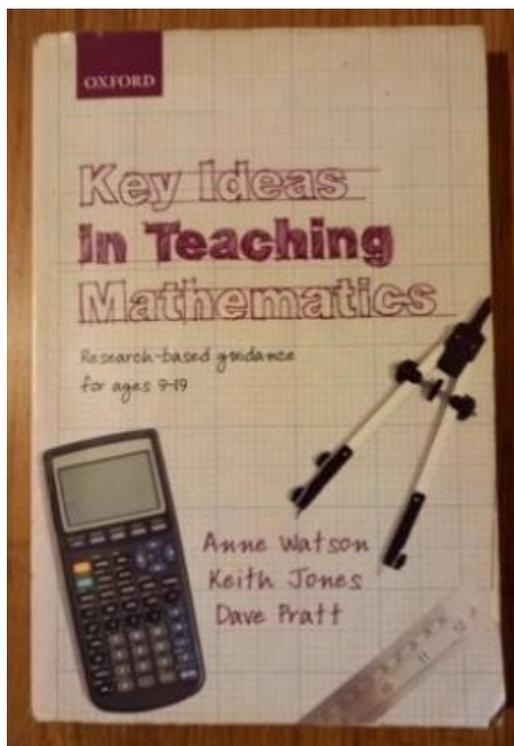
Mary Pardoe @PardoeMary · 16h   ···

Yes ...this is a para in the introduction ...
#mathscpdchat

Key ideas of school mathematics

We have organised most of the book around seven key mathematical domains. These are: relations between quantities and algebraic expressions; ratio and proportional reasoning; connecting measurement and decimals; spatial and geometrical reasoning; reasoning about data; reasoning about uncertainty; functional relations between variables. Chapter 9, the last chapter, focuses primarily on some advanced aspects of mathematics which are rooted in teaching and learning at a younger level but are developed much further in higher education.

... mathematics learning is a recurring issue for

Mary Pardoe @PardoeMary · 16h   ···

... of this book ...
global.oup.com/academic/produ..
#mathscpdchat

A new question from Jenny Hill-Parker prompted this discussion between the host and Mr Hawes:

Jenny Hill-Parker @JennyHillParker · 15h ···
Replying to @JennyHillParker
To what extent do you agree with this statement from the NCETM
#mathscpdchat

Jenny Hill-Parker @JennyHillParker · 15h ···
Developing maths reasoning skills at and before KS2 is crucial to succeeding in the new curriculum and its maths mastery approach to learning. #mathscpdchat

MrHawesMaths @HawesMaths · 16h ···
Replying to @JennyHillParker
Definition of mastery? #mathscpdchat

Jenny Hill-Parker @JennyHillParker · 16h ···
Replying to @HawesMaths
How would you define mastery @HawesMaths? #mathscpdchat

MrHawesMaths @HawesMaths · 16h ···
For me it's having a good understanding of the topic skills to the level that it can applied in context and across other topics too. #mathscpdchat

The next set of responses were generated by this question from Jenny Hill-Parker …

Jenny Hill-Parker @JennyHillParker · 19h ···
Unpopular but useful question. Ofsted often ask 'how do you teach problem solving?' As one of their Deep Dive questions. What's a great answer? #mathscpdchat

… which prompted two comments (from Jack Campbell and Kylie) that were responses to the 'Ofsted visit' aspect of the question:

Jack Campbell @NWMaths · 7h ···
Replying to @JennyHillParker
Am of the view that as long as a dept's approach is considered and appropriate to context and not completely ridiculous (ie includes fluency, planned opportunities for problem solving and reference to meta cog strategies) + has evidence of impact Ofsted will be ok with it.

Kylie @MsWeaverMaths · 18h

Replying to @JennyHillParker

I replied,we don't teach p.s. as in a p.solving unit/p.solving lessons. Explained that we do p.solving questions regularly but only once they have secure understanding of the topic/knowledge required and other such strategies to reduce the cognitive load. She was happy with that

Responses that did not mention Ofsted included an 'interchange' between Scott Alexander and Jenny Hill-Parker …

Scott Alexander @AnAngryScott · 6h

Replying to @JennyHillParker

Problem solving is a domain specific not domain general skill.

Jenny Hill-Parker @JennyHillParker · 5h

Can you explain further Scott, I'm interested!

… an 'interchange' between SIMMSPriMaths and Jenny Hill-Parker …

@SIMMSPriMaths @simmsprimaths · 5h

Replying to @JennyHillParker

We engage in different sorts of problem-solving throughout the curriculum and we explicitly model successful problem-solving strategies with all year groups alongside the development of the fluency and reasoning needed to access the problems.

Jenny Hill-Parker @JennyHillParker · 4h

Sounds great! What are your problem solving strategies?

… these individual comments from John Tomsett, Rajendra and Lee Overy …

John Tomsett @johntomsett · 7h

Replying to @JennyHillParker

In maths, ensure procedural fluency, then conceptual understanding, then, with some metacognitive tools, they can begin problems solving. Ask @ChrisMcGrane84

Rajendra @RajendraSathe · 4h

Replying to @JennyHillParker

😃 by posting on social media.
Sorry on a serious note personal view (I'm no expert) 1 biggest hurdle is patience. Build up patience, perseverance first step.
2. Solution is a series of small steps. Encourage to take first few to begin with.

Lee Overy @Lwdajo · 17h ···

Replying to @JennyHillParker

Late reply, but ask students to solve all mathematics problems in 2 or 3 ways. Keep the domains of problems singular until all domains within a problem are mastered. Just focus on one of Polya's problem solving techniques at a time. #mathscpdchat

… this brief conversation between Ben Arrowsmith and Jenny Hill-Parker …

Ben Arrowsmith @bjaerosmith · 6h ···

Replying to @JennyHillParker

Modelling and practice - within specific subjects.

Jenny Hill-Parker @JennyHillParker · 5h ···

Which specific subjects Ben?

Ben Arrowsmith @bjaerosmith · 5h ···

All that involve problem solving - I don't think 'problem solving' can be taught in general very well. You teach them to solve mathematical problems in maths lessons, chemistry problems in chemistry etc

… and this interchange between Alice Ward-Gow and Mindset Lab:

Miss Ward-Gow @mcwardgow · 18h ···

Replying to @JennyHillParker

Provide lots of opportunities for students to solve problems so that they can develop strategies for problem-solving #mathscpdchat

Mindset Lab @themindsetlabs · 1h ···

I agree. Ask questions - there is loads of evidence to show that answering questions is a great way to learn (Professor Dunlosky (2013)) but it also forces you to practise solving problems.

Even when you don't know the answer, simply have a go based on what you do know.

Neil Eley and Paul Martin both responded to this strategy suggested by Rob Southern:

Rob Southern @mrsouthernmaths · 18h ···

Replying to @JennyHillParker

Set questions/problems that can be approached in a number of different ways and discuss the merits of each strategy.

Which "method" is the most efficient?
Will this always be the case?
Give me an example of when this alternative approach would be better.

#mathscpdchat

Neil "not Santa" Eley @neileley · 6h
Exactly. - they need experience over entire school career. Early on - they might find difficult- then shown different approaches - they need chances to apply these approaches hopefully they can start to try their own methods - developing independent problem Solving skills.

paul martin @paulmartin42 · 5h
Replying to @mrsouthernmaths and @JennyHillParker
Never happened in my day as pupil at school, 4 or 5 decades ago. We just had textbooks and worked through examples, with the occasional cry of "the answer at the back of the book is wrong"

There was a conversation between Ted Lemerande and Ed Southall …

Ted Lemerande @TedLemme · 3h
Replying to @JennyHillParker
I post a @Cshearer41 or @edsouthall puzzle outside my door on Monday and require an attempt from every student by Friday. Even if they can't get to an answer, they must at least answer: What do I know, and what can I find easily? What rules do I know that might apply?

Ted Lemerande @TedLemme · 3h
Then, we discuss as a group, and lead them through how to finish out the different strategies proposed. Also, it's open to all students in the school. I give candy bars to any successful and able to explain their results at least semiformally.

Ed Southall @edsouthall · 3h
i used this strategy but for the maths department, to re-enthuse them about their subject 😂 fewer candy bars though to be fair

Ted Lemerande @TedLemme · 3h
Yeah, the candy bars are only for the students NOT in my class, and to earn them, they must show me enough written work that it could be a proof with a little editing and expository language. Other teachers send their kids by my room on Mondays to get a photo for their classes.

… and this comment from Kevin Hewitson:

Kevin Hewitson NPQH @4C3d · 1h
Replying to @JennyHillParker
I see learning as a problem solving activity and although this can be broken down to a series of steps it's about developing curiosity and confidence. We should therefore create a need and enable pupils to meet that need. More in ukedchat.com/2021/03/16/rea…

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

Jenny's second question …

Jenny Hill-Parker @JennyHillParker · 16h

Second question: Does logical reasoning in Maths require metacognition, and if so how can we engender this in terms of behaviour and attitude? #mathscpdchat

… required contributors to interpret the word 'metacognition'. These statements, the first from Vanderbilt University, and the second from the Education Endowment Foundation, may be helpful:

Metacognition is, put simply, **thinking about one's thinking**. More precisely, it refers to the processes used to plan, monitor, and assess one's understanding and performance. Metacognition includes a critical awareness of a) one's thinking and learning and b) oneself as a thinker and learner.

Metacognition and self-regulation approaches to teaching support pupils to think about their own learning more explicitly, often by teaching them specific strategies for planning, monitoring, and evaluating their learning.

Interventions are usually designed to give pupils a repertoire of strategies to choose from and the skills to select the most suitable strategy for a given learning task.

One of the replies to the question was 'general' …

Catherine Edwards @Edwards08C · 16h

Replying to @JennyHillParker

Yes , it requires accessing a schema, linking the problem Infront of them to previous problems and knowledge they possess. It also requires the use of paper as an external memory field (which I think is really key in maths) How to engender - exposure and modelling #mathscpdchat

… but the focus of discussion soon moved on to pupils' misinterpretations/bafflement that may be caused by the 'wording' of questions/problems …

IanNoakes @maths_noakes · 13h

Replying to @JennyHillParker

Interesting question! Yes, I'd say so. Students need to know what they already know about topics. But they can get caught up with the wording. For geometry questions, we cut out the actual final question and ask students to just work out what they can 1/2

Jenny Hill-Parker @JennyHillParker · 13h

Good strategy! So a goal free approach to starting the solution?

IanNoakes @maths_noakes · 13h

Replying to @maths_noakes and @JennyHillParker

We then show the question. Sometimes simplified wording. Often students have already found enough information to answer that question. We can then show the simplified question vs the actual question to help them gain understanding. More work to be done though 2/2

… and then the focus moved on more specifically to students' (lack of) understanding/knowledge of the mathematical meanings of words, with one of Catherine's tweets generating this conversation …

Catherine Edwards @Edwards08C · 16h

Replying to @JennyHillParker

Maths specific vocab helps when they are communicating their reasoning or discussing the problem. Accuracy in expressing themselves helps clarify thinking.

As we've said many times before, the non maths context language can be as if not not confusing than maths #mathscpdchat

Mary Pardoe @PardoeMary · 15h

Yes! Can definitely mislead! EG 'face', 'acute', 'factor', 'table', 'base', 'identity', 'focus', 'even', 'cardinal', …, …. …
#mathscpdchat

Tazreen Tershanah @tershanah · 15h

Pimm stated 3 types of vocab in maths
1. Maths specific
2. Maths and other contexts, same meaning
3. Maths and other contexts, different meaning.
  Maybe catergorising them would be helpful when introducing new vocab?
#mathscpdchat

Jenny Hill-Parker @JennyHillParker · 15h

I think doing that with the students would be very powerful!
#mathscpdchat

… and this conversation:

Catherine Edwards @Edwards08C · 16h

Replying to @JennyHillParker

Maths specific vocab helps when they are communicating their reasoning or discussing the problem. Accuracy in expressing themselves helps clarify thinking.

As we've said many times before, the non maths context language can be as if not not confusing than maths #mathscpdchat

Jenny Hill-Parker @JennyHillParker · 16h · · ·

Yes, I did some work on the different areas of vocabulary in Maths. Tier 2 words that need the domain specific definition vs other uses. Ie translate in Maths vs translate in French. #mathscpdchat

Jenny Hill-Parker @JennyHillParker · 16h · · ·

Imagine having a low reading age, or English as a second language and trying to comprehend that if it isn't specifically taught to you? #mathscpdchat

Catherine Edwards @Edwards08C · 15h · · ·

I think we tend to teach tier 2 and 3, it's more things like the infamous theatre GCSE question that talks about the circle. A lot of students just don't have the context for that #mathscpdchat

Jenny Hill-Parker @JennyHillParker · 15h · · ·

Ooh have you got a link? Sounds interesting! #mathscpdchat

Catherine Edwards @Edwards08C · 15h · · ·

This one #mathscpdchat

A theatre has the capacity to seat people across two levels, the Circle, and the stalls.

The ratio of the number of seats in the circle to a number of seats in the stalls is 2:5

Last Friday, the audience occupied all the 528 seats in the circle and 2/3 of the seats in the stalls

What is the percentage of occupancy of the theatre last Friday? Given 2 significant figures.

The host moved the discussion on to look specifically at the role played in sudents' ability to reason mathematically by their understanding (or lack of understanding) of mathematical vocabulary:

Jenny Hill-Parker @JennyHillParker · 16h · · ·

Third question: what are the links between reasoning and mathematical vocabulary, and what can we do practically to strengthen these links? #mathscpdchat

Jenny Hill-Parker @JennyHillParker · 16h

Replying to @JennyHillParker

And does declarative knowledge have a part to play in high quality maths reasoning? Ie should we get the students to learn a bank of knowledge to draw on as a sort of 'maths toolbox' #mathscpdchat

Jenny's second question above prompted these single replies:

Tazreen Tershanah @tershanah · 16h

Replying to @JennyHillParker

Declarative knowledge and the confidence to take up space is an important first step but should be followed by the expectation of empirical proof and examples (generalizations, non-examples, conjectures etc) provides real evidence of reasoning #mathscpdchat

Catherine Edwards @Edwards08C · 16h

Replying to @JennyHillParker

Having a range of knowledge to draw on definitely helps. Although sometimes it can lead students to always go to one particular method.

Thinking of myself here, I tend to lean on algebra, when it isn't always the "best" method.
#mathscpdchat

The two questions together generated this conversation, in which 'Frayer models' were exemplified:

Miss Ward-Gow @mcwardgow · 16h

Replying to @JennyHillParker

In order to be able to reason mathematically you have to be able to use the correct vocabulary. We can model good verbal/written use of vocabulary and challenge incorrect use 👍 #mathscpdchat

Jenny Hill-Parker @JennyHillParker · 16h

I love this. What strategies to you use to teach Mathematical vocabulary?
#mathscpdchat

Miss Ward-Gow @mcwardgow · 16h

We've used the Frayer model with KS3. And not doing anything other than modelling with KS4. Any suggestions? 🙂 we were doing some guided reading during tutor times but had to go back to other stuff for tutor.
#mathscpdchat

Catherine Edwards @Edwards08C · 16h · · ·
I use Frayer models throughout
If it ain't broke ....
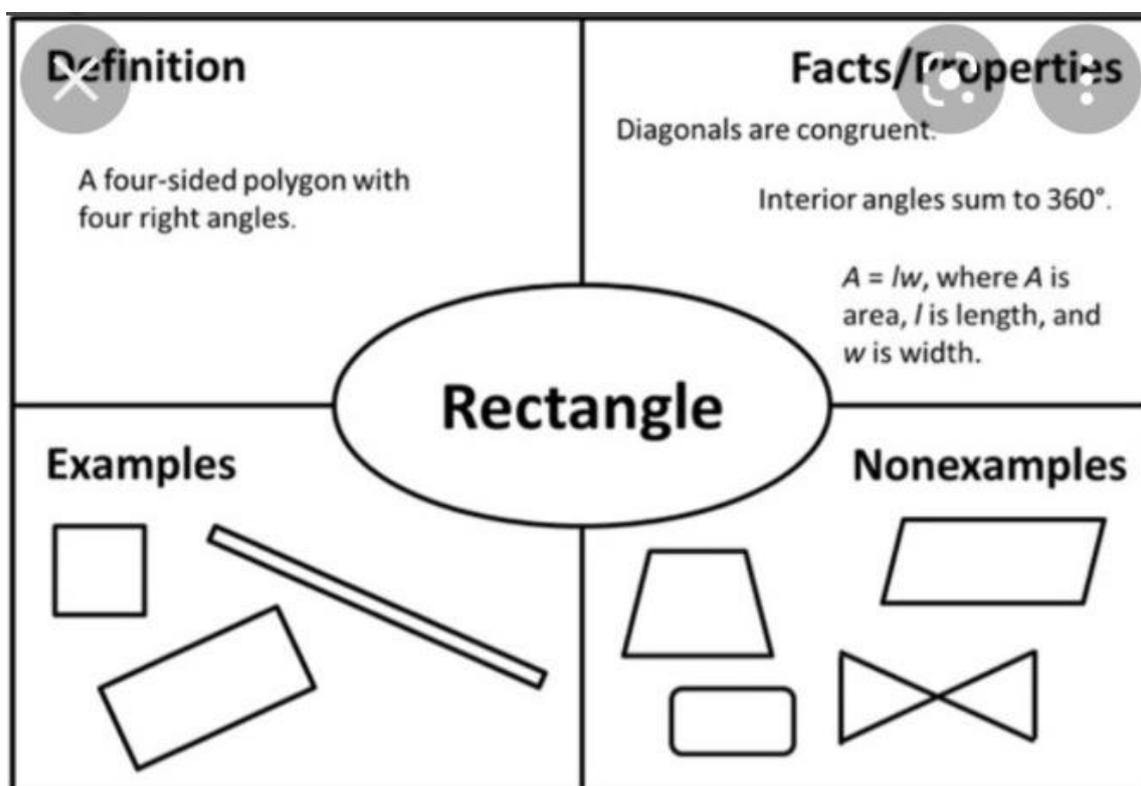#mathscpdchat

Tazreen Tershanah @tershanah · 16h · · ·
What's a Frayer model? Thank you. #mathscpdchat

There were three (illustrated) responses to Tazreen's question:

Catherine Edwards @Edwards08C · 18h · · ·
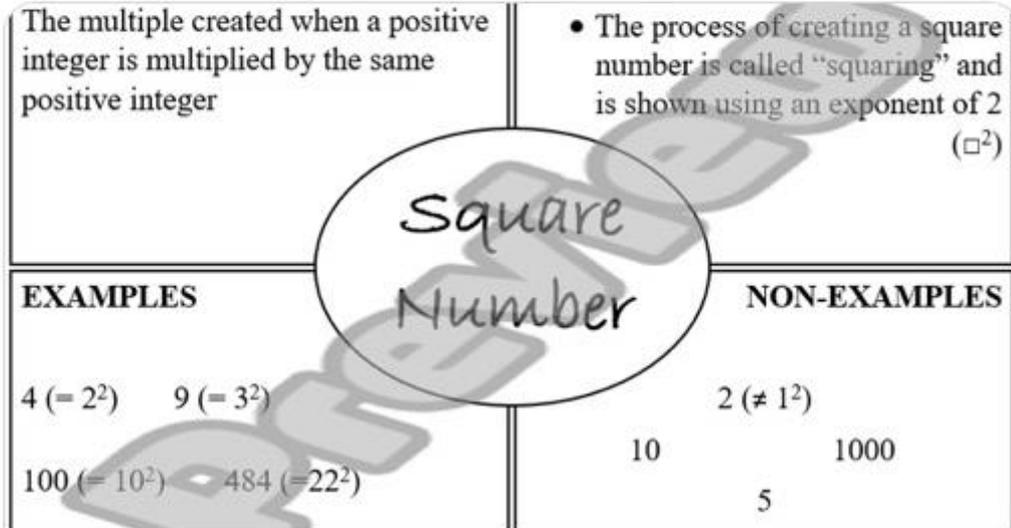Replying to @tershanah @mcwardgow and @JennyHillParker
#mathscpdchat

Definition

A four-sided polygon with four right angles.

Facts/Properties

Diagonals are congruent.

Interior angles sum to 360°.

$A = lw$, where A is area, l is length, and w is width.

Rectangle

Examples

Nonexamples

Tazreen Tershanah @tershanah · 18h · · ·
Thanks, Catherine :)

#GOALS

Miss Ward-Gow @mcwardgow · 18h ···

Replying to @tershanah @Edwards08C and @JennyHillParker

frayer-model.co.uk :)

The multiple created when a positive integer is multiplied by the same positive integer	• The process of creating a square number is called "squaring" and is shown using an exponent of 2 ($\square^2$)

Square Number

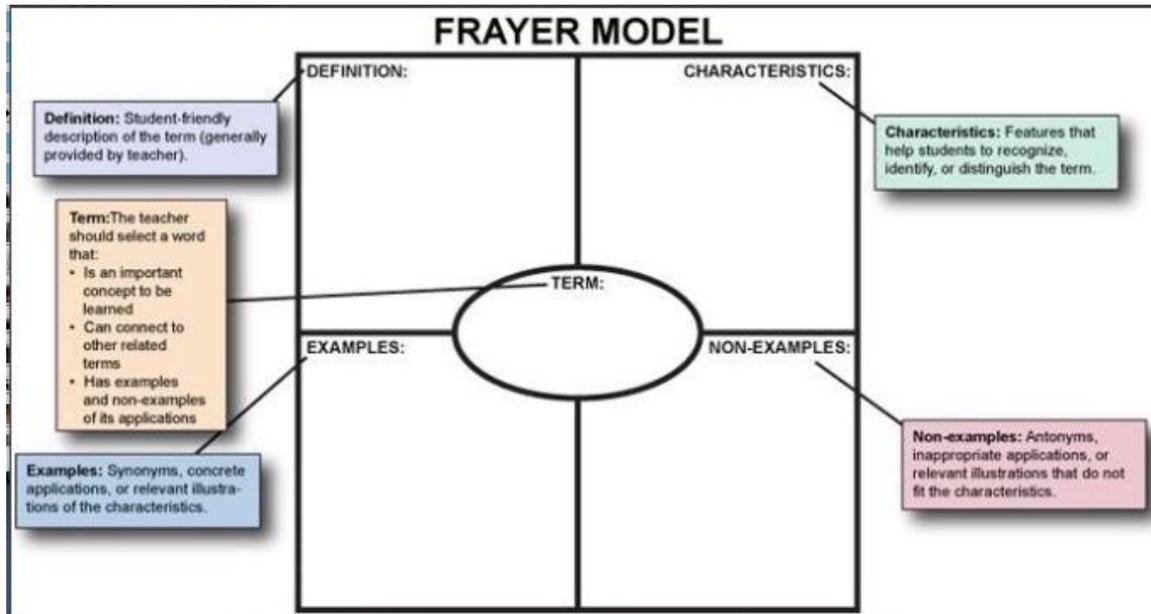| EXAMPLES	NON-EXAMPLES
$4 (= 2^2)$ $9 (= 3^2)$ $100 (= 10^2)$ $484 (= 22^2)$	$2 (\neq 1^2)$ 10 1000 5

frayer-model.co.uk

Frayer Model | Frayer-model.co.uk

Frayer Models are a great resource for organising information for learners. Find lots of free maths Frayer models here.

MrHawesMaths @HawesMaths · 18h ···

Replying to @tershanah @Edwards08C and 2 others

FRAYER MODEL

DEFINITION: Student-friendly description of the term (generally provided by teacher).

Term: The teacher should select a word that:
• Is an important concept to be learned
• Can connect to other related terms
• Has examples and non-examples of its applications

Examples: Synonyms, concrete applications, or relevant illustrations of the characteristics.

Characteristics: Features that help students to recognize, identify, or distinguish the term.

Non-examples: Antonyms, inappropriate applications, or relevant illustrations that do not fit the characteristics.

DEFINITION: CHARACTERISTICS:

TERM:

EXAMPLES: NON-EXAMPLES:

This discussion focussed on etymology …

Tazreen Tershanah @tershanah · 16h   ...
Replying to @JennyHillParker
Hello Jenny, sorry I am late. I think the link is being able to see a words etymology and root meaning and then infer meaning in a new context e.g. parallel and paralellogram or even simply part and partition. #mathscpdchat

Tazreen Tershanah @tershanah · 16h   ...
Replying to @tershanah and @JennyHillParker
Or even informal uses vs mathematical register to piece together meaning e.g. interval #mathscpdchat

Jenny Hill-Parker @JennyHillParker · 16h   ...
Hi Tazreen! You have mentioned my favourite ever word when it comes to discussing Maths education!! What's your favourite bit of etymology? #mathscpdchat

Tazreen Tershanah @tershanah · 16h   ...
That etymology is historical and always evolving. It is even sometimes fractious because of the influence of other languages over time e.g. the word ratio deriving from ration which is hidden in the word fraction! #mathscpdchat

… and this conversation included more suggestions:

MrHawesMaths @HawesMaths · 16h   ...
Replying to @JennyHillParker and @mcwardgow
I sometimes (perhaps need to do it more) I get students to write down as many words associated with a topic and and then highlight the ones they can confidently explain. We then discuss the others. #mathscpdchat

Tazreen Tershanah @tershanah · 18h   ...
Replying to @HawesMaths @JennyHillParker and @mcwardgow
Sounds like great AfL.You could link those words in some way either in books or on a wall to create a concept map #mathscpdchat

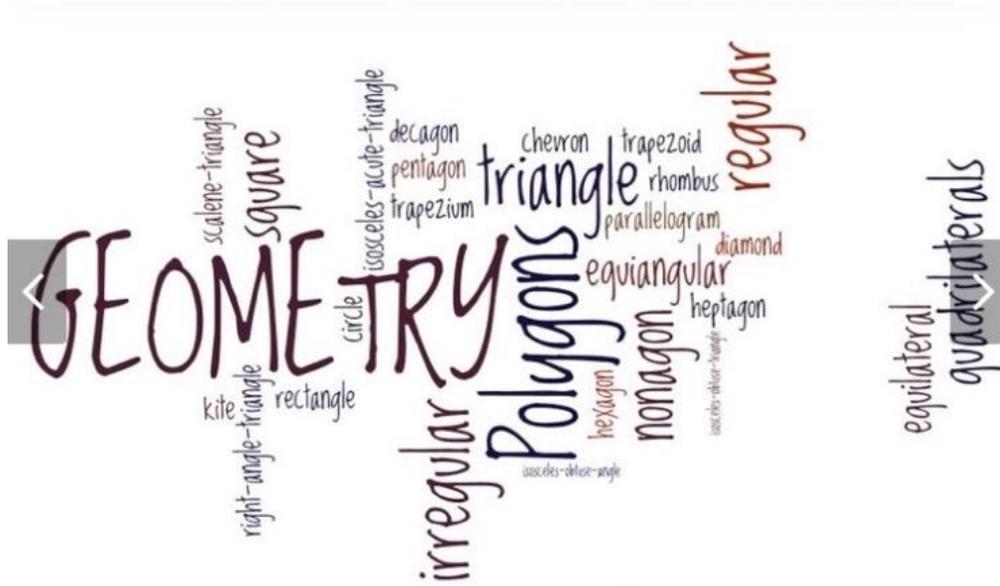**Jenny Hill-Parker** @JennyHillParker · 16h   ...
Great idea. We do something similar, and then write down definition in the front two pages of the exercise book, so that can be found and referred to easily #mathscpdchat

MrHawesMaths @HawesMaths · 16h   ...
Also sometimes create a wordless (not that one!!) or word cloud kind of like this. #mathscpdchat

These statements from Jenny …

Jenny Hill-Parker @JennyHillParker · 17h   ···
From Helen Dury: Problem solving is at the heart of mastering mathematics. Teaching for mastery involves holding problem solving as the ultimate aim of learning mathematics for every student, whatever their home background or prior attainment. #mathscpdchat

Jenny Hill-Parker @JennyHillParker · 17h   ···
Replying to @JennyHillParker
Every student can learn to solve complex problems in unfamiliar contexts.

… prompted Alice to ask an important question …

Miss Ward-Gow @mcwardgow · 17h   ···
Replying to @JennyHillParker
Does this suggest that problem solving should be done towards the end of a topic? 🤔 #mathscpdchat

… to which there were no replies!

This link to a video …

Jenny Hill-Parker @JennyHillParker · 17h   ···
This is an interesting watch; #mathscpdchat

Dan Finkel: 5 ways to share math with kids | TED Talk

ted.com
5 ways to share math with kids
Mathematics is not about following rules, it's about playing—and exploring, fighting, looking for clues, …

… and this comment …

Jenny Hill-Parker @JennyHillParker · 17h   · · ·

Replying to @JennyHillParker

His main points are;

1. Pose a question
2. Give the students time to struggle
3. You are NOT the answer
4. Say yes to all ideas and help explore, be excited!
5. Have a 'play' mindset

#mathscpdchat

… prompted replies about useful kinds of question …

Mary Pardoe @PardoeMary · 18h   · · ·

Replying to @JennyHillParker

WHAT questions provide opportunities for mathematical thinking/reasoning?

This is a good one … twitter.com/ProfSmudge/sta…

#mathscpdchat

The diagram shows six equilateral triangles.

The **red** line is 18 cm long.
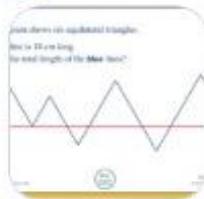What is the total length of the **blue** lines?
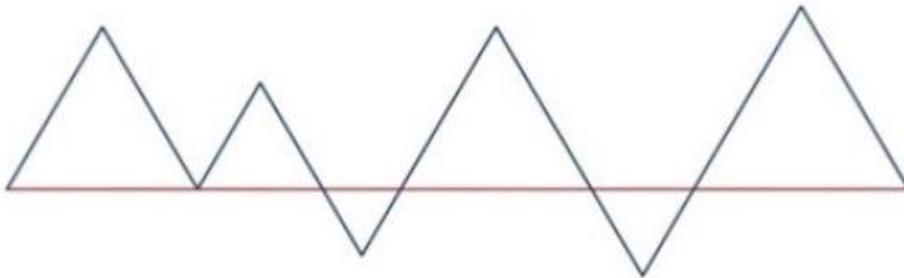
MultipliXing©
Grazing in the multiplicative conceptual field

MUL
02C

mathsmed.co.uk
© Maths Medicine · Dexter Graphics

Professor Smudge @ProfSmudge · Dec 4, 2021

#Multiplixing
Something to chew on…?

Show this thread

Tazreen Tershanah @tershanah · 18h   · · ·

These are more question starters to adapt but support deepening levels of mathematical thinking. #mathscpdchat

nrich.maths.org
Using Questioning to Stimulate Mathematical Thinking
Good questioning techniques have long being regarded as a fundamental tool of effective teachers. This article for teachers looks …

… and some comments about struggle:

Catherine Edwards @Edwards08C · 18h   · · ·

Replying to @JennyHillParker

So hard to let them struggle, I think that's the hardest bit for both teacher and student

#mathscpdchat

Jenny Hill-Parker @JennyHillParker · 18h   · · ·

So so hard. But so necessary to let them come forward with their own ideas. #mathscpdchat

It also prompted the sharing of the link to another video:
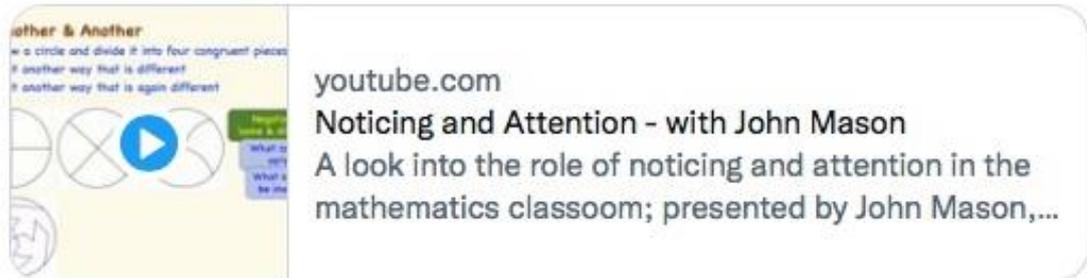
Mary Pardoe @PardoeMary · 17h   ···

Replying to @JennyHillParker

So is this:

youtube.com/watch?v=6oLldN...

... helping teachers support pupils in mathematical reasoning!
#mathscpdchat

youtube.com
Noticing and Attention – with John Mason
A look into the role of noticing and attention in the mathematics classoom; presented by John Mason,...

Many of the replies to Jenny's last question …

Jenny Hill-Parker @JennyHillParker · 19h   ···

And now to resources! Dive in and share your bet finds for problem solving questions #mathscpdchat

… are represented in the links provided at the top of this summary. However, there were some single replies without links …

Miss Ward-Gow @mcwardgow · 19h   ···

Replying to @JennyHillParker

There's often nice problems on Mathspad or Don Steward 🙂
#mathscpdchat

Jenny Hill-Parker @JennyHillParker · 20h   ···

@giftedHKO needs a mention for excellent problem solving resources here too #mathscpdchat

Jenny Hill-Parker @JennyHillParker · 20h   ···

@robeastaway has some lovely resources on problem solving too.
#mathscpdchat

… and three conversations, this one …

Catherine Edwards @Edwards08C · 19h   ···

Replying to @JennyHillParker

I used to have an excellent set that were farming based, I think they came from one of the regional hubs.
Anyone remember/have them?
#mathscpdchat

Jenny Hill-Parker @JennyHillParker · 20h ···
Replying to @Edwards08C
No but I'd love a copy if you find them! #mathscpdchat

Catherine Edwards @Edwards08C · 20h ···
They were pdf and GCSE maths. #mathscpdchat

… this one …

Rob Southern @mrsouthernmaths · 19h ···
Replying to @JennyHillParker
For A level, Underground Maths, Integral and RISPs.

Jenny Hill-Parker @JennyHillParker · 19h ···
And your resources Rob. I've just had a look and they're amazing. Do you do any key stage four to five transition stuff?

Rob Southern @mrsouthernmaths · 8h ···
Thank you!

I have collated some resources here:
mrsouthernmaths.wordpress.com/transition/

Also the transition resources that @Advanced_Maths released last year are superb. They have a great mix of routine practice and exploration.

… and this conversation:

MrHawesMaths @HawesMaths · 19h ···
Replying to @JennyHillParker
I like to do a lot of the UKMT maths challenges with the students using Dr Frost maths. Self marked and creates awesome discussion points. #mathscpdchat
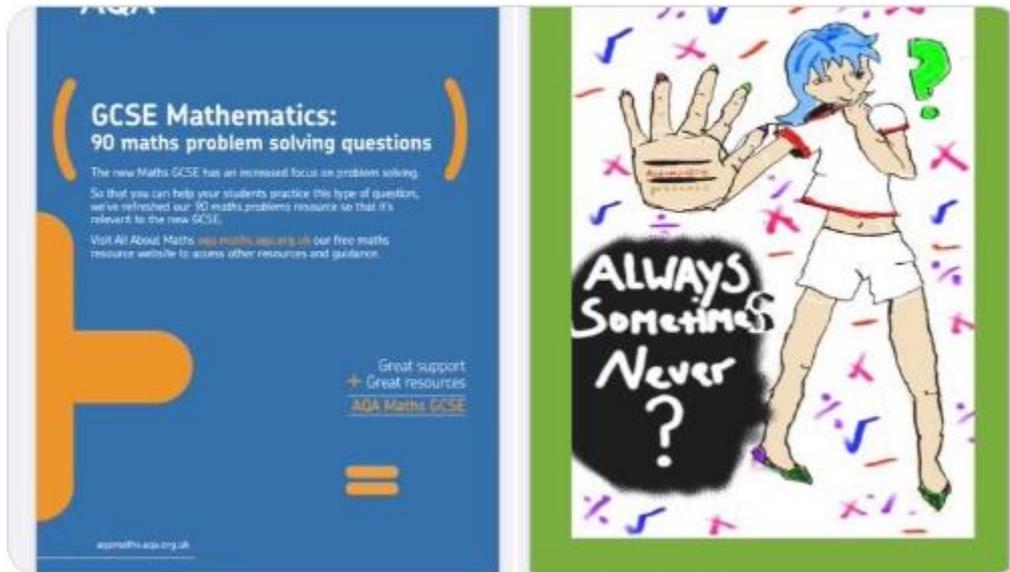
MrHawesMaths @HawesMaths · 19h

Replying to @JennyHillParker

I use these as well

Catherine Edwards @Edwards08C · 19h

The standards box has some great always sometimes never activities in it
#mathscpdchat

Jenny Hill-Parker @JennyHillParker · 19h

Love the Standards Units! #mathscpdchat

Yorkshire Steve @Yorkshire_Steve

Early in my career I was the recipient of a Best Practice Research Scholarship grant. It paired up some early career teachers with education researchers. I was paired with Malcolm Swan and it led to some of what became 'the Standards Unit' resources being trialled in my lessons. I even got the opportunity to assist in authoring a couple and Malcolm invited me to present with him at BCME5. I remember being amazed at just how many hours of work went into every activity. Plan, trial, adjust, trial and so on.