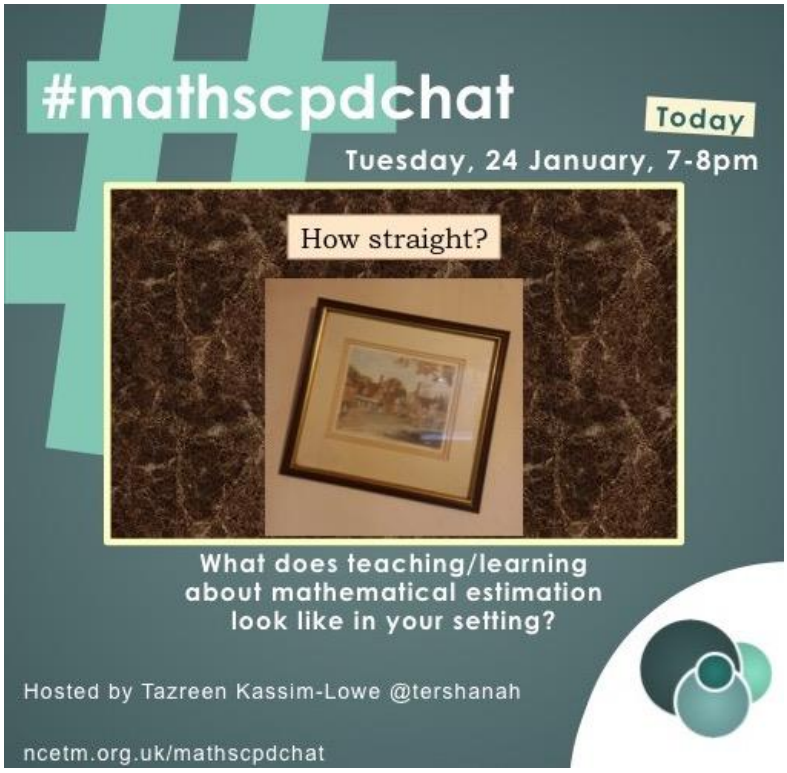
#mathscpdchat 24 January 2023

What does teaching/learning about mathematical estimation look like in your setting?
Hosted by Tazreen Kassim-Lowe

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:

A fresh take on modelling and estimation with Junaid Mubeen which is a live online session in the AMSP 2023 Core Maths Winter Festival. The speaker is Junaid Mubeen who is a mathematician and educator, a *Countdown* series winner, and author of the book *Mathematical Intelligence: what we have that machines don't*, which explores the role of maths in the age of AI. It was shared by Tazreen Kassim-Lowe

1.1 Place Value, Estimation and Rounding which is core concept 1 in theme1, *The structure of the number system*, of the NCETM's *Secondary Mastery Professional Development Materials*. It was shared by Tazreen Kassim-Lowe

As Close As It Gets which are non-typical multiple-choice problems created by Pam Harris and presented on her website. Each problem challenges you to pick the 'choice' which is ***closest*** to the actual result of a given calculation. It was shared by Tazreen Kassim-Lowe

Estimation which is a collection of resources by NRICH based around the topic estimation. It was shared by Mary Pardoe

Global Warming which is a mathematical investigation presented on the NRICH website. It involves using data to find reasonable estimates of various quantities, such as the amount of fuel burned per week over the last thirty years per person on the planet. It was shared by Mary Pardoe

Estimation materials which are lesson plans and supporting resources on the topic of estimation provided by the AQA exam board. It was shared by Mary Pardoe

Functional Skills Mathematics: Level 1: Estimation which is are pages of 'guidance' provided by Pearson Edexcel in 2019 and intended to support the teaching of Level 1 Functional Skills. It was shared by Mary Pardoe

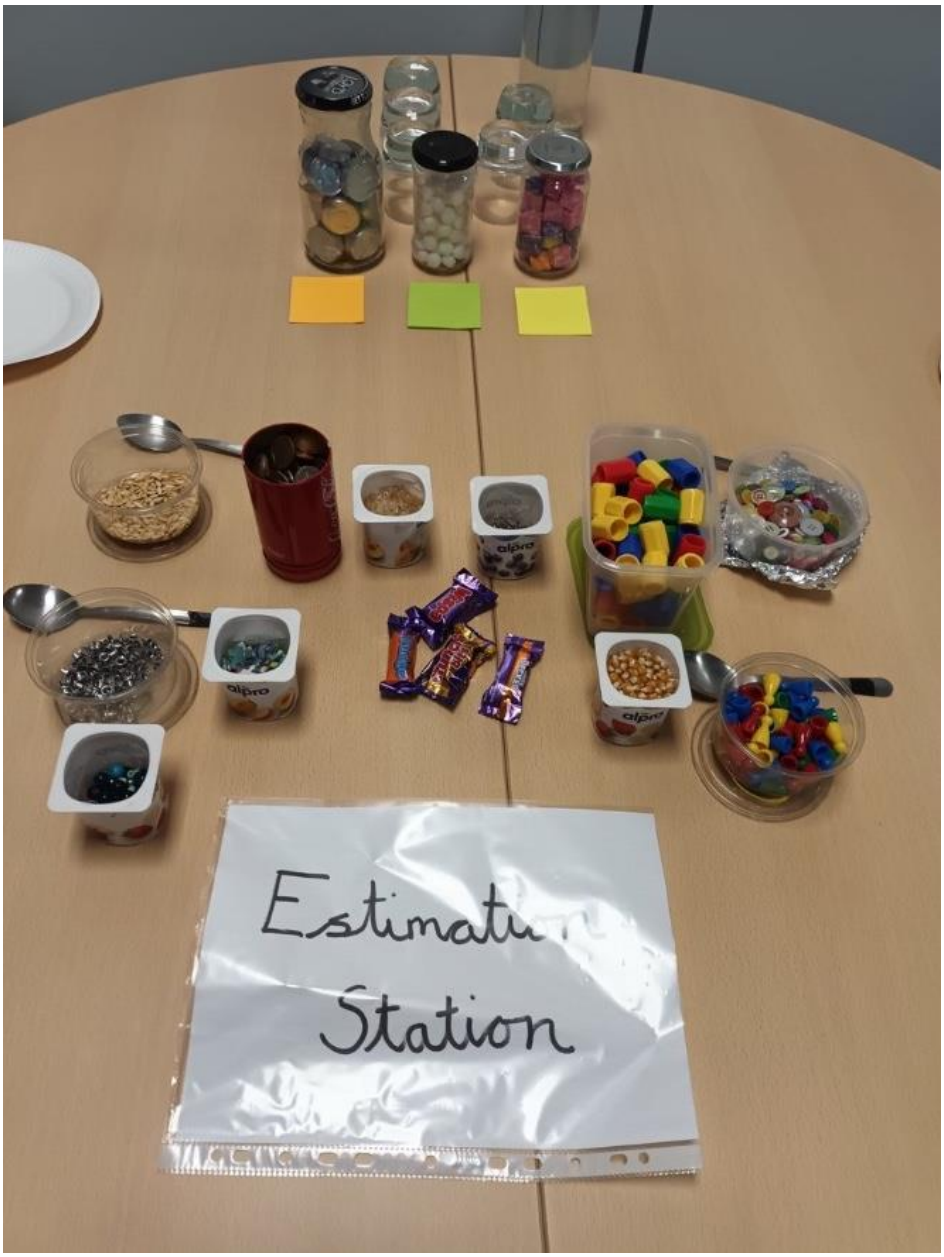
An illustrated summary of the discussions in this #mathsCPDchat follows.

The host's tweeted this reminder one hour before the discussion began …

Tazreen Tershanah @tershanah · 16h

A photo taken whilst working with Primary Teaching assistants on #numbersense.

For more **#mathscpdchat** about estimation join us in 1hour.



… and then this …

Tazreen Tershanah @tershanah · 15h

It is nearly that time for #mathscpdchat . 5 minutes to go. Grab yourself a drink and keep warm. Looking forward to mediating our discussion about what mathematical #estimation looks like in your setting.

… before her 'welcome' message …

Tazreen Tershanah @tershanah · 15h

It's that time again. Thanks for joining this #mathscpdchat : What does teaching/learning about mathematical estimation look like in your setting?

Don't forget to use the hashtag: #mathscpdchat

I will do my best to respond to posts and comments thoughtfully.

… to which there was this reply and, in response, a question:

Joanne Green @MsJoanneGreen · 16h

@tershanah #mathscpdchat Hello 👋🤗

In my current school, I've been in Year 7 maths. They've used fractions and percentages for estimating values on Pie charts. For e.g., a pie chart has 10 dots around it and represents 100 pupils. The angle covers 2.5 dots, so how pupils? 25.

Tazreen Tershanah @tershanah · 16h

Replying to @MsJoanneGreen

#mathscpdchat Pie charts and representations which display proportionality provide great opportunities for estimation. But what is estimation and what is it not?

This was echoed in the host's first main question addressed to everyone …

Tazreen Tershanah @tershanah · 15h

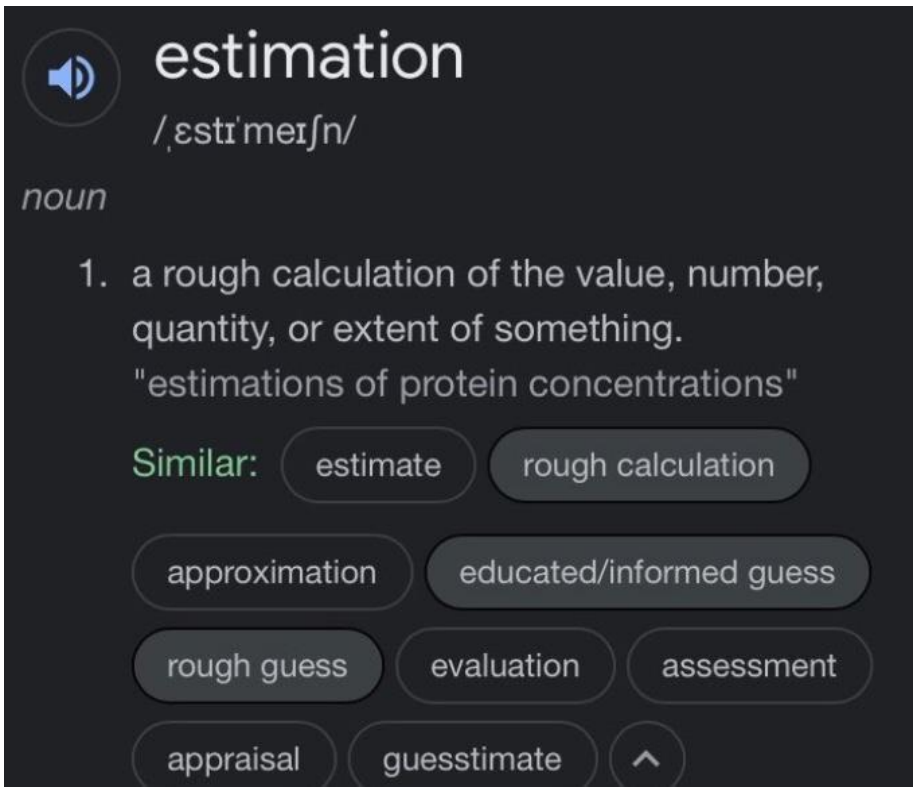
Question 1. What is estimation and what is it not? #mathscpdchat

… which generated the following conversation:

MrHawesMaths @HawesMaths · 15h

Replying to @tershanah

Start off with a definition and indicate that it is not just rounding numbers. There are physical element a too like the mass or capacity of an object. #mathscpdchat



Tazreen Tershanah @tershanah · 15h

Replying to @HawesMaths

#mathscpd Welcome and thank you for this. There is more to estimation than rounding! In the Primary curriculum attention is drawn to measure as well as rounding in order to calculate. What are the expectations like in the phase you work in?

Tazreen Tershanah @tershanah · 15h

Replying to @HawesMaths

#mathscpdchat I personally am fond of the idea that estimation provides a window in to a child's mathematical thinking!

MrHawesMaths @HawesMaths · 15h

Replying to @tershanah

I was recently observing ks2 on capacity and the whole lesson was spent on estimating the capacity of various objects using manipulatives. Was very good. Further up the school I guess estimations are used to check erroneous answers and correct. #mathscpdchat

Tazreen Tershanah @tershanah · 15h

Replying to @HawesMaths

#mathscpdchat Certainly seems to be two strands here. A) checking calculations/using the inverse/rounding and B) applying it to measures such as volume, length, money etc 👍🏽

Mary Pardoe @PardoeMary · 15h

Replying to @tershanah and @HawesMaths

One of the exam boards gave this example … here: qualifications.pearson.com/content/dam/pd..

Lewis is building a brick wall.

The wall will need 19 bags of cement.

Each bag of cement costs £7.83.

Use estimation to work out how much Lewis will need to pay for the cement.

You **must** show your working.

(3)

Notice the question uses the word estimation, telling you what to do.

Notice the word **must** is in bold. This means you need to show your working out.

There are three ways you can approach this question but only one will lead to marks:

1. Work out the answer in full: this takes a lot of time (estimation is usually non calculator), is easy to get wrong and will not lead to marks
2. Work out the answer in full and then estimate the answer: this takes a lot of time, is easy to get wrong and can give you the wrong answer
3. Use estimation to find the answer: easier than the other two options and will lead to a valid answer

Look at the example question.

- Using estimation 19 bags at £7.83 each would be 20x8 = £160.
- Using the real numbers and then estimating is 19 x7.83 = £148.77, with £150 as the answer.

We would only accept £160 as the correct answer.

Tazreen Tershanah @tershanah · 15h

Replying to @PardoeMary and @HawesMaths

Thanks for this example @PardoeMary. So easy to see numbers and want to simply calculate and skim over the word 'estimation'. #mathscpdchat

The day after the #mathscpdchat the following Twitter exchange about the example shared above took place:

Mike Ollerton @MichaelOllerton · 16h

@PardoeMary Hi Mary. I recently saw a tweet about an exam question which involved finding an approximate value of 19 times £7.83 Unfortunately I managed to lose it whilst I was tweeting my response. Could you send it to me? Thanks Mike

Mary Pardoe @PardoeMary · 12h

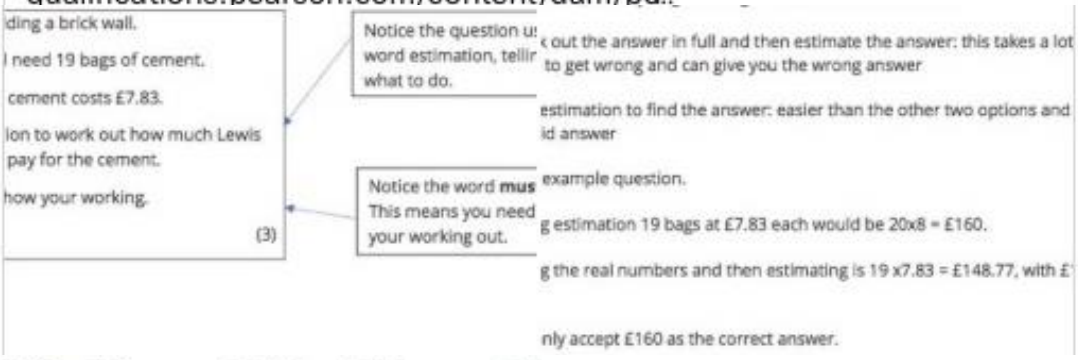
@MichaelOllerton Was it this Pearson stuff?

Mary Pardoe @PardoeMary · Jan 24

Replying to @tershanah and @HawesMaths

One of the exam boards gave this example … here:

qualifications.pearson.com/content/dam/pd..



Mike Ollerton @MichaelOllerton · 12h

Replying to @PardoeMary

Yes, it was thank you. I was concerned on two levels. The 1st was a flawed attempt to write a so called “real life” question. The 2nd was the issue of doing an approximation of 7.83x19 and rounding both values up to 8x20 instead of 7.5x20. The latter being far better.

Q1 from the host, Tazreen, ‘What is estimation and what is it not?’, prompted two other conversations, this …

Mr Mattock FCCT NPQSL @MrMattock · 15h

Replying to @tershanah

Depends on context. I guess in it is centred around the idea of "inaccurate but suitable for purpose". But how this is applied to a calculation (say) is different to how it is applied to estimating from a graph, or estimating a summary statistic based on grouped data.

Tazreen Tershanah @tershanah · 15h
Replying to @MrMattock
Thanks for your contribution! So far, examples of what estimation look like from the #mathscpdchat seem to be a) to aid a procedure of b) to make sense of measure in a given context.

Mr Mattock FCCT NPQSL @MrMattock · 15h
Replying to @tershanah
Seems a bit restrictive, but not far off #mathscpdchat

… and this 'conversation', in which Tazreen referred to a book by Peter Mattock (@MrMattock who tweeted as shown above):

Joanne Green @MsJoanneGreen · 16h
Q1. @tershanah #mathscpdchat Estimation is a judgement to find a value, i.e., 30 pupils in a class. Estimation is NOT an approximation that's a more accurate calculation, such as pi's value to 5 d.p. The approximation is taken from a value already known, estimation is unknown.

Tazreen Tershanah @tershanah · 16h
Replying to @MsJoanneGreen
#mathscpdchat Interesting point here as there is this idea of a move towards estimating with more and more accuracy.

Tazreen Tershanah @tershanah · 16h
Replying to @tershanah and @MsJoanneGreen
#mathscpdchat I always thought of estimation as a skill but since reading #Conceptualmaths by @MrMattock I am wondering if it is a concept in its own right.

Tazreen Tershanah @tershanah · 19h
Replying to @MsJoanneGreen
Forrester and Pike (1998): "First, it is usual for researchers to divide estimation into three distinct categories, corresponding to its application within the domains of computation, judgment of numerosity" #mathscpdchat

The host's second main question …

Tazreen Tershanah @tershanah · 16h
#mathscpdchat
Question 2. What opportunities do your students have to estimate?

… prompted this long discussion in which several links to resources were shared …

MrHawesMaths @HawesMaths · 16h

Replying to @tershanah

Every lesson. I would always ask how I could check/estimate an answer. I try to make part of everyday questioning. Even if it is basics and obvious. Such as finding the hypotenuse (you would estimated it to be larger than the other two sides etc.) #mathscpdchat

Tazreen Tershanah @tershanah · 17h

Replying to @HawesMaths

#mathscpdchat That is the thing @HawesMaths there are so many opportunities to estimate in every lesson. I particularly like the idea of thinking of an estimate before hand, conjecturing and then comparing that to the answer to check if it is feasible.

Tazreen Tershanah @tershanah · 17h

Replying to @HawesMaths

#mathscpdchat If it the calculation aspect that is being explored in your setting. I highly reccomend the following:

mathisfigureoutable.com
As Close As It Gets
Find a collection of problems you can use in your classroom to promote reasoning and thinking!

Joanne Green @MsJoanneGreen · 19h

@tershanah @HawesMaths #mathcpdchat I have signed up to receive updates, and that hasn't cost anything at all 🥰

Tazreen Tershanah @tershanah · 16h

Replying to @HawesMaths

#Mathscpdchat I always loved using liquid and volume to estimate whether x amount of liquid will fit in to a container with x capacity. Any opportunity to discuss whether there is enough of something as part of daily routines.

Tazreen Tershanah @tershanah · 17h

Replying to @tershanah and @HawesMaths

#mathscpdchat Makes me think about Davydov's non-numerical comparisons of quantities: lengths of strips or capacities of containers etc

Joanne Green @MsJoanneGreen · 19h

@tershanah **#mathscpdchat** @HawesMaths This is done in Nursery and Reception, sometimes near to painting too - to show reduction. However, I think secondary children for Chemistry could do with this. They like to 'play' with things in labs, so build upon that, carefully!

Tazreen Tershanah @tershanah · 19h

Replying to @MsJoanneGreen and @HawesMaths

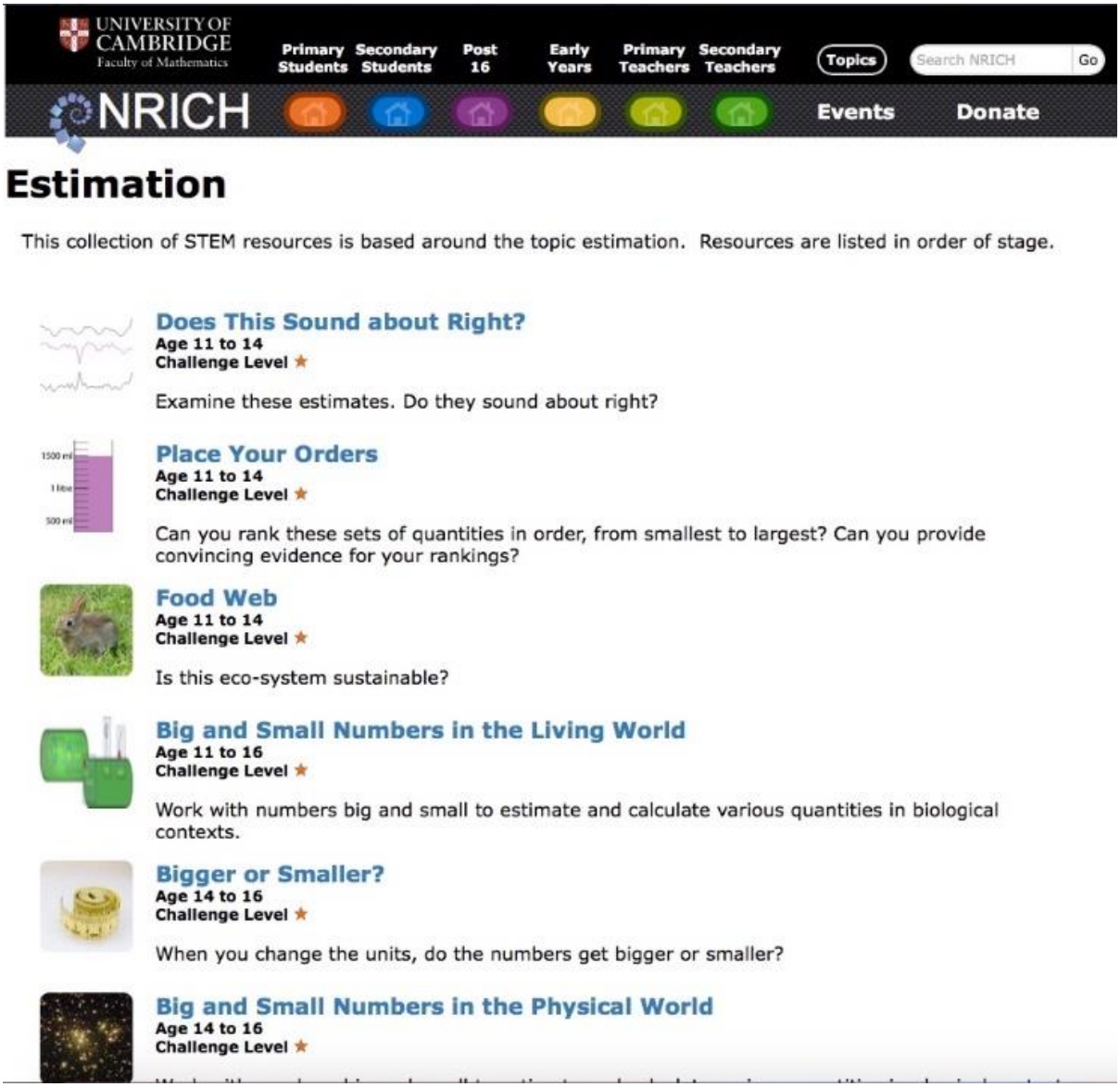
#mathscpdchat certainly estimation can go beyond the maths classroom. In to other areas of the curriculum and real life.

Mary Pardoe @PardoeMary · 16h

Replying to @tershanah and @HawesMaths

NRICH also have some nice tasks that can generate pupil-pupil discussion ... here: nrich.maths.org/8988

#mathscpdchat



Tazreen Tershanah @tershanah · 17h

Replying to @PardoeMary and @HawesMaths

Thanks for sharing this. Excellent resource to aid some 'figuring out' collaboratively. #Mathscpdchat

Mary Pardoe @PardoeMary · 17h

Replying to @tershanah and @HawesMaths

AQA have some 'estimation' resources aimed at secondary maths learning ... here: allaboutmaths.aqa.org.uk/1259 #mathscpdchat

AQA

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Estimation

Estimation resources
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Related resources:

Estimation Worksheet Extension Answers
♥(2)
Download file (292.4k)

Tazreen Tershanah @tershanah · 16h

Replying to @PardoeMary and @HawesMaths

For those of you interested in #coremaths there is an event this week spotlighting #estimation #mathscpdchat

amsp.org.uk
Event - AMSP

Tazreen Tershanah @tershanah · 16h

Replying to @PardoeMary and @HawesMaths

#mathscpdchat And this resource from @NCETM for #primary

Mary Pardoe @PardoeMary · 16h

Replying to @tershanah and @HawesMaths

And this NRICH link may be useful for Core Maths teachers:
nrich.maths.org/6453 #mathscpdchat

Global Warming

Age 14 to 16
Challenge Level ★★

- Warm-up
- Try this next
- Think higher
- Read: mathematics
- Read: science

In this investigation you will need to use a variety of pieces of physical data to come up with a reasonable estimate. What data will you need? Where will you find it? What estimates are sensible? What modelling assumptions are you making at each step? These are the sorts of questions that you will need to ask yourself as you undertake your investigation .

As a conservative estimate, the average temperature of the atmosphere has increased by $0.4^{\circ}\mathrm{C}$ over the last thirty years.

Estimate how much energy has gone into warming up the planet in this way.

Estimate how much burned fuel would be needed to give rise to this increase on the assumption that this were the only cause of changes in the earths temperature.

How much fuel burned per week over the last thirty years per person on the planet would this correspond to?

What do you think about your answer? How does the amount of burned fuel correspond to the levels of fuel actually used? What other factors would come into a more sophisticated analysis of global warming?

Joanne Green @MsJoanneGreen · 19h

@PardoeMary **#mathscpdchat** @tershanah A sheet would need to be provided to connect the temperature of a degree rise to volumes of fuel. That way different assumptions can be modelled and for an answer that fits with, i.e., policy or school thinking.

… and this comment:

Joanne Green @MsJoanneGreen · 19h

Q2. @tershanah **#mathscpdchat** Today in Year 11 Chemistry, pupils were asked to read a graph to estimate mass lost in $CaCO_3$ chips at 3 minutes for 1 chip, lots of chips same mass, and powder same mass. I showed mathematically how to calculate it as the equation wasn't on that page.

Tazreen Tershanah @tershanah · 19h

Replying to @MsJoanneGreen

#mathcpdchat So what I am hearing is that in the context of reading and interpreting data and, like the pie chart you mentioned earlier, there is that underlying proportionality.

The host's Q3 …

Tazreen Tershanah @tershanah · 19h

#mathscpdchat Question 3. How do you model effective estimation?

… prompted a comment that provided an opportunity for the host to share more thoughts:

Joanne Green @MsJoanneGreen · 19h

@tershanah **#mathscpdchat** I like to model. The school I'm at has many types of whiteboard - which is challenging as they each operate utterly differently 🤣 Today, I used Word and saved the calculations and modelled answers onto the Desktop for IT to retrieve for the teacher 😍

Tazreen Tershanah @tershanah · 19h

Replying to @MsJoanneGreen

#mathcpdchat I think part of modelling estimation is talking through how 'far off' we are or if we were 'way off' and thinking aloud about how we could be more accurate next time. Estimation is not always perfect!

Joanne Green @MsJoanneGreen · 19h

#mathscpdchat @tershanah Estimation is not supposed to be perfect. Seeking perfection is more for Trial and Error. An estimation is an estimation, a starting point or benchmark from which to work from - either forwards or backwards.

To the host's fourth main question …

Tazreen Tershanah @tershanah · 19h

Thanks for all the contributors. 10 minutes to go and the final question of #mathscpdchat

Question 4. When is estimation a valuable mathematical skill?

… there were the three following responses:

Joanne Green @MsJoanneGreen · 19h

Q4. @tershanah #mathscpdchat It's a skill that needs to be taught, mostly. It's needed for graph reading and understanding, for estimating from graphs, and for providing proof of estimation.

Tazreen Tershanah @tershanah · 19h

Replying to @tershanah

#mathscpdchat I know for me it is when I do the shopping. Estimating how much of x to buy to last of y days or when I bought paint for the kitchen. Better to over estimate in these cases otherwise there are real life consequences!

Mary Pardoe @PardoeMary · 19h

Replying to @tershanah

When checking to see that your result of a calculation is reasonable (near what it ought to be as seen by estimating the result in your head with 'nice' numbers). #mathscpdchat

This was the host's closing message:

Tazreen Tershanah @tershanah · 19h

Thank you so much for joining me for this #mathscpdchat. Today we have discussed what estimation is (and isn't), how we model it and when it is valuable.
Have a lovely evening and stay warm!