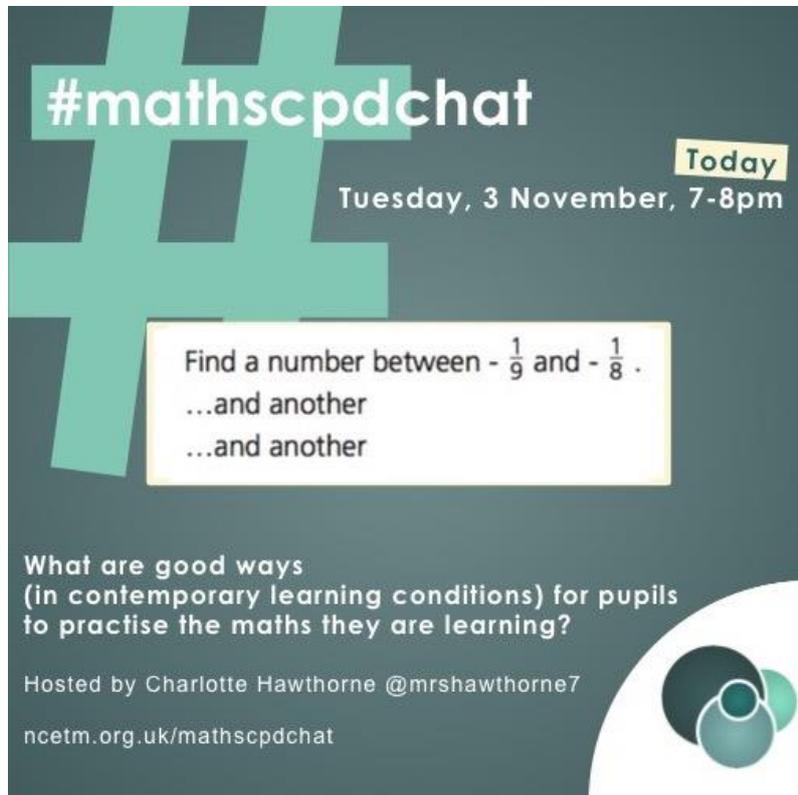# #mathscpdchat 3 November 2020

What are good ways (in present learning conditions) for pupils to practise the maths they are learning?

Hosted by [Charlotte Hawthorne](#)

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

The **results of a poll**, tweeted by the host at the start of the chat, were:

Charlotte 📏✏️📋🦺
@mrshawthorne7

Think about a typical series of lessons on something for e.g. Pythagoras.
So from first lesson to moving in to the next topic...

Roughly what % of that whole time would the students spend practising the mathematics?

Less than 25%	4.2%
25-50%	31.9%
51-75%	47.2%
More than 75%	16.7%

72 votes · Final results

Some of the areas where discussion focused were:

ways in which maths teachers are arranging for their students to practise maths:

- that **how students practise maths depends on what the aim is** … there may be a need for procedural practice … or a need for students to practise reasoning with particular mathematical ideas … or a need to practise applying ideas in a variety of new situations;

- that it is important to **enable students to talk about the maths** they are learning … explaining, reasoning and linking … 'revisiting' maths that was addressed during the first lockdown;

- during lessons **students look with the teacher at many examples**, then they **practise by working on some more examples** … students follow-up their in-lesson-practice by **working on questions for homework**;

- whether it is helpful to **'make it explicit to students that they are practising AO1/AO2/AO3 questions'**, and if so, how this is best done … perhaps this kind of explicit reference is helpful only when feeding back to students about how well they have responded to questions (for example about where marks have/have not been gained) … scanning 'through our work to see what is AO1/2/3';

- '**drill and thrill' practice** … a discussion followed about where that phrase originated and to what it is meant to refer … that most teachers probably understand it to mean 'the doing of lots of questions, all AO1 style, very procedural' … that perhaps it ought to mean doing 'lots of drilling questions and then a thrilling question too' … that @danicquinn used the phrase 'Drill and Thrill' in her blog;

- that teachers 'love the times **when there's another purpose for the practice**' … **@colinfoster77's mathematical études** (embedding opportunities for developing procedural fluency within rich mathematical contexts) (link provided below);
- **one teacher creates 'six-grid assessments'** in each of which six example questions are presented … weak areas are 'identified and then practised' to 'instil knowledge and confidence in those areas' … these 'grids' are made 'as we go, based on what has been taught and we think needs to be assessed … if poor it will appear next week and so on until it has been confidently answered';
- teachers mentioned using **'intelligent practice questions', 'contextual style questions' and 'questions that link the topic to other topics'** … that such questions can be sourced rather than being made up by the teacher;

how teachers try to make sure that the way their students practise maths is effective:

- ensuring that the type and purpose of the practice is appropriate to where students are in relation to the maths that is being practised … **whether you can know immediately whether some particular practice has been effective** … using effective assessment, formative and summative, in 6 or 12 or 39 weeks' time in order to find out if students have retained what they practised … also to see whether students can 'transfer' (use and apply in new situations, and develop) what was practised;
- the pupils of some teachers **keep/store (in their maths folders) paper copies of the products of their practising**, while the **teacher retains digital copies** of those products to refer to as 'snapshots of how students are getting on' … some teachers sometimes use again the products of students' practising as a starting-point for the learning of something new;
- some teachers **'try to steer away from mindless practice'** … for example by finding/creating a set of questions that all have the same answer, and challenging students to explore why … points at which students get stuck in this kind of practice informs the teacher about what needs to be addressed;
- some teachers like **all practice questions to be designed with possible misconceptions in mind** … that is, to be created as 'diagnostic' questions (possibly as multiple-choice questions);
- some teachers think of **'purposeful practice'** as 'isolating a specific skill', and that then following it with **'intelligent practice'** 'allows for deeper understanding';
- that students **doing a lot of practice does not imply that they are learning** … 'lots of work and students being engaged doesn't mean they're learning' … students often believe that they are learning when they have 'produced a lot of correct calculation regardless of the amount of 'thinking hard' they've had to do' … teachers need to make sure that students 'have enough procedural practice but also that they're challenged, thinking hard and not just on algorithm autopilot' … seeing that students are engaged

and focused is a necessary requirement for making a judgement that they are learning, but it is not sufficient … that learning is about what's happening inside a student's mind – what they're thinking … a teacher cannot control what a student is actually thinking, and can only 'do everything to create the ideal environment and situation where they can focus their attention on the important ideas';

how teachers interpret 'purposeful practice' and 'intelligent practice', and what they understand the difference between these two kinds of practice to be:

- some teachers interpret **'purposeful practice'** as the **practice that students experience while they are engaged with a task that serves a larger aim over-and-above just practice** … that this isn't necessarily the case with **'intelligent practice'**, which is intended to **direct attention to particular 'structures'** … but that the two are not mutually exclusive:

- teachers agreed that to do **'purposeful practice'** is to '**practise a technique with another goal in mind**, whereas **'intelligent practice'** is practice that '**is designed to encourage a student to think about the maths involved, what changes and how it affects the results**';

how teachers enable students to practise mathematics while they are learning remotely, and whether such practice is the same as practice done in the classroom:

- that during 'blended teaching and learning' (when some students in a class are being taught remotely because they are at home while others in the same class are learning in school) some teachers **set more practice questions than they do normally in order to build the confidence of those students at home because 'they can't ask for help as easily'** … answers must be available in order to prevent students repeating the same error (for example continuing to work under a particular misconception) … some teachers pointed out that **with 'purposeful practice' (when the task has an aim other than mere practice) the learner's response may provide its own feedback**;

- that **when students are engaged in 'purposeful practice' they probably 'need others around'** (they need to interact with other students and their teacher), and that 'intelligent practice' is possibly only effective when it involves discussion … **some things that students are given to do in order to practise maths may be most effectively done in pairs or small groups** … recent experience has shown some teachers that by operating **breakout rooms in Zoom** students can interact and collaborate … interaction between students works well in Zoom because responses can be immediate/very quick in the breakout rooms, but 'Teams is too laggy';

- that in remote teaching some teachers 'have to **slow things down and do tons of questioning to make sure students are engaged**' whereas in the classroom 'you can actually see what they are doing' … that is, it is 'difficult to get people to have a quick chat about something, and much harder for the teacher to eavesdrop'

- for some teachers **the main difference between practice done remotely and that done in the classroom is in how the teacher responds to what students do and say** … that feedback given by a teacher to a whole class or to an individual 'is far more fluid in a room than online' … finding ways to 'close the gap down' … at least one teacher has found that, when teaching online, teacher-student interaction is very effective … she found that during private online student-teacher conversations students ask more questions (perhaps because they cannot be 'shown up' in front of other students?) and she has time to respond in more depth … consequently when teaching in school this term this teacher has continued to engage in online conversations with individual students;

preferred sources of tasks that provide 'purposeful' or 'intelligent practice:

- that **the most appropriate source depends on the intended purpose ('where you want attention to be and what you want students to practise')** …what 'practice' is, and what its purpose is ('everyone thinks it (practice) is a good idea but no-one says what it is')

- teachers mentioned: Don Steward's resources, NRICH, 'open-middle' tasks, Études, ATM publications, 'Variation Theory' tasks, Rayner texts, Mathsbot, and Mathsbox (links provided below);

- some teachers find it is hard to source **suitably interesting practice tasks for the very lowest attaining students**, who seem to need there to be very much repetition 'built-into' the same task or within a set of questions;

- that there is **never a need for any teacher to give students boring maths practice exercises**.

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 enabling students to interact while they are practising maths whether they are working in the classroom or remotely in their homes. The conversation was generated by this tweet from Charlotte Hawthorne:

> Charlotte ✏️📐📋🤓 @mrshawthorne7 · Nov 3
> LIVE lessons or blended learning - How do you get students to practise the mathematics in your remote lessons? How is this different to in the classroom?

and included these from Nikki, Tom Francome and Mary Pardoe:

Nikki 📧📐😊 @mathszest · Nov 3

Replying to @mrshawthorne7

Difference in the feedback. If it's right or wrong practise, easy for students to find out if its right or wrong! Purposeful practise I'd say usually needs others around (either peer or teacher feedback) and intelligent practise often involves discussion #mathscpdchat (1/2)

Nikki 📧📐😊 @mathszest · Nov 3

Replying to @mathszest and @mrshawthorne7

So more difficult to use purposeful or intelligent practise when remote as not as easy to discuss findings from their practise. #mathscpdchat

Tom Francome @TFrancome · Nov 3

It's really tricky to get people to have a quick chat about anything.
It's much harder to eavesdrop.
#mathscpdchat

Mary Pardoe @PardoeMary · Nov 3

Sometimes with purposeful practice (e.g. when there are other 'aims' too) the learner's response provides its own feedback?!

Tom Francome @TFrancome · Nov 3

Replying to @PardoeMary @mathszest and @mrshawthorne7

Yes I often want the practising to be self-checking. #mathscpdchat

Mary Pardoe @PardoeMary · Nov 3

'taxicab distance' is like that in a sense!

$Dt(P, A)$ is the shortest distance from P to A on a two-dimensional coordinate grid, using horizontal and vertical movement only. We call it the taxicab distance.

For this exercise $A = (-2,-1)$. Mark A on a coordinate grid. For each point P in (a) to (h) below calculate $Dt(P, A)$ and mark P on the grid (in the original, they are in a single column so there is no temptation to work across rows instead of in order down the columns):

(a) $P = (1, -1)$ (e) $P = (\frac{1}{2}, -1\frac{1}{2})$

(b) $P = (-2, -4)$ (f) $P = (-1\frac{1}{2}, -3\frac{1}{2})$

(c) $P = (-1, -3)$ (g) $P = (0, 0)$

(d) $P = (0, -2)$ (h) $P = (-2, 2)$

and these from Peter Mattock, MrHawesMaths, Charlotte Hawthorne and Tom Francome:

Mr Mattock FCCT NPQSL @MrMattock · Nov 3

Why would it need to be different? #mathscpdchat

MrHawesMaths @HawesMaths · Nov 3

Replying to @MrMattock and @mrshawthorne7

Try and keep the principles the same. Surely.

Mr Mattock FCCT NPQSL @MrMattock · Nov 3

Indeed, whatever point they are in the journey dictates the practice that is most appropriate, and if you reach that point they need that practice. How we manage it might be different I suppose. #mathscpdchat

Charlotte @mrshawthorne7 · Nov 3

Do you think some things we may give students to do to practise the maths may be better done in pairs or more so that they can discuss the maths? This could be difficult to do online. #mathscpdchat

MrHawesMaths @HawesMaths · Nov 3

From experience of using Zoom. We were able to operate break out rooms where students could collaborate on problems and work together. Meant social interaction was maintained as well as mental health. I loved using it for the murder mystery tasks or maths challenges #mathscpdchat

Tom Francome @TFrancome · Nov 3

It works well in zoom because the breakout rooms are quick but Teams is too laggy #mathscpdchat

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

Among the links shared were:

Association of Teachers of Mathematics (ATM) which is an association dedicated to the teaching and promotion of mathematics in any institution or business – including, of course, in schools, colleges and universities. It was shared by Peter Mattock

NRICH which is part of the Millennium Mathematics Project at the University of Cambridge. It is committed to giving all students access to a rich, imaginative mathematics education and contains award-winning resources that are free and open to everyone. It was shared by Peter Mattock

2 + 3 = 8 The simple life which is an article by Dr Colin Foster in which he explains and demonstrates how gaining essential skills in algebraic manipulation doesn't have to entail tedious drill and practice. It was shared by Jonathan Payne

Mathematical etudes: embedding opportunities for developing procedural fluency within rich mathematical contexts which is a paper by Dr Colin Foster. The author describes mathematical tasks which embed the practice of essential techniques within a richer, exploratory and investigative context. He illustrates this effective way of providing practice in three central areas of the high-school mathematics curriculum: plotting Cartesian coordinates, solving linear equations and performing enlargements. It was shared by Mary Pardoe

Developing mathematical fluency: comparing exercises and rich tasks which is another article by Dr Colin Foster that includes examples of mathematical études. It was shared by Mary Pardoe

Foster77 mathematics education which is the website of Dr Colin Foster. It includes many other very useful resources. It was shared by Nikki

Seeing an exercise as a Single Mathematical Object: Using Variation to Structure Sense-Making (Scroll down to the bottom of the page!) This is an article by Anne Watson and John Mason in which they discuss possible pedagogical roles of maths exercises. It includes the *taxicab distance* exercise which is an ordered set of small tasks ('questions') that most learners greatly enjoy suddenly and surprisingly seeing as a single object! It was shared by Mary Pardoe

Don Steward: mathematics teaching 10 - 16 which is where you will find all the wonderful resources from the late Don Steward. It was shared by Nikki

Practising Mathematics - Developing the Mathematician as Well as the Mathematics which is an ATM book by Dave Hewitt and Tom Francome. It is an inspiring collection of ideas for practising the content of the upper primary and secondary (KS2/3/4) mathematics curriculum. It was shared by Nikki

Mathematics Teaching 163 which is the ATM journal containing the article *Approaching Arithmetic Algebraically* by Dave Hewitt. The article was recommended by Tom Francome during a discussion (towards the end of the chat) about thinking of doing mathematics as cycling between specialising and generalising. It was shared by Tom Francome

Mathematical Tasks: The Bridge Between Teaching and Learning which is a book by Chris McGrane and Mark McCourt in which they explore a range of practical approaches, strategies

and principles behind the design and effective use of tasks in the mathematics classroom. It was shared by [Nikki](#)

[variationtheory.com](#) which is an valiant attempt by [Craig Barton](#) to assemble a collection of high-quality sequences of questions and examples using key principles from Variation Theory. It was shared by [Tan S](#)

[Open Middle](#) which contains problems that can be solved by reasoning in various different ways, some of which may be equally effective and 'elegant'. It was shared by [Peter Mattock](#)

[GCSE Mathematics Revision and Practice](#) which is a book by David Rayner containing mathematics exercises for students. It was shared by [Heather Scott](#)

[What makes great teaching?](#) which is a PDF version of an ordered set of PowerPoint slides for a conference presentation by Robert Coe about understandings that he believes are required in order to make decisions about education. It includes a slide that [George Stone](#) shared during the chat.