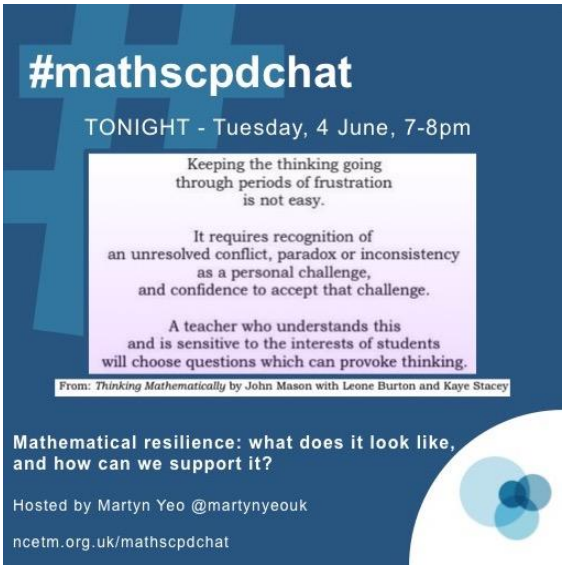
#mathscpdchat 4 June 2019

Mathematical resilience: what does it look like, and how can we support it?
Hosted by Martyn Yeo

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:

- pupils **'bouncing back' from mistakes** and persevering independently;
- pupils being prepared to **try more than one approach** when they are trying to solve a mathematical problem; that mathematical resilience is **more than just persevering** when finding mathematics difficult … that mathematical resilience has to do with willingness to try different approaches, rather than trying again and again using the same approach … that **pupils have to be taught to do this**, and that showing-by-example is effective;
- that mathematical resilience is required in order to **continue to search for 'an improved strategy'**, which involves finding what needs to change;

- pupils **'needing answers'** to problems rather than wanting to learn from their 'problem-solving-journeys' … ways of **turning around such pupil-priorities**;
- **motivation begetting resilience** … that the degree of a pupil's mathematical resilience depends on the pupil's judgements about how worthwhile will be the required 'making-of-an-effort'; **whether mathematical resilience can be learnt** … whether a pupil's mathematical resilience is merely a consequence of her expectation of success and her judgement about whether a particular learning-situation is worth being resilient in … whether resilience is merely 'determination in the face of adversity';
- whether it is helpful to make a **distinction between 'mathematical resilience' and 'everyday resilience'** … that any kind of resilience is strongly linked to beliefs about oneself … that you can be more resilient in some areas of your life than in others … that being 'low-in-energy' may result in low resilience;
- that being mathematically resilient includes knowing that 'there are problems I can solve, problems that I can't solve straight away but will solve eventually, and problems that aren't for me' … that **leaving questions unanswered at the end of a lesson** encourages pupils to go away and think about them;
- the responses on the ***Mathematical Resilience*** website (link below) to the question 'What is mathematical resilience?' … including, for example, pupils understanding the need to struggle mathematically, pupils holding a growth theory of learning (not believing that there is a pre-determined 'ceiling' to what they can do/know/understand), pupils knowing how to find support;
- that pupils who **see themselves as 'bad at maths'** (even temporarily) tend to give up or seek help quickly;
- whether **pupils who are used to succeeding** are the most resilient … or whether they (the 'rapid graspers'/'high achievers') are more resistant than other pupils to considering alternative approaches to a problem;
- that pupils (people) who are **used to solving problems quickly 'in their minds'** tend to be **'shocked' by being challenged to use different strategies**, to show reasoning/findings on paper, and to tackle problems for which reasoning to a solution may take a long time;
- that pupils who have experienced success by **routinely and repeatedly applying remembered procedures** to solve lots of very similar problems do not like being pushed out of that **'comfort zone'**;
- that problem solving becomes easier as a result of **searching more deeply for links** within mathematics;

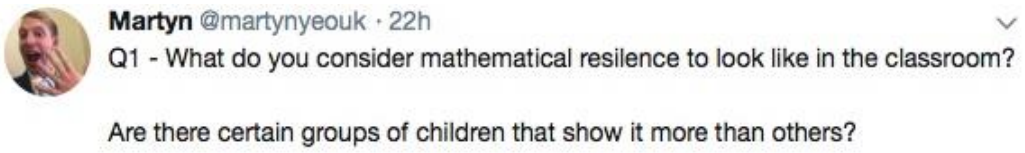
- that one of the most challenging aspects of teaching maths is **identifying tasks and problems that facilitate the growth of mathematical resilience** … e.g. finding problems that are 'almost out of a pupil's reach' and yet 'just within their reach' … finding problems that are sufficiently challenging without being 'off-putting' … that it is common for a teacher to underestimate the level of challenge that a pupil can cope with … that being 'over-protective' in estimating the appropriate level of challenge does not encourage mathematical resilience;
- gauging the type and level of teacher-input that enables a pupil to solve a problem while feeling that **she has solved it herself**, and to go on to solve new problems unaided;
- **not 'helping' pupils if you know they can do it** … using prompts such as 'what do you know?', 'what could you do now?' … then pointing out to pupils what they did by themselves;
- pupils' **fears of being 'slower than their classmates'** … how to combat this using strategies that make pupils more resilient … eg providing 'solutions' at which pupils can 'take-a-peek' while working at their own paces, … if they have used strategies that are different to those in the 'provided-solutions', this can result in pupils asking interesting questions that generate useful discussion;
- strategies that teachers can adopt in order to **encourage pupils to 'make a habit of' being mathematically resilient** … using 'show that the answer is …' rather than 'find the answer to …' … providing challenges where it's easy to understand the aim, even if finding a solution is not easy; pupils then expect to be successful because they see it as an 'easy' challenge … the resilience shown when they expect success can be made sufficiently habitual that eventually they become resilient even when the expectation of success is low;
- **coping with time pressures** … giving pupils some problems that they can solve quickly, some that they are unlikely to solve in one lesson, and some that they are unlikely to be able to solve at all … that is, taking-away time pressure by giving pupils unlimited time;
- showing to pupils **their own previous achievements** (that might have been 'captured' at an earlier time using technology);
- that the **classroom atmosphere** influences pupils' mathematical resilience … e.g. if it's OK to be wrong and so modify your approach, you become a more resilient problem-solver … also using lots of discussion, partner talk, group talk, whole-class talk, low-floor/high-ceiling tasks, free access to concrete resources, and so on;
- **using 'ask me a question such that my answer will get you unstuck'** … just thinking about what that question will be often removes the need for the pupil to ask

anything (gets them unstuck) … also using, ‘Stuck? Lucky you – a chance to learn something new!’;

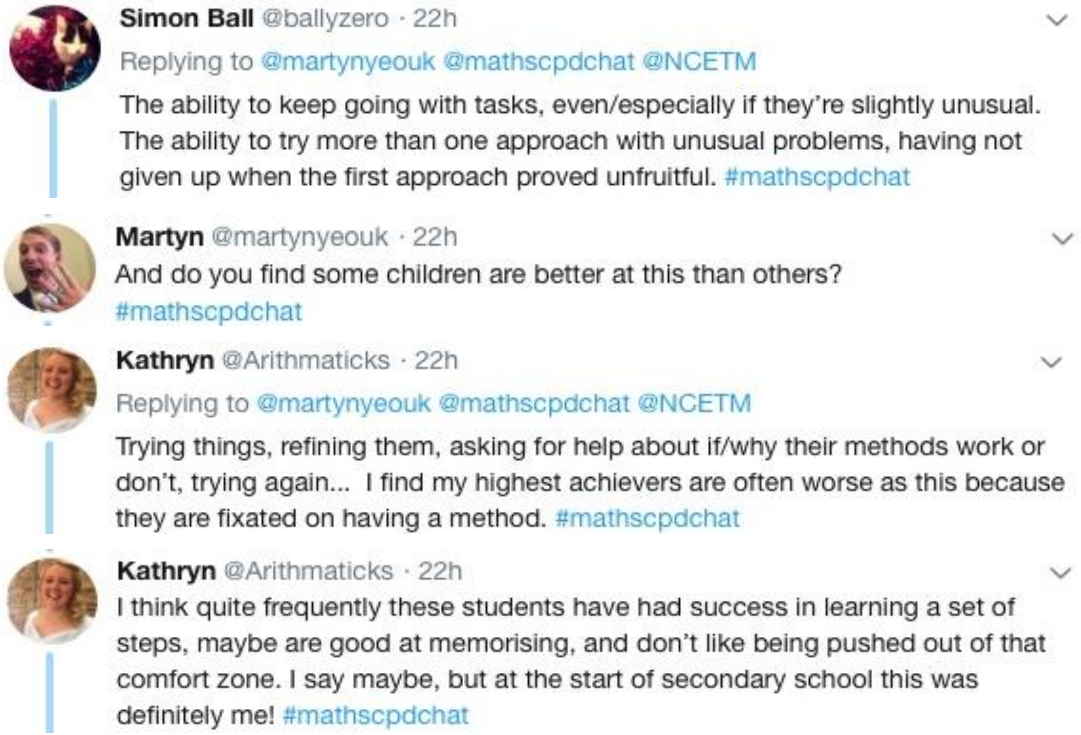
- focussing on **a test as ‘a collection of interesting problems to solve** … some you will be able to solve, with some you’ll be nearly there, and with some you won’t, and all these outcomes are OK!’;
- giving a **‘problem of the week’** beyond the scheme-of-work, and returning to it much later;
- counteracting **parents’ antipathy towards mathematics**;
- **teachers’ own mathematical resilience** … ‘modelling the behaviour you want pupils to display’ … being resilient ‘teachers of mathematical resilience’, e.g. persevering with looking for ways to encourage, facilitate and support pupils’ mathematical resilience;
- demonstrating (by modelling) that you **don’t have to ‘like’ an area of mathematics** in order to understand and value it;
- using **‘concept cartoons’** to show how/that many **other people can be wrong-at-first**;
- a **‘four mindsets’** (self-efficacy, growth, belonging, purposes) explanation of pupils’ (people’s) abilities to learn;
- that there is no evidence that simply saying to pupils ‘you can do anything’ teaches them to adopt a **growth mindset**;
- whether the idea that the brain ‘changes’ when a person learns from (experiences that result from) making a mistake has been ‘debunked’ … that **simplistic ‘growth mindset’ theories need to be modified** by knowledge about more serious research;
- that in ‘real life’ **we choose ourselves which problems we want to solve** and which we want to leave alone!

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

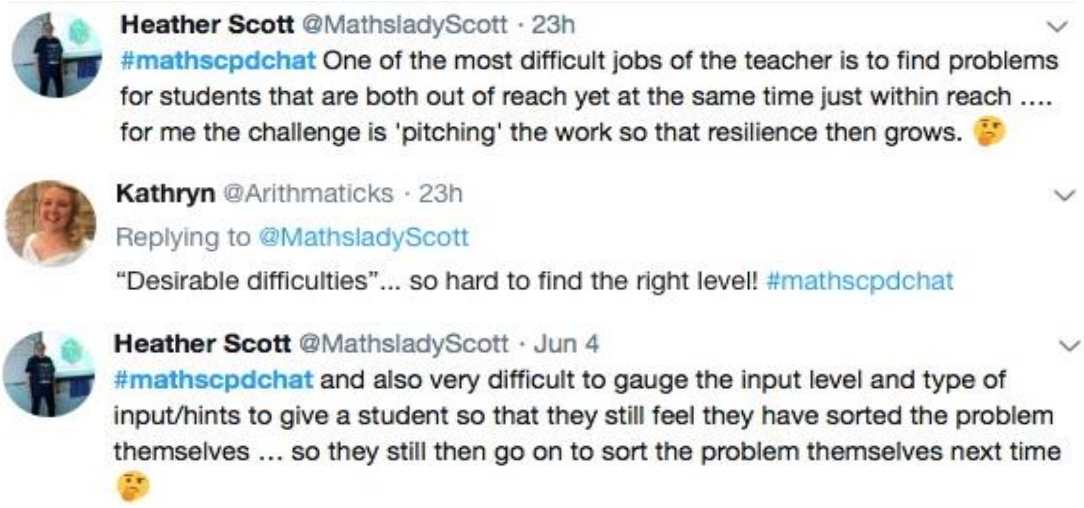
This is part of a ‘conversation’ of tweets, about how pupils show mathematical resilience, why some pupils are less resilient, and choosing problems that help pupils develop resilience. The conversation was generated by this tweet from Martyn Yeo:



including these from Simon Ball, Martyn Yeo and Kathryn Darwin:



and these from Heather Scott, and Kathryn Darwin:



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

Among the links shared were:

The Mathematical Resilience website, which was set up in 2014 by Clare Lee and Sue Johnston-Wilder. The site aims to help all those interested in enabling people to learn and use mathematics to find out about how focusing on developing mathematical resilience can enable more people to take a positive stance towards learning mathematics. It was shared by Mary Pardoe

Mistakes, Mindsets and Mathematics which is an article about developing effective learners by David Bowman in *Impact, The Journal of the Chartered College of Teaching, 2018*. It was shared by David Bowman

Language for Learning Mathematics: Assessment for Learning in Practice by Clare Lee which is a book providing practical advice, supported by researched theory, about using mathematical language powerfully in the classroom in order to support learning. It was shared by Gerry McNally

Maths: See Where It Can Take You which is an interactive poster, from St Joseph's High School, Cumbria. It shows how skills such as problem-solving skills and mathematical resilience are key skills for employment within areas such as Architecture, Navigation, Music, Aerospace, and so on. It was shared by Martyn Yeo

#YesUCan Toolkit is an area of the GLOW Maths Hub website that supports schools to develop positive mathematical mindsets of children, students, teachers, leaders and parents. It was shared by David Bowman

Domino Square which is a task from NRICH, designed to 'test' pupils' thinking and mathematical resilience. It was shared by Martyn Yeo

What's it Worth which is a reasoning task from NRICH which requires pupils to make choices about effective approaches and 'paths' to the solution. It was shared by Martyn Yeo

15 ideas for promoting positive attitudes to maths which is a PDF resource developed by Maths Week London. It provides '15 great ideas to show students how much they can enjoy maths'. It was shared by Mary Pardoe.