



Mathematics Resilience

Clare Lee, Sue Johnston-Wilder and the MR rest of the team

<http://www.mathematicalresilience.org/>

Programme

10:30-11:40	Talks – Clare Lee, Mathematics Resilience; Mike Ellicock, National Numeracy; Sue Johnston-Wilder, The Gatsby Report	
	Brief break	
12:00	Seminars in two different venues on the work in different areas	
1:00	Lunch	
1:45	Meena Kotecha – Building resilience in mathematics and statistics	
2:10	Working Groups	
3:20	Plenary –reporting back	

What is Mathematics Resilience?

- The construct we call mathematical resilience (Johnston-Wilder and Lee 2008 , 2010, 2013) is a positive adaptation that allows people to overcome barriers that frequently present when learning mathematics.
- Mathematical resilience is a pragmatic construct designed to give those concerned with helping people learn and use mathematics something to work for, something to develop in learners to counter many historic and current destructive influences.
- Paying attention to mathematical resilience increases pupils' willingness to engage with mathematics.
- Mathematical resilience allows students to become mathematical thinkers – it works against mathematical anxiety.

Pervasive Negative Constructs

- Mathematics anxiety and phobia (Ashcraft, 2007; Newman, 2004)
- Unwitting cognitive abuse
- T.I.R.E.D. mathematics teaching (Nardi & Steward 2003)

Nardi, E., & Steward, S. (2003). Is Mathematics T.I.R.E.D.? A profile of quiet disaffection in the secondary mathematics classroom. *British Educational Research Journal*, 29(3), 345–366.

Adversity when learning mathematics?

- When we have observed teaching we have seen that learning mathematics presents learners with adversity:
 - For example:
 - over-regard for rapid technical performance
 - under-regard for understanding
 - particular reliance on memory
 - mathematics as chameleon

Pervasive Destructive Influences

- The culture of fixed mindset (Dweck 2000) – that mathematics is hard and only for the few.
- The culture of anxiety and helplessness in the face of mathematics is so ingrained in our society that it is difficult to overcome in adults and is readily passed on to children. Such thinking about maths is so prevalent, it has become the norm, and so people think it is normal!
- Current systems of assessment tend to mitigate against development of Mathematical Resilience.

Mathematical resilience is a positive affective stance to mathematics

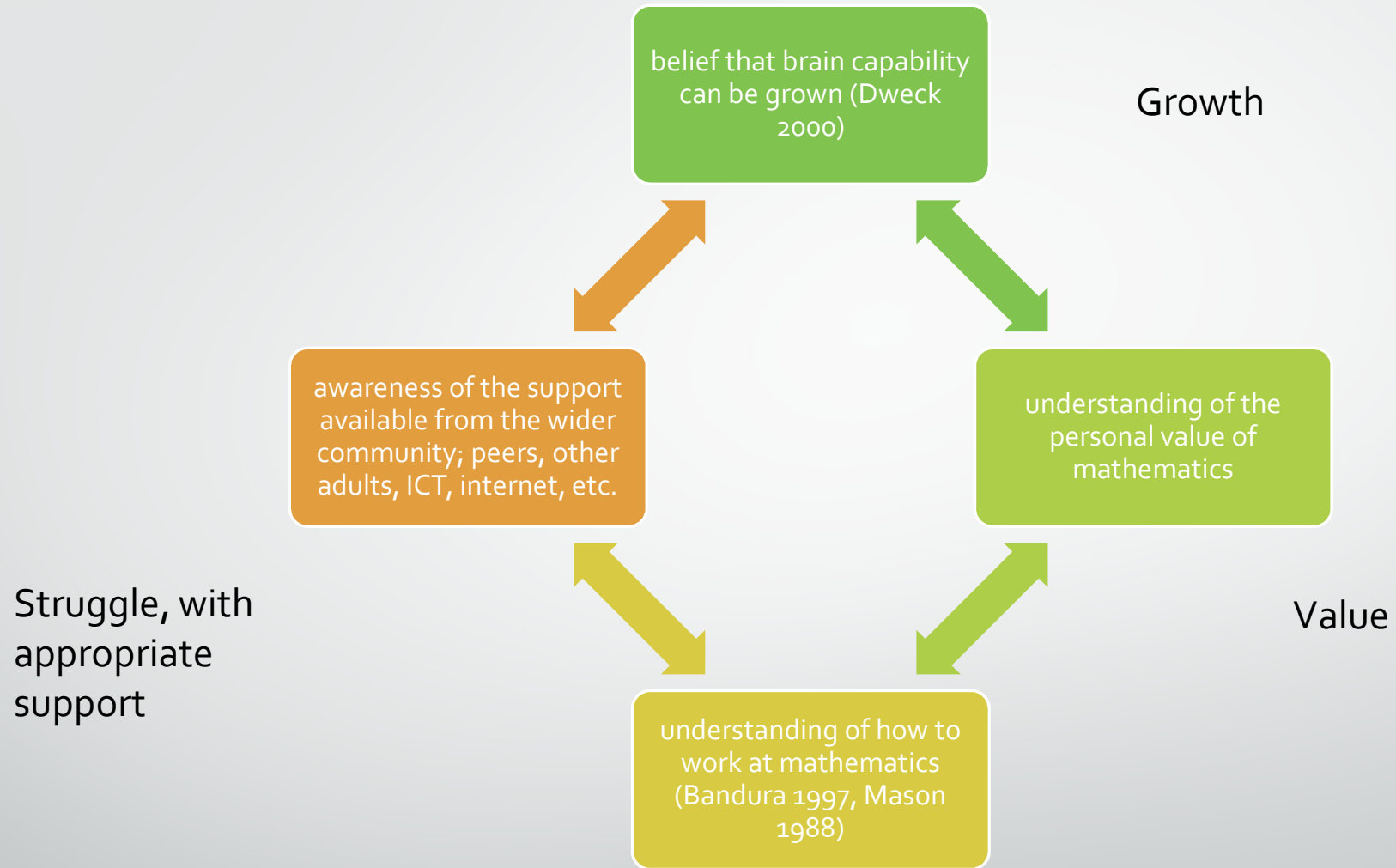
- Pupils who have mathematical resilience will:
 - Persevere, seeking appropriate support , when faced with difficulties, (Lee & Johnston-Wilder, 2013)
 - work collaboratively with their peers (Swan 2009);
 - have the language needed to express their understandings, misunderstandings and questions (Lee 2006);
 - have a growth theory of learning (Yeager and Dweck 2012), that is they will know that the more they work at mathematics the more successful they will be.

Kooken's questionnaire

- Janice Kooken's questionnaire and extensive survey confirms and allows the measurement of three affective dimensions when studying mathematics: value, struggle and growth
 1. **Value:** the belief that mathematics is a valuable subject and is worth studying,
 2. **Struggle:** the recognition that struggle with mathematics is universal even with people who have a high level of mathematical skill,
 3. **Growth:** the confidence that all people can develop mathematical skill and the belief that everyone can learn more mathematics with effort and support.

She further tested for resilience as a separate but interrelated factor but found that resilience itself reflected aspects of the other three dimensions and hence was not a dimension in and of itself.

Kooken, J., Welsh, M., Mccoach, B., Johnston-Wilder, S. and Lee, C. (2013) Measuring mathematical resilience: an application of the construct of resilience to the study of mathematics. In: AERA 2013, San Francisco, California, 27 Apr-1 May 2013



The Four Factors in Mathematics Resilience

What fosters mathematical resilience?

The literature suggests that this positive adaptation to mathematics can be developed through allowing learners to:

- develop the vocabulary and phraseology that allows expression of emergent mathematical ideas *for themselves*;
- experience experimenting (playing) with mathematical ideas *for themselves* eg using ICT,
- see *for themselves* that all mathematics is connected
- experience a focus on mathematical thinking and reasoning
- build a willingness to persevere/struggle
- hold a belief in mathematical growth

Current work in Mathematics Resilience



In Schools



With parents



Mathematics resilience coaches



In schools

Mathematically resilient learners ...

- are willing to seek help
- know how to ask questions
- see asking as clever and understand that persistent asking allows them to become even more clever
- take responsibility for their own understanding
- actively seek understanding
- know how to get help
- know it is good to help others

In schools

Mathematically resilient learners:

- know they have the right to understand
- know that learning mathematics may involve struggle
- refuse to feel mathematically stupid
- refuse to feel mathematically isolated and are willing to share their energies
- feel part of a mathematical community
- refuse to just accept

In schools

Therefore to develop mathematical resilience learners must:

- be encouraged to talk about mathematics and have the skills to do so;
- be given opportunities that ask for thinking and reasoning and exploring mathematical concepts;
- consolidate ideas and develop fluency through meaningful practice;
- develop a growth mindset and lose the fixed mindset;
- collaborate when learning;
- have choice, independence and the opportunity to experiment, make mistakes and grow as a mathematician.

In schools

Therefore to develop mathematical resilience learners must:

- Work within a social constructivist domain – using talk and collaboration in learning
- Understand incremental learning theory (Dweck)
- Work within an awareness of situated cognition – support one another, learn from one another, explore mathematical concepts, experiment and learn in context.

In schools

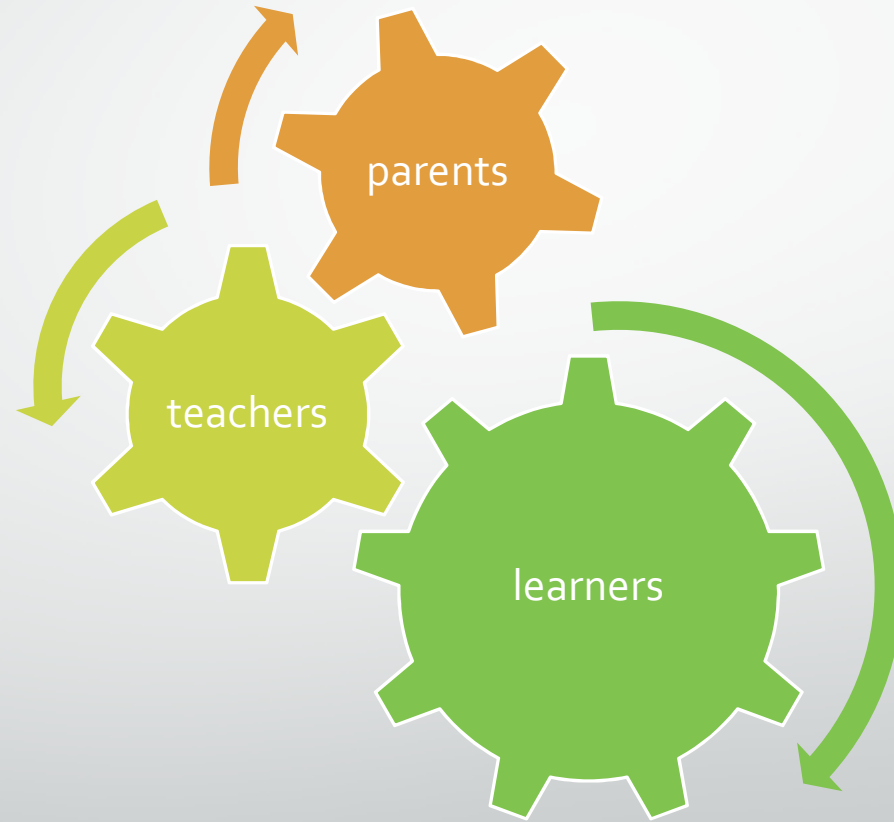
In tasks that build resilience ...

... learners must:

- have independence and a focus on a challenging task;
- work collaboratively (Swan 2006) not just work in a group;
- be active and harness their energies constructively;
- articulate their ideas clearly;
- see the learning happening for themselves;
- engage in repetition and consolidation of ideas but in the right task these come naturally;
- have an end product to work towards.

With parents

Building
Mathematics
Resilience



Mathematics Resilience Coaches

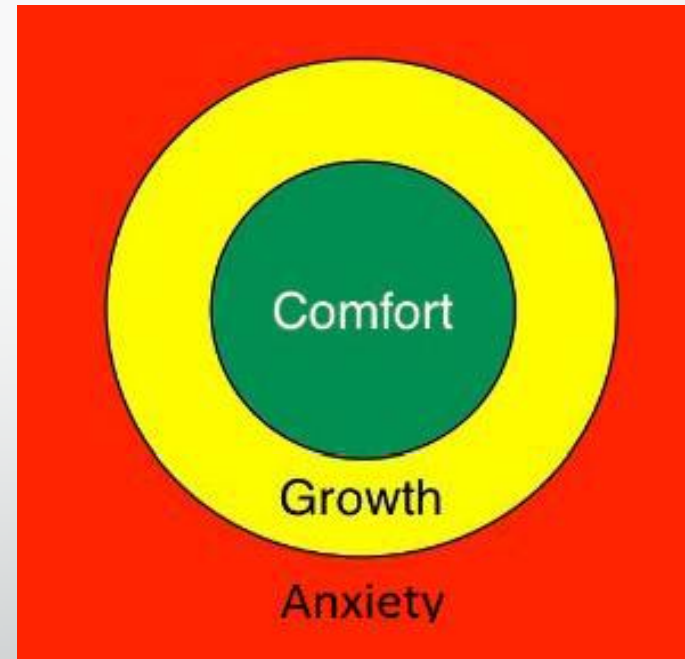
First have to build their own mathematics resilience

Must understand personally that struggle is part of learning mathematics

Are a key part of tackling mathematics anxiety in the working population

Mathematical Resilience Coaches

The “Growth Zone” ideas have a key part to play in developing and coaching for mathematics resilience



Strand A	Lecture Theatre A
Promoting Mathematical Resilience in Learners	Kath Grant
Parenting and Teaching for Mathematical Resilience; National Numeracy approach	Sarah-Jane Gay Els de Geest
Strand B	Lecture Theatre B
Coaching for Mathematical Resilience	Liz Garton
Parenting for Mathematical Resilience	Dr Janet Goodall/ Dr Rosemary Russell

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