Halswell School

Parent information evening

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UC Education *Plus*

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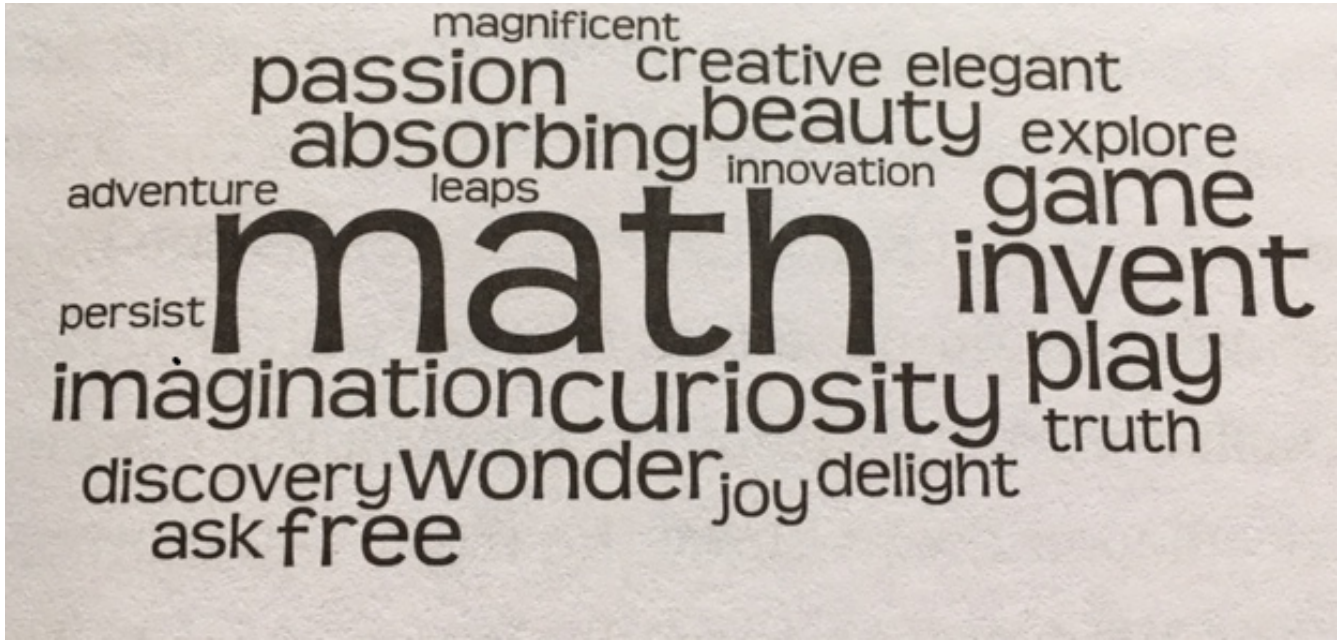
Whakatauki

Ehara taku toa i te toa takitahi,

engari he toa takitini.

Success is not the work of one, but the work of many.

Words used to describe mathematics



Mathematics is the 'study of patterns'. 'All mathematicians…would agree that maths combines creative thinking with critical thinking.'

Steve Strogatz, Professor of Applied Mathematics, Cornell University

How maths has changed

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Maths ≠ calculations
Maths >> calculations

(Conrad Wolfram, Wolfram Alpha)

We need children to

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- Be curious
- Ask questions
- Form conjectures
- Form models (use diagrams)
- Reason
- Problem solve
- Extend tasks, go beyond them
- Communicate their thinking and question the thinking of others
- Collaborate
- Seek connections

(Marian Small; Jo Boaler)

Growth mindset

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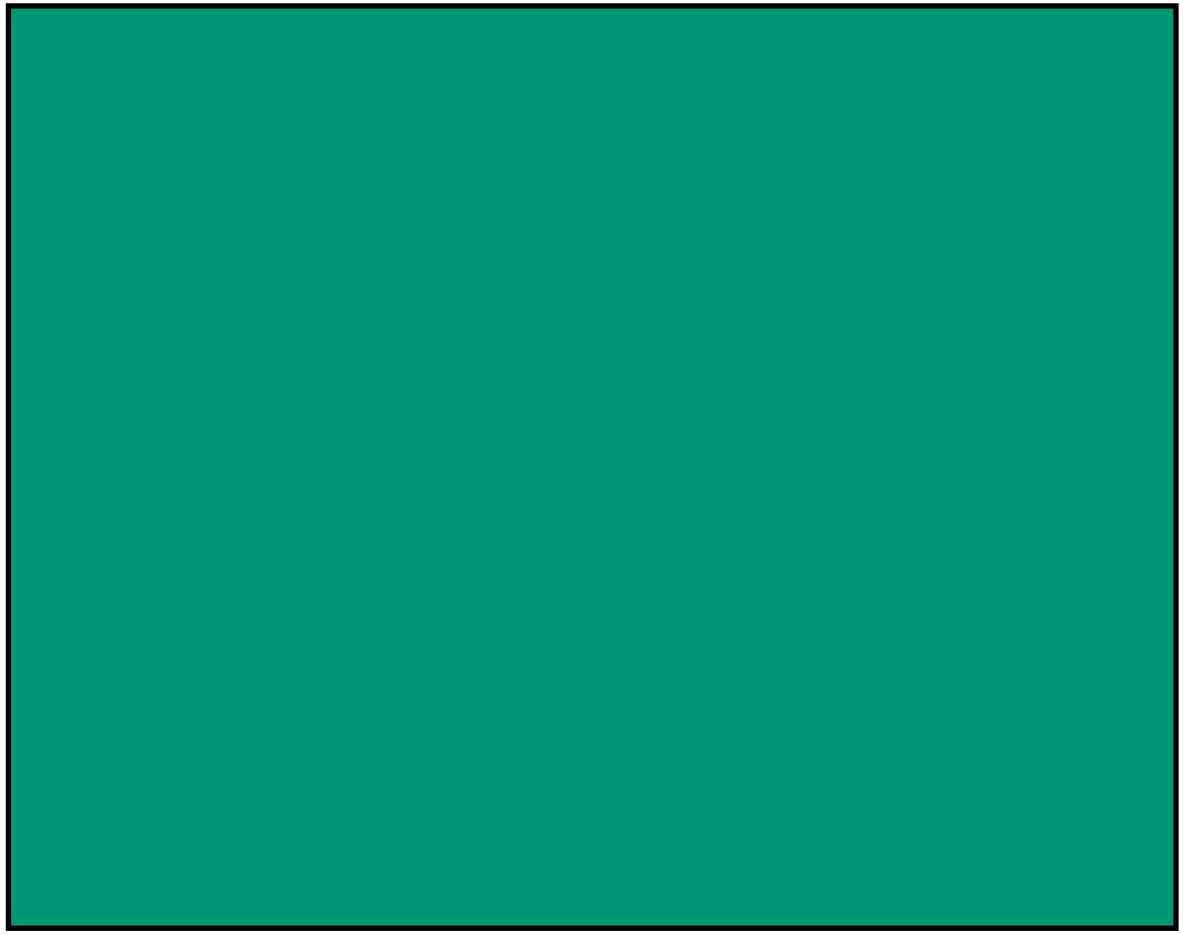
- We used to think some people had a maths brain, and others didn't.

Now we know (through brain research and MRI imaging):

- 'No one is born knowing math, and no is born lacking the ability to learn math.' (Jo Boaler)
- When we make mistakes our brain sparks and grows – the brain is challenged
- Growth and fixed mindset

To be finished



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https://www.youcubed.org/resources/solving-math-problem/

Flexible thinking/number sense

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Research by Gray and Tall found that the difference between high and low achievers wasn't that the high achievers knew more; it was that they engaged in flexible thinking.

Gray and Tall (1994)

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The two groups were asked to solve the same problems:

61% of above average students used number sense.

No below average students used number sense.

In comparison, 94% of below average students counted.

Flexible thinking/number sense

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Given a problem like 21 - 6

Higher achieving students made it easier by:

- Changing the problem to 20 – 5
- Subtracting one from 21 and then the 5

Low achieving students

- Counted backwards, starting at 21 and counting down (difficult and prone to error)

We used to…

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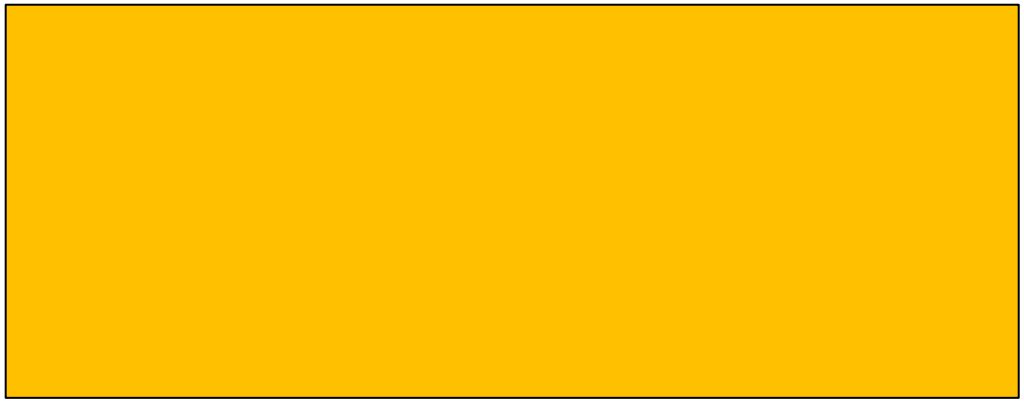
Solve problems like this:

What is the area of this rectangle?

12

4



Now we…

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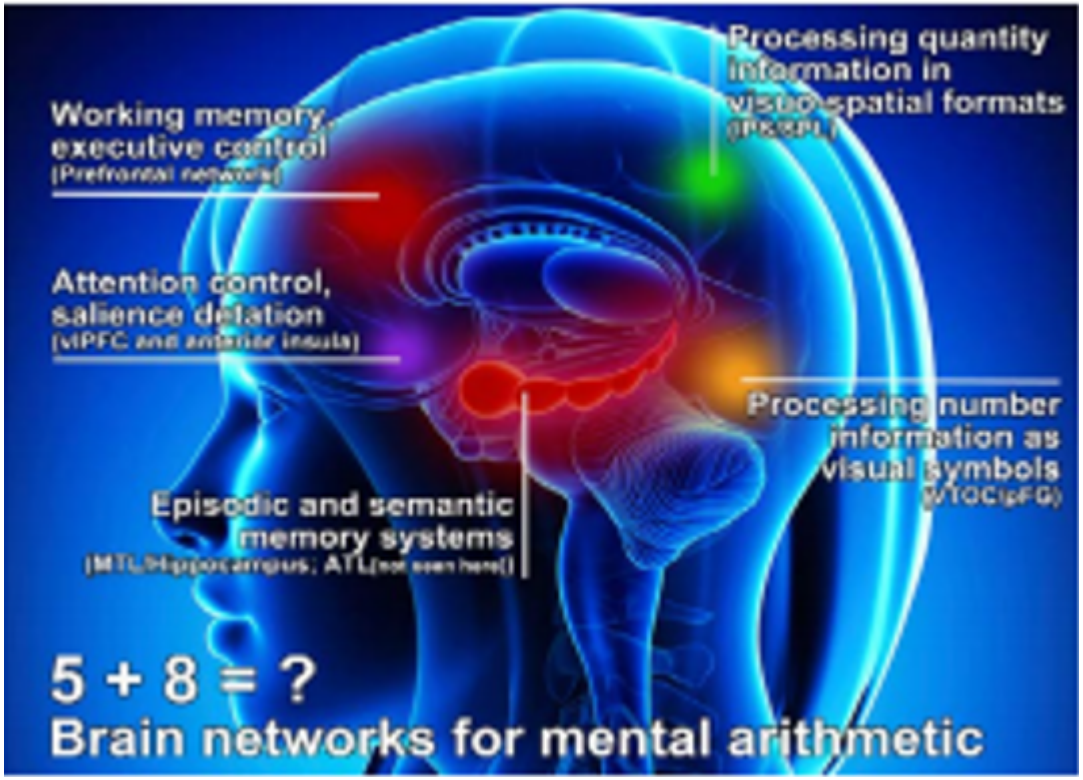
Ask open problems, that can be solved at a number of levels.

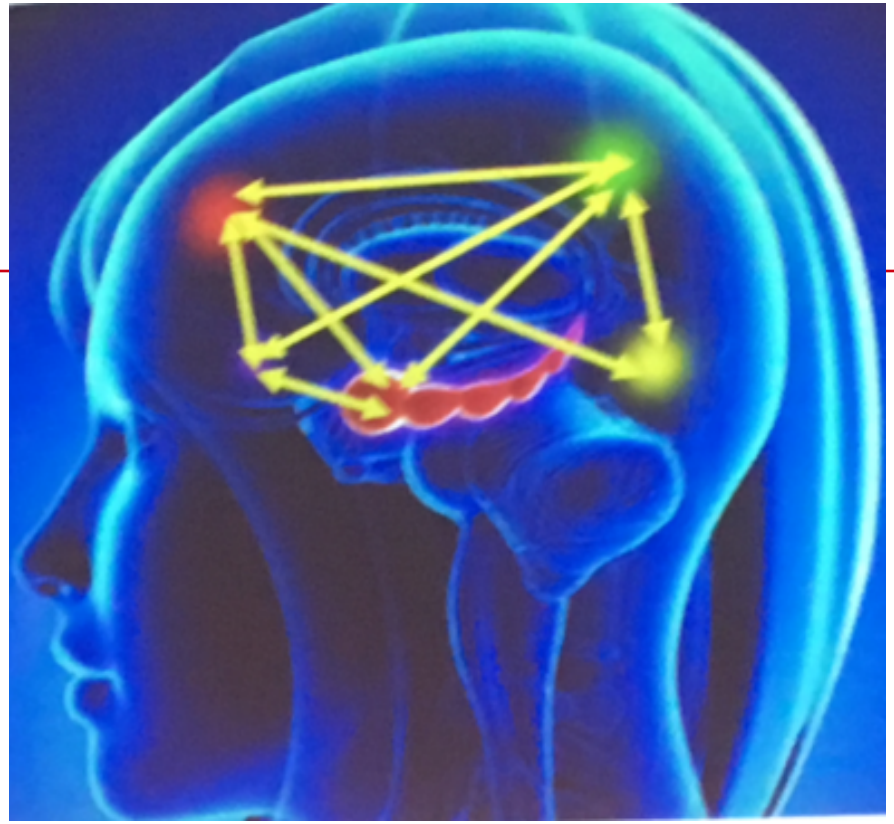
Use materials, or draw diagrams to show your thinking:

A rectangle has an area of 24 cm^2 (or 24 squares). What might it look like?

Brain connections



Menon (2014), Brain networks for mental arithmetic in brain mapping: An encyclopedic reference



- We develop and strengthen brain connections when maths is experienced differently: numbers, visual, movement, building, tables, graphs, diagrams, algorithms, words, sounds.
- Interconnected brains are the most powerful.
- Creative, flexible thinking is what is most important.

Maths is collaborative

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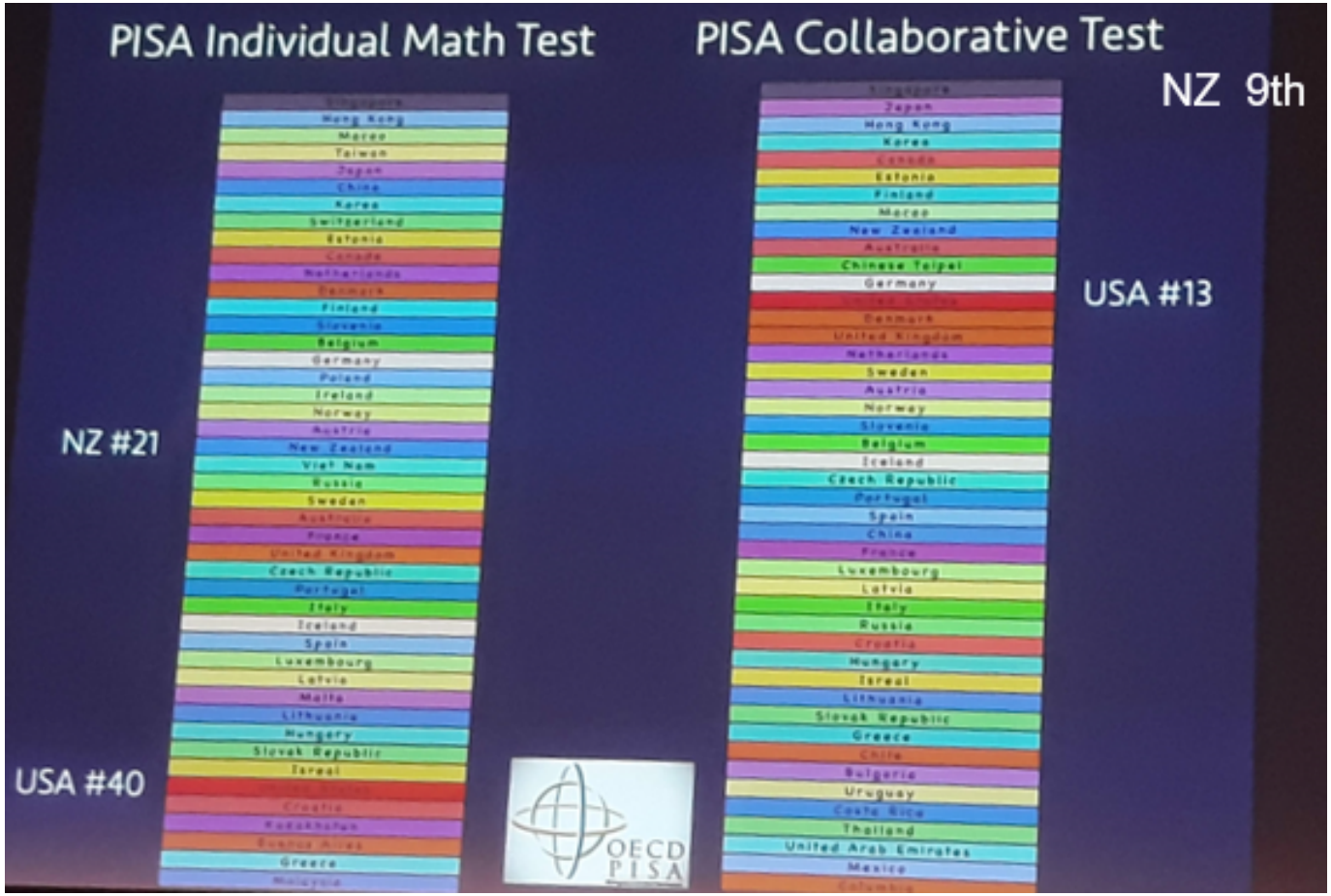
Mathematicians prove theories through mathematical reasoning. They need to produce arguments that convince other mathematicians by carefully reasoning their way from one idea to another, using logical connections. Mathematics is a very social subject, as proof comes about when mathematicians can convince other mathematicians of logical connections.

PISA Collaborative Problem Solving – students interact with computer 'agents' to solve complex problems


PISA Individual Math Test
PISA Collaborative Test
NZ 9th
NZ #21
USA #13
USA #40
Singapore
Hong Kong
Macao
Taiwan
Japan
China
Korea
Switzerland
Estonia
Canada
Netherlands
Denmark
Finland
Slovenia
Belgium
Germany
Poland
Ireland
Norway
Austria
New Zealand
Viet Nam
Russia
Sweden
Australia
France
United Kingdom
Czech Republic
Portugal
Italy
Iceland
Spain
Luxembourg
Latvia
Malta
Lithuania
Hungary
Slovak Republic
Israel
Croatia
Kazakhstan
Buenos Aires
Greece
Malaysia
Singapore
Japan
Hong Kong
Korea
Canada
Estonia
Finland
Macao
New Zealand
Australia
Chinese Taipei
Germany
United States
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United Kingdom
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Russia
Croatia
Hungary
Israel
Lithuania
Slovak Republic
Greece
Chile
Bulgaria
Uruguay
Costa Rica
Thailand
United Arab Emirates
Mexico
Colombia
OECD
PISA

Seeing algebra differently

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- What was your experience of algebra at school?
- What was your reaction to that way of teaching or what was the outcome for you?

What is algebraic thinking?

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- Algebra is about making sense of patterns and making a statement that describes the pattern you see.
- People can see different patterns .
- Mathematicians who can see patterns visually as well as numerically can make deeper connections to the problem.
- There is no rush to get to the algebraic rule.

Jo Boaler

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- Research of Kieran and Comfrey - we need to teach algebra in a way that highlights the structure in a pattern or situation (structural algebra).
- The way algebra is taught in most schools is procedurally – solving for 'x' – where 'x' stands for a single answer.

Tug of war – working collaboratively

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- Work with the people around you.
- Use materials and/or diagrams to explain how you are working to solve the problem.

Animal tug of war

Four oxen are as strong as 5 horses (there was a tie)

One elephant was is as strong as one oxen and 2 horses

The third tug of war was between one elephant and three horses on one side and 4 oxen on the other side. Who wins?

Anxiety and maths

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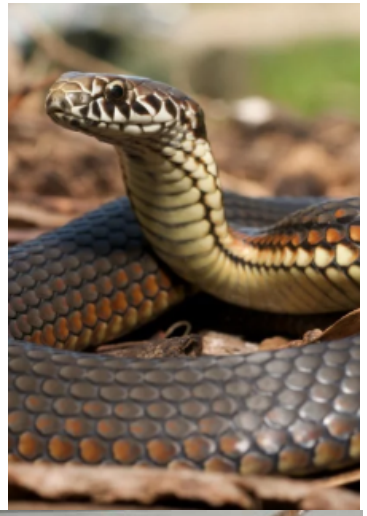
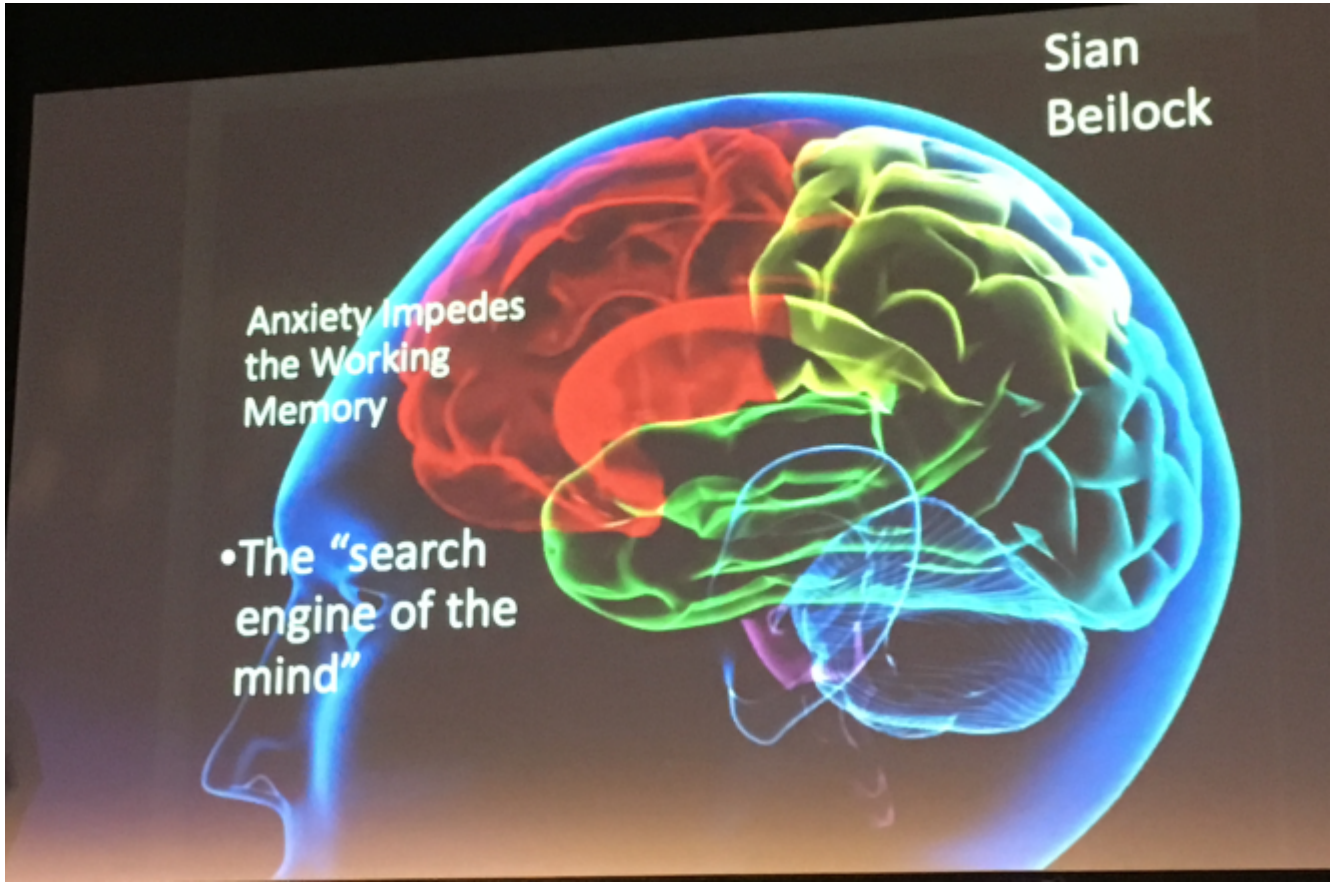
When people with maths anxiety see numbers

A fear centre lights up that
is the same fear centre that
lights up when we see snakes
and spiders



At the same time, the problem
solving centres shut down


Sian Beilock
Anxiety Impedes the Working Memory
•The "search engine of the mind"

To be good at maths ≠ being fast

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- Speed is the enemy of deep flexible thinking
- Timed tests lead to maths anxiety
- Timed tests are a barrier to deep understanding
- Memories are strongest and best when they access knowledge that is built in different parts of the brain, connected, rich and multi-dimensional

Now we know that…

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Some children memorize well.

Others feel anxious about maths, or about having to calculate a correct answer quickly, or not having time to think.

What about basic facts?

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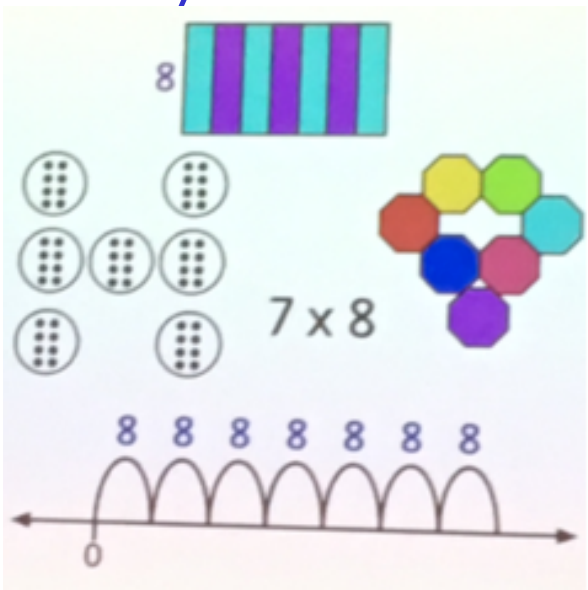
Facts remain important.

Now we realize that a child is much better off if they have built powerful connected memories, and if they have tools to help them recall something they have forgotten – if they have strategies (and number sense).



So how can you help?

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- Encourage your child to explain how they solve problems.
- Encourage your child to play – puzzles, blocks, games, Lego.
- Einstein called play 'the highest form of research'.

Look at everyday things:

- Cutlery in the draw ?
- Trees on the street?
- Windows in our house?
- Number of our house?
- Looking for patterns – arrays.

Interesting questions

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- How long is long hair?
- How far can you go in 100 steps? (How far can I go? Why are they different?)
- What would be a lot of people to put in our car?

Finally…

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- Never tell your child that you were bad at maths at school!

https://nzmaths.co.nz/maths-our-house

Dan Finkel
https://www.youtube.com/watch?v=ytVneQUA5-c