Managing Year 5 Mindset, Mastery and Motivation in Mathematics: Adaptability to the power of 3

Deb McKay

Prince Alfred College

Further Information

This poster and further information is available at http://www.theibsc.org/

Researcher's Email: dmckay@pac.edu.au

Research Question

How might intentionally designed teaching strategies cultivate positive attitudes and flexible approaches to Mathematics in Year 5 boys?

Research Context and Participants

Prince Alfred College (PAC) is an independent boys school in Adelaide, South Australia. Established in 1869, it is affiliated with the Uniting Church and is an accredited International Baccalaureate school.

Approximately 1100 boys, including boarding and international students, aged between 2 and 18 years old attend PAC. Our school is guided by the motto:
Do brave deeds and endure and the values: *Work Hard - Be Kind.*

The participants were my Year 5 class - 19 boys, aged 10 and 11.

The Research Action

Three components of adaptability were central to the project:

BEHAVIOURAL adaptability - Adjusting one's actions or behaviour in response to uncertainty.

COGNITIVE adaptability - Adjusting one's thinking.

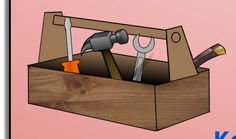
EMOTIONAL adaptability - Adjusting one's positive and negative emotions.

The boys revisited growth mindset and also watched "Youcubed" videos that challenged negative mathematical mindsets. They approached adaptability from many different angles and came to see its value in Maths and life.

Strategic and explicit mathematical instruction ensued with a focus on number sense and problem-solving. A Mathematics expert-in-residence also provided problem-solving guidance and opportunities. The plan included:

- **Goal-setting**
- **Explicit teaching**
- **Practice**
- **Self-regulation (metacognition)**

It's fun to learn all the interesting strategies and patterns and their connections.

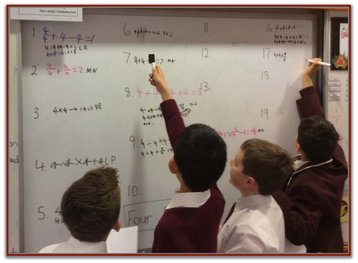


Problem-Solving Tool Kit

This helped the boys connect with and make use of diverse problem-solving strategies.

Key Readings

- Martin, A. (2013). *Coping with change: Teaching adaptability will help kids grow.* Retrieved from http://theconversation.com/coping-with-change-teaching-adaptability-will-help-kids-
- Hattie, J. A., Fisher, D. B., Frey, N., Gojak, L. M., Delano Moore, S., & Mellman, W. L. (2016). *Visible Learning for Mathematics, Grades K-12 : What Works Best to Optimize Student Learning* . Thousand Oaks, US: SAGE Publications Inc.
- Gregory, G. and Kaufeldt, M. (2015). *The Motivated Brain: Improving Student Attention, Engagement and Perseverance.* ASCD, Virginia, USA



Collaboratively solving the Four-4's challenge - proving and disproving the accuracy of their equations.

Today's Number is 15 … having fun while working with numbers.

Working with our Mathematics expert-in-residence, Anthony Harradine..

Data Collection

Two **questionnaires** were given to begin the project and again at the conclusion and the results compared.

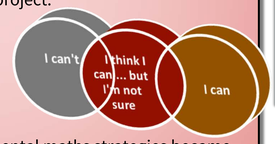
Observation, conferencing and field-note writing were used throughout the project.

Photographs and video captured information regarding the boys tasks and engagement and provided a useful ongoing record.

Work samples were a powerful means of data collection; outlining the boys' strategies and Mathematical processes, recording methods, accuracy and errors in calculation as well as the amount of work completed in lessons.

An **on-line survey** concluded the project.

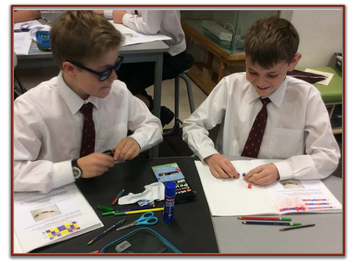
Data Analysis



Three levels of mindset were identified ...

Deficiency in number-sense and mental maths strategies became apparent. Systematically teaching mental maths and problem-solving strategies to the boys resulted in:

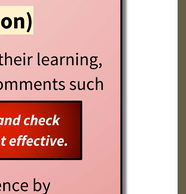
- **Greater mental maths scores and strategy use**
- **Application of various strategies in problem-solving**
- **Increased contribution of mathematical knowledge and ideas from a broader range of boys**



Using 'hands-on' resources to solve a problem and utilising the 'visualisation' strategy to record the process.

Watching 'Youcubed' videos about Mathematical Mindsets

Using playing cards in a fractions number game.



Key Findings and Discussion

Three main themes emerged:

1)Mindset and Valuing Adaptability (Mindset)

Lessons on mindset and adaptability resulted in the boys being more conscious of growing their capabilities through hard work and being willing to fail.

Evidence of **adapted "I can't" mindsets:**
- **Significant reduction in apprehension of tasks**
- **Independence and perseverence with tasks**

I feel excited about maths. Before I came to PAC I hated maths.

Evidence of **adapted "I'm not sure" mindsets:**
- **Contributing more to class discussions**
- **Peer teaching their strategies**

You feel happy when you can work something out.

Evidence of **adapted "I can" mindsets:**
- **More articulate explanations of maths processes**
- **Seeking more extension challenges**

It's good to struggle in maths because you can learn a lot when you finally understand.

The boys learned that **finding maths solutions need not be rushed** and that **thinking deeply will foster new maths discoveries.** Behavioural adaptation was evident in broader, more successful strategy use.

2) Competence and Confidence (Mastery and Motivation)

Explicit teaching and deliberate practice, bolstered confidence and motivation. Cognitive and emotional adaptation was evident with comments such as:
"I felt like I would not be able to do this, and it would be too hard, but at the end of the task I felt good because I got it."

I realised I am smarter than I expected.

3) Self-Regulation and Reflection (Metacognition)

In reflecting on the behaviours which helped or hindered their learning, the boys became more discerning and mindful, making comments such as: ***"I should have been more focussed."***

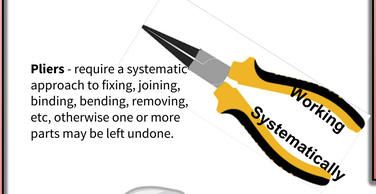
Guess and check was not effective.

Conclusions

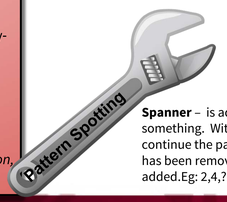
Fostering adaptability is a journey which requires persistence by students and teachers alike. This project concluded that:
- **Intentionally designed teaching strategies and experiencing success cultivated positive attitude to Mathematics in the boys.**
- **The boys adapted their strategy-use to 'best fit' problems.**
- **Sharing the journey with colleagues is empowering**

A significant conclusion drawn from this project:

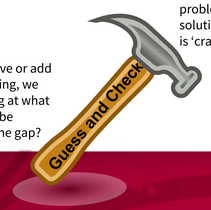
Teacher adaptability is crucial for successfully impacting students.



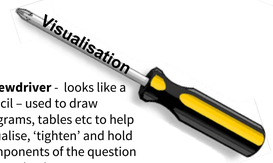
Pliers - require a systematic approach to fixing, joining, binding, bending, removing, etc, otherwise one or more parts may be left undone.



Spanner – is adjusted to remove or add something. With pattern spotting, we continue the pattern by looking at what has been removed or needs to be added.Eg: 2,4,? 8. What fits in the gap?



Hammer away at solving a problem until you hit on a solution and the problem is 'cracked'/solved.



Screwdriver - looks like a pencil – used to draw diagrams, tables etc to help visualise, 'tighten' and hold components of the question to be solved.

Chisel - A chisel is usually tapped *away* from the user. In a manner of speaking the chisel is working backwards.

Measuring Tape - Reasoning logically is like having a "measured" approach to the problem. Size up what is known and what you need to know.

International Boys' Schools Coalition Action Research Program 2017 – 2018: Adaptability in a Changing World