Self-Reg Reframing: Why and how the theory of Self-Reg leads us to reframe leading issues in education

Dr. Stuart Shanker
Our Problem Today:
The Self-Reg view of the Math Decline

We have seen a significant decline in Grade 3 and Grade 6 EQAO Math scores (7%)

Tied to the sharp increase in High Math Anxiety

Self-Reg questions: Why is this happening, and How does Self-Reg respond?
Caught in a Stress Storm

Ministries and trustees inundated with reports about how we are falling behind

And a constantly growing number of young learners with math anxiety (HMA)

Researchers struggling to understand why the “fixes” aren’t fixing

Alarmist media

Parents worried about their children’s future

Teachers and administrators struggling to deal with the demands being placed on them, not least of which are the constant changes to the curriculum
The Decline in Math

If ever there was an issue that needed to be looked at through the lens of Self-Reg, it’s the debate over the steady decline in EQAO math scores.

Prompted a kneejerk reaction that somebody somewhere needs to start making more of an effort: Is it the kids? Their parents? The teachers? The teachers’ teachers? The curriculum boffins?

Big part of the problem here that our thinking about this issue has remained predominantly Blue Brain and not Triune.
The Evolution-Designed Brain

- Reptilian Brain
- Limbic System
- Neocortex
Neuroception

Limbic system scans environment for signs of safety or threat

Threat-detection (Amygdala) is non-conscious

Triggers behavioural, physiological, and neural response (arousal)

Impact:

- Hypervigilance
- Poor discrimination of threat vs. safety
- Escape or avoidance
- Negative bias
Stress and Arousal

Heightened stress leads to arousal in four domains:

- Physiological
- Neural
- Psychological
- Emotional

Arousal leads to kindled threat-detection
Kindled threat-detection exacerbates arousal
Shift from Blue Brain to Red Brain dominance
5 Self-Reg Domains: Stressors

- **Biological**: Noises, crowds, too much visual stimulation, not enough exercise, lack of sleep, junk food
- **Emotion**: Strong emotions, both positive (over-excited) & negative (anger, fear)
- **Cognitive**: Difficulty processing certain kinds of information
- **Social**: Difficulty picking up on social cues, or understanding effect of behaviour on others
- **Prosocial**: Difficulty coping with other people’s stress; sense of injustice (may include misinterpreting stress behavior as misbehaviour)
Emotional, social, and prosocial stresses: poor self-esteem and self-confidence, negative math experiences, gender and racial stereotypes, the effect on students of teacher or parental anxiety

Anxiety breeds anxiety

The more anxious the student, the more drawn to maladaptive coping strategies (e.g., avoidance), which results in even greater anxiety down the road

The more anxious the adult trying to help the child, the more anxious the child becomes, and vice versa;

Greater the societal anxiety the more all of the above are exacerbated
Root of the Problem

Math is a cognitive stress.

Western educators have intuitively known this fact about math for well over a thousand years, if not considerably longer.

But only recently have we begun to understand the cognitive reasons why it’s such a big negative stress for some and positive stress for others.
Strain on Working Memory

Math makes considerable demands on working memory.

Common amongst students with HMA: problems in number sense, counting, subitizing, comparing the magnitude of two numbers.

Cognitive deficits result in anxiety: direct impact on working memory, performance.
Blue Brain View of the Problem

On “dual-task” paradigm, working memory is said to be divided between math task and intrusive thoughts.

The reason why reappraisal or mindfulness exercises improve math scores in older students – if and when they do – is because these practices reduce intrusive thoughts and thereby restore working memory to full capacity.

Self-Reg paints a more complex, Triune picture of what is happening here – and accordingly, how to address the roots of the problem.
The Cost of Cognitive Stress

- The more stressful a task, the more glucose consumed
- Student with poor numerical processing finds math stressful in the same way that a child with poor phonemic awareness finds reading stressful
- Not simply a working memory –Blue Brain – issue
- Anxiety introduces a further dimension: viz., the costs of hyperarousal
Going Red Brain

Engaging in a difficult cognitive task when not aroused (e.g., doing the Sunday NY Times crossword puzzle) does not affect blood glucose

Add in hyperarousal and glucose drops sharply

Anxiety elicits a limbic response: e.g., elevated heart rate and blood pressure, increased breathing, sweating and higher levels of cortisol
Falling Behind

When a student with a numerical processing problem works on a math problem, he completely tenses up because of the difficulty that he’s having.

Then other domains of stress are layered on top (e.g., social, prosocial).

The student becomes more vulnerable to HMA as he lags behind the other students or fails to meet the teacher’s – or his own – expectations.
Cognitive Neuroscience

HMA is associated with hyperactivity in the right amygdala and anterior hippocampus and reduced activity in the fronto-parietal systems associated with mathematical and numerical reasoning (the IPS and DLPFC) or emotion regulation (VMPFC).

What is happening here is that HMA kids are exhibiting a threat response to problems in arithmetic, with a corresponding reduction of prefrontal processes (including WM-related DLPFC activity).
Fight-or-Flight

Math triggers a fight-or-flight reaction in HMA

In a great many – if not all – cases, this starts in JK-3

Is this reaction innate or acquired?

But why would a young child see math as a threat?

But why would a young child see math as a threat?
Ball-and-Bat Problem

If a baseball and bat cost $1.10 together, and the bat costs $1 more than the ball, how much does the ball cost?
What Kahneman Found

All of the subjects who realized that there was something misleading about the ball-and-bat problem, and tried but failed to solve the problem, would reach a point where they suddenly just quit.

There was great variability in how long it took them to get to that point; but they all reached what Kahneman describes as an “intolerable peak” in their discomfort, following which they immediately shut down.
Kahneman’s “Eureka Moment”

Kahneman could predict when subjects would quit on the basis of tracking pupil dilation and heart rate.

His “eureka moment” was when he realized that “the tasks we had chosen for study were exceptionally effortful”.

We’ve known for some time that you can correlate the difficulty of a task, and hence, effort, with pupil dilation and an increase in heart rate.

But what happens if you remove “mental” from his argument about “mental effort”??
Same signals are evident in physical effort:

“Pupil size signals the level of effort invested in a task, irrespective of whether it is physical or mental.”

Pupil dilation and elevated heart rate are indicators of autonomic arousal
The Cost of Concentration

Our whole body tenses up

Cascade of cerebral, behavioural and metabolic changes consumes energy while blocking restorative processes

We grit our teeth, clench our occipotofrontalis muscles, increase the tone of the striated muscles, breathe more rapidly

Go into “ergotropic” state

There is increased activity of the sweat glands and inhibition of the gastrointestinal tract
The “Inverted-V Curve”

The more reserves are depleted to begin with, or subject is affected by hidden stresses, the more quickly “intolerable peak” is reached.

We screech to a halt when we find a problem too hard, rather than gradually slowing down.

Self-Reg asks: What happens if you push past the peak?
Back to the Triune Brain

Blue Brain and Red Brain act as brakes on one another

Red Brain: Limbic braking mechanism

Blue Brain via “cognitive competencies”: e.g., reappraisal

Brakes kick in when blood glucose drops too low
Overriding the Limbic Brakes

• HMA student struggles to keep up with the others, until the point that limbic brakes kick in

• If that child is then pressed to persevere – i.e., pushed past the peak of the inverted-V energy/arousal curve -- the memory of this aversive episode is registered

• That is, the hippocampus keeps a meticulous cost-benefit record of experiences that exhausted energy reserves without a big compensating payoff

• The mere cues associated with that experience are then enough to trigger a fight-or-flight response
Ultimate Questions

Why are we pushing so many children to override their limbic brakes – without our knowing it?

How can we turn off a “kindled math alarm”?
Influence of the Self-Control Paradigm

- Automatically assume that a child lagging behind peers needs to be pushed to make a greater effort.
- The greater the societal angst around math the more likely it is that Self-Control mindset takes hold.
- When it does, we fail to read the signs that the child is rapidly approach his peak (e.g., in pupil dilation, changes in prosody).
- Misread resistance as disobedience; see anxiety as non-compliance.
- Persist in what we’re doing when we should be pausing and asking: Why? Why is this child, who is so active and interested in other school subjects, having such a hard time in math?
Self-Reg is a 5-Domain Model

All five stress domains have to be addressed if we are to break the math stress cycle

Especially the cognitive domain

The better we understand cognitive stresses and how they interact with other stresses in a stress cycle, the better we can implement strategies targeted at this element as well as the entire stress complex
Not Operating in a Vacuum

In addition to the Self-Reg measures to reduce physical, emotion, social and prosocial stress, it is imperative that we reduce the processing-load.

Math mindfulness (which kinds of math problems are particularly stressful)

Physical activities (spark bike)

Reduce the time element

Example of Christine Roman-Lantzy’s work in CVI

Exercises to promote numerical processing

Less abstract (Wason)
Self-Reg Step 1

Reframe why THIS child is having a problem in math

Especially in cases where the child’s problem is math-specific

Seeing the student’s behaviour as fight (e.g., oppositional) or flight (e.g., avoidance) rather than unwilling to make the same sort of effort that the successful students are making.
Step 2

Identify the stressors, looking, not just looking at exogenous stressors (e.g., lights, noise, seating)

Or social-emotional stressors, but processing deficits as well (e.g., does the child have a problem with numerical representation, visual-spatial processing)
Step 3

Reduce the stressors: not just with a seat cushion or a fidget toy, but the cognitive stressors unique to math, as well, of course, as emotion, social and prosocial stress (Roman-Lantzy)
Step 4

Help the child develop, not just mindfulness, but what we might call "math mindfulness"

Help the child learn when approaching peak, not just when gone past it
Step 5

Work not just on the large strategies around self-regulation, but math specific strategies to reduce the cognitive stress (e.g., speed, dual modality)

Reduce math teach anxiety, parental anxiety (Foundations)

Ignore the newspapers!
The Goal

• The overall goal here is not to raise EQAO scores
• The goal is to help THIS child enjoy math, for all the positive reasons noted in the literature
• The fact that math is such a big part of their long-term wellbeing is the reason why we need to take this issue so seriously:
• not to “compete” in the international arena, but because we want all of our students to experience *math flow*
“no such thing as a bad kid”

-Stuart Shanker
Free Online Resources

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SELF-REG
How to Help Your Child (And You) Break the Stress Cycle and Successfully Engage With Life

Calm, Alert, and Learning
Classroom Strategies for Self-Regulation
TMC Offerings

Our Foundations Program is a four-course designed and delivered by Dr. Stuart Shanker, which leads to a certification in Shanker-Self Reg.

Self-Reg Portal Plus is our online community for people interested in exploring Shanker Self-Reg.

The Self-Reg Parent Portal is a moderated online community for parents interested in exploring The Shanker Method.

www.self-reg.ca
TMC Offerings

Three webinar-based 6 part mini-courses
- The Self-Reg Framework 101
- The Shanker Method 101
- Radar

Reduce stress, restore energy and learn about Self-Reg for 30 day. Classroom, school-wide and mentoring options available.

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