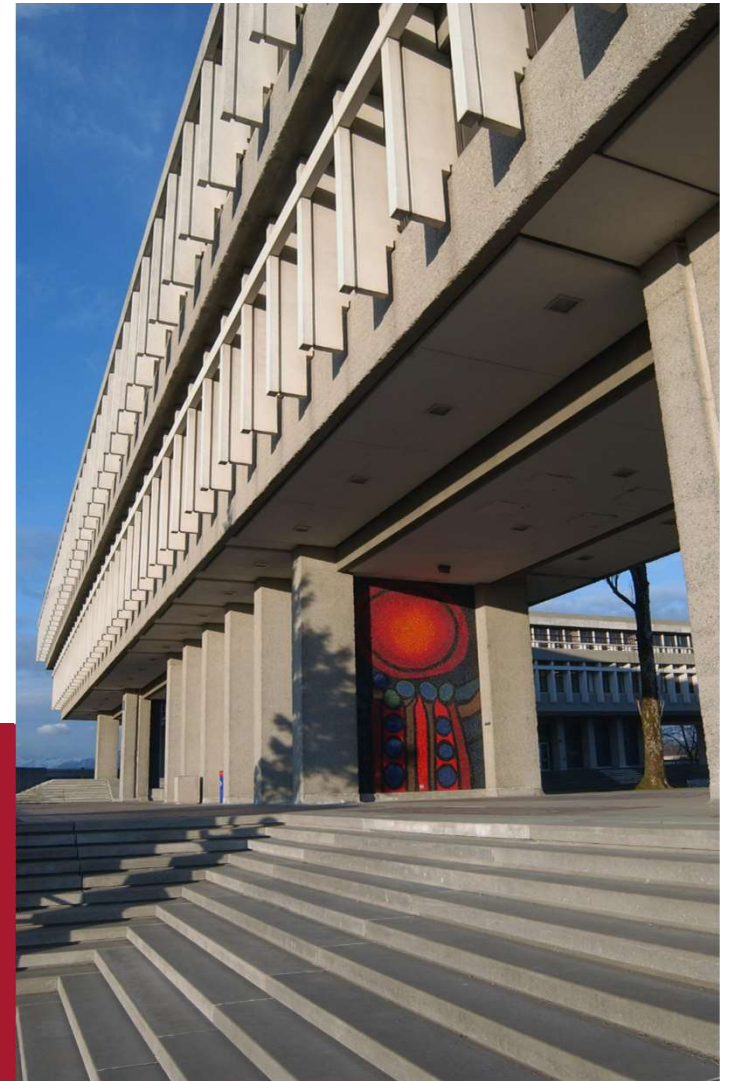


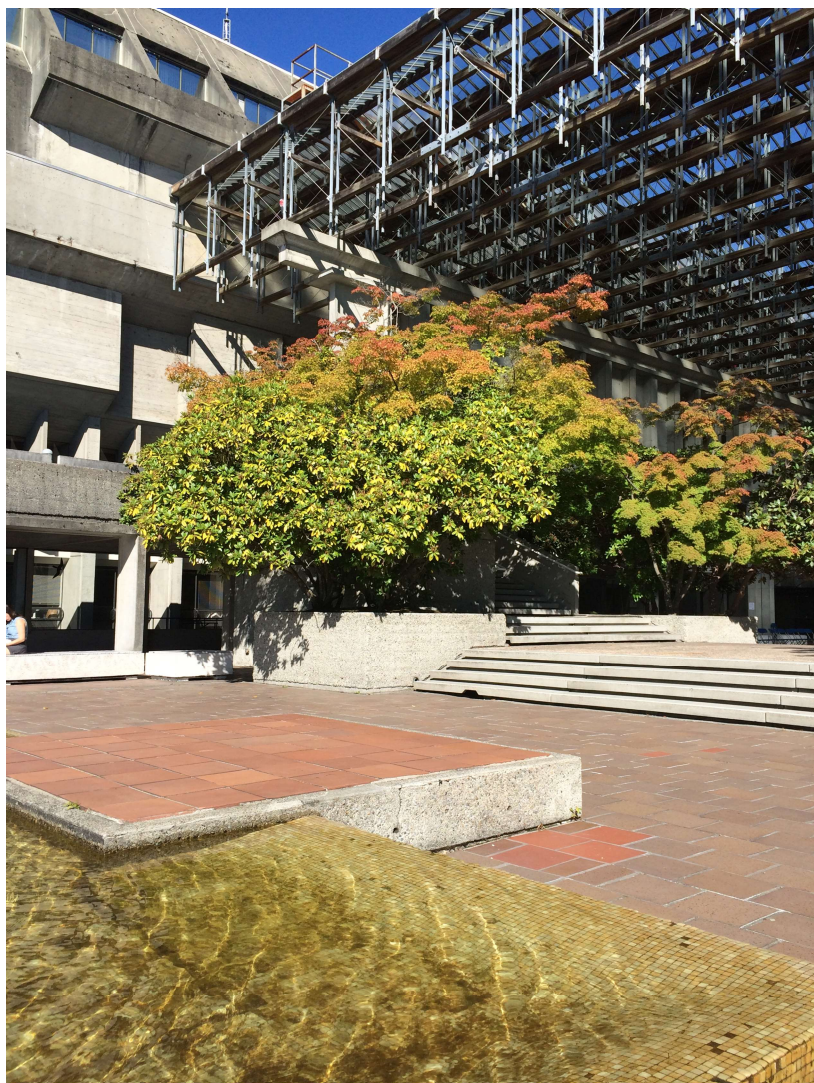


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Tensions in Teaching Mathematics: Emerging Understandings

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University of Bristol - February 4, 2019





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(AN UNMATCHED LEFT PARENTHESIS
CREATES AN UNRESOLVED TENSION
THAT WILL STAY WITH YOU ALL DAY.

<https://xkcd.com/859/>

Tension is described variously in research as:

~internal turmoil experienced by teachers as they find themselves pulled in different directions by competing pedagogical demands~
(Berry, 2007)

~a situation in which a perfect solution is not available~
(Katz & Rath, 1992)

~striving to attain competing, worthwhile aims~
(Ball, 1993)

Seed Problem

Choose any two numbers – these are your ‘seed’ numbers.
Add them.

$$13 + 7 = 20$$

13, 7, 20, 27, 47

?, ?, , , 100

Find all the seed numbers that will
make the fifth number 100.

Student: Can we use negative numbers?

Teacher: No.

Teacher: We don't do negatives in grade four.

Teacher: It's not because it's not in the grade four curriculum.

It's because I'm not strong in math.

I wasn't sure what negative numbers might do – if they would work in the problem.

I want to give them *[the students]* good problems, but what if I don't know the answers?

Don't I need to know all the answers?

1. Useful tension
2. Tension and emotion
3. Tension and goals
4. Absence of tension
5. Tension metaphors

1. Tensions as useful

Tensions are “a powerful explanatory and analytic tool, and a **source of praxis** for mathematics teachers” (Adler, 1998).

Mathematics teachers are dilemma managers who accept conflict as endemic and **useful to practice** rather than as a burden that needs to be eliminated (Lampert, 1985).

Managing recurring tensions is not akin to solving them, rather it is a matter of compromise and ‘satisficing’—**sacrificing in order to satisfy** (Cuban, 1992).

1. Tensions as not only useful but *necessary*.

Tensions are “the *sine qua non* of reflection and ingenuity” (Dewey, 1922).

This a *dialectical* view of development in the Hegelian sense, as a process driven by tensions.

Conceptualizing tensions as ending points where a mathematics teacher must now utilize skills of ‘satisficing’, means overlooking the growth and development that occurs in overcoming tensions.

2. Tension and emotion

frustration, confusion, pressure, uncertainty

If tensions are understood as the engine of change, it seems that **negative emotional responses are a necessary first step.**

Yet positive emotions enable human flourishing and optimal functioning (Güsewell & Ruch, 2012).

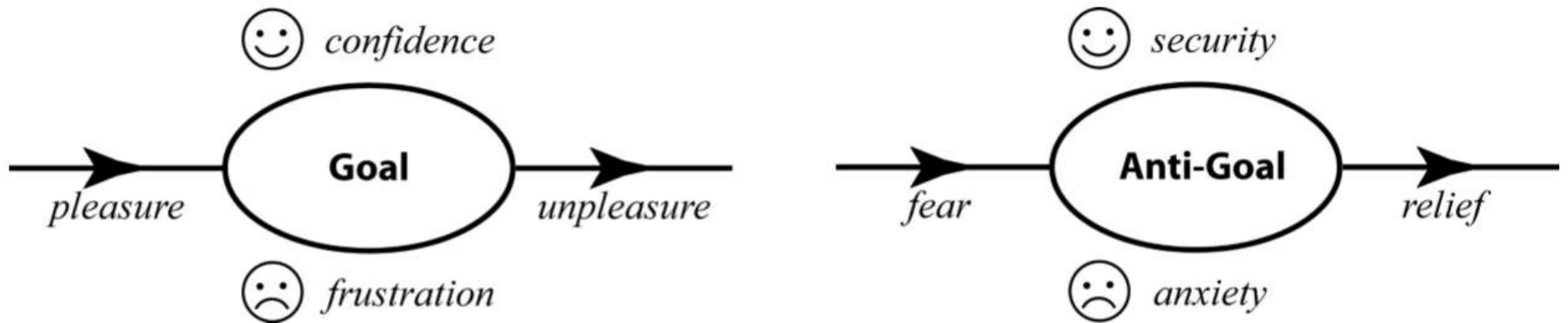
2. Tension and emotion

Surprise, relief, pleasure

- **positive emotions are necessary for the change to endure.**
- individuals must see the positive within the negative moment of development if they are truly to advance (Hegel).

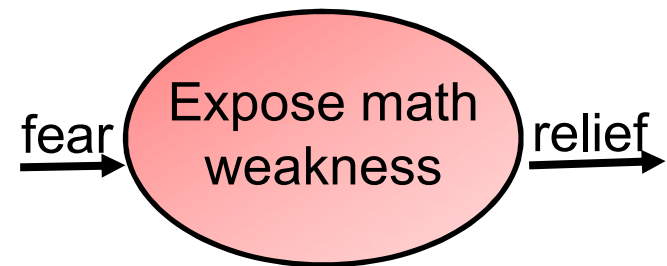
e.g., surprise after uncertainty

3. Tension and goals

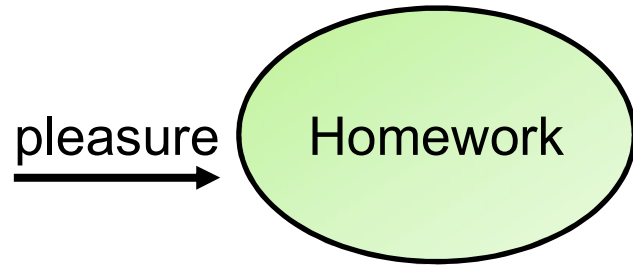


Emotions associated with goals and anti-goals (Tall, 2010)

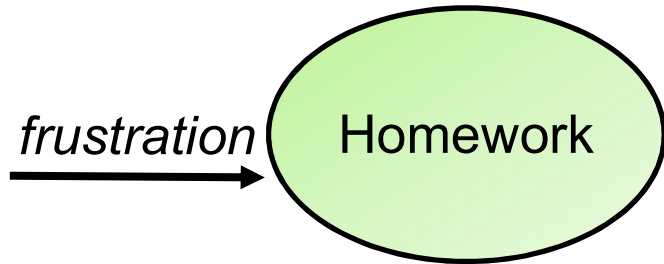
3. Tension and goals



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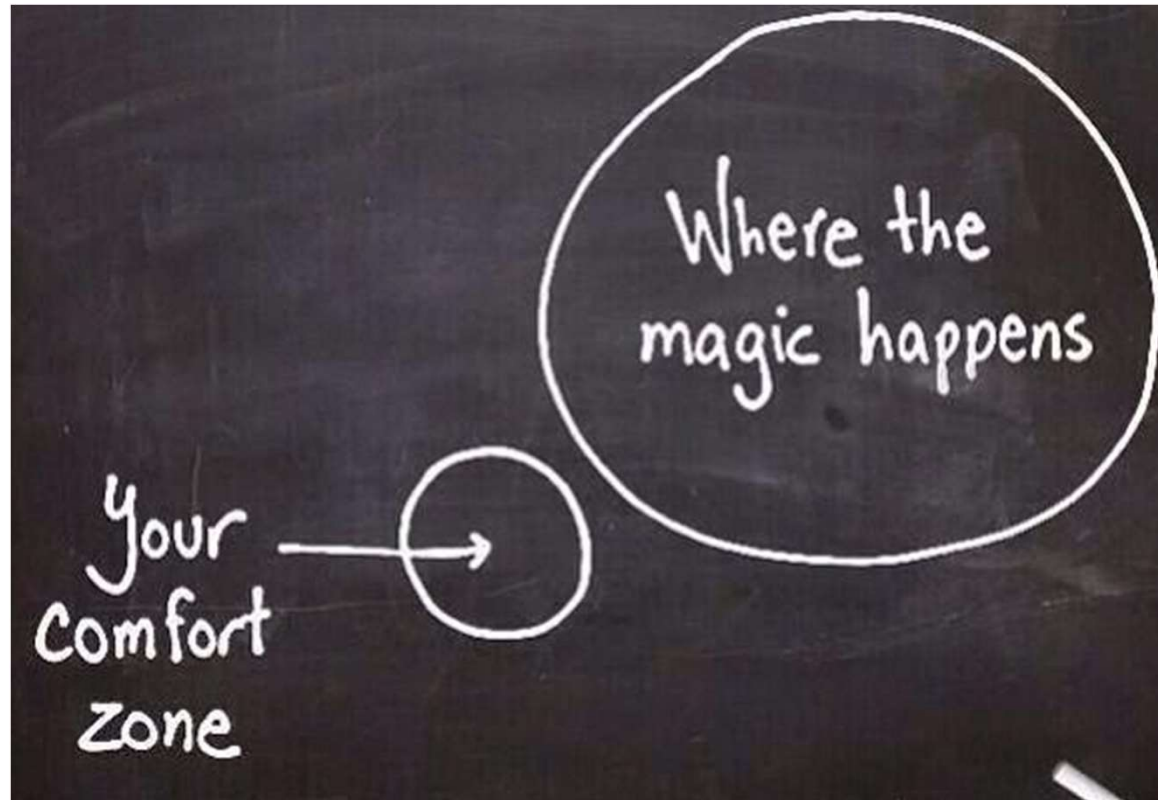
Eric: He'd sit at the back and say "No, you're wrong" or "I disagree" or "What about this?".
And I loved it because there was this back and forth, and like this is good!
So, I think zeros, forget that.
And man did he bring something to the [class].
I loved it.
So that really changed my philosophy on taking in homework.
Because he just sat there, but he was into it.
I thought this was great!
A lot of the students, all they do is just hand me homework, I like this better.

3. Tension and goals



Eric: I used to collect homework, but... there was no engagement.

4. Absence of tension



4. Absence of tension

Keeping with my premise of tensions as useful and necessary:

- Tension may need to be **deliberately introduced** for a change in practice to occur (Liljedahl, 2014).
- Berlak and Berlak (1981) suggest that because a person is **capable of being made aware of tensions**, they are capable of altering their practice.

4. Absence of tension



4. Absence of tension

Jennifer: The minute you told us to stand up and that we will be doing multiplication questions; I went into a panic. My heart was racing, my stomach was clenching and I felt as if my brain was freezing.

Meryl: It's definitely eye opening, having that memory from almost 20 years ago, and then the feeling of panic that I had when I thought that it was going to happen all over again in a university class.

Sandra: After you revealed that we actually weren't going to do this activity, and we debriefed it, I realized just how unhealthy it was for me to think that this was a normal way of teaching.

4. Absence of tension

Helen: When debriefing, I found it relieving and surprising to know how many other people felt the same way I did. Standing in a room full of adults who are becoming teachers, looking around at how much anxiety was caused by this one activity, I can only imagine in a room full of young students how they would feel.

Reese: As a teacher of mathematics, I will never force my students to do timed drills. After experiencing anxiety when you suggested we do this and seeing the anxiety it provoked in my peers, I was able to understand the anxiety that this causes in our students when we do the same to them.

5. Tension metaphors

Tension as friction (Tsing, 2005)

Describes the creative potential for productivity that tensions can generate:

- A wheel turns because of its encounter with the surface of the road; spinning in the air it goes nowhere.
- Rubbing two sticks together produces heat and light; one stick alone is just a stick.

5. Tension metaphors

Tension as friction (Tsing, 2005)

Friction in teaching, results from the “**rubbing together**” of **notions** such as philosophies of teaching and learning, assessment practices, and education policies

Can often result in new and **unanticipated insights into processes of teaching.**

5. Tension metaphors

Tension as sparks

Change occurs as a result of experiencing a **succession or accumulation of tensions**.

- Think of a car, where multiple spark plugs must fire in order for the engine to start.

This suggests tensions can be managed until they reach a **tipping point**.

5. Tension metaphors

Tension as an elastic band

She feels like an elastic band; stretching and then bouncing back and then trying to stretch a bit further.

What happens when an elastic band is stretched too far?

What happens when an elastic band is stretched for too long?

5. Tension metaphors

Tension as a vise/hydraulic press

Rather than being pulled they feel **inward pressure** from tension.

They feel **hemmed in** by curricular constraints, imposed assessment practices, parental expectations.

5. Tension metaphors

Tension as play (Carr, 1998)

Describes that **flexible sensation of possibility** we encounter when we experience a constructed world or an object of loose fit, or when we feel the opposition of forces.

The tension and play in our own growing and changing informs the reshaping of ourselves.

- Too much play and we lose direction and power
- Too little play and we have no direction or motion

5. Tension metaphors

Tension as Scylla and Charybdis (Pimm, 2016)

Homer's mythical sea monsters between whom Odysseus must navigate.

- There is no other way round
- There is no ideal path between them

One must engage to some degree with one or the other, though this engagement has costs (Pimm, 2016).

