Connecting Experiences in Mathematics and Math Trauma

Department of Mathematical Sciences
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A note:

This presentation was originally given at the 2023 Convention of the School of Science and Mathematics Association in Colorado Springs, CO (October 2023); a related, peer-reviewed paper was published in the Proceedings shortly after.

The research and other related work was completed by myself and my co-author, Devon Gunter.

INTRODUCTION

“Oh my goodness, you’re a *math teacher*?!”

Who experiences this phenomenon?

- “...many people have been traumatized by math...we know that negative and damaging messages are still handed out to students every day” (Boaler, 2015, p xi).
- Students, teachers, and parents in homes and classrooms (Boaler, 2015; Lange & Meaney, 2011; Ruef, 2018a)

The bottom line:

We need to know if this phenomenon we call “math trauma” *is actually trauma*

If it is, this likely gives us avenues for reducing, mitigating, and handling it in our classrooms.

If it is not, then we have to cease use of the phrase.

Literature Review

Trauma Psychology

- Defining the construct of trauma arose from diagnostic needs related to Post Traumatic Stress Disorder (PTSD), which was first included in the Diagnostic and Statistical Manual of Mental Disorders (DSM) in 1980
- Clinicians now often use a more personal construct of trauma that is more defined by the individual's understanding and reactions (Dalenberg et al, 2017)
- This more personal construct includes those events which might be threatening to one's "foundational beliefs about self and the world" (Dalenberg et al, 2017, p. 24)

...threatening to one's

"foundational beliefs about self and the world"

Literature Review

Systematic search for literature regarding math trauma specifically led to **21 results** (list provided at the end of the slides)

There were **two** proposed definitions of "math trauma"

- "...being deprived of opportunities for expression, interpretation and agency in relation to mathematics and hence positioned as passive receivers of superficial mathematical knowledge amounts to *mathematical trauma*" (Lange & Meaney, 2011, p 38).
- "In its worst manifestations, math anxiety becomes what my colleagues and I call math trauma—a form of debilitating mental shutdown when it comes to doing mathematics" (Ruef, 2018a).

...neither of which were empirically derived or examined

Research Questions

1. What is a general concept of trauma?
2. Can experiences that students share about their mathematics education be linked to the general concept of trauma?

    a. If a connection is found, what are the themes in those experiences that students share?

Methodology

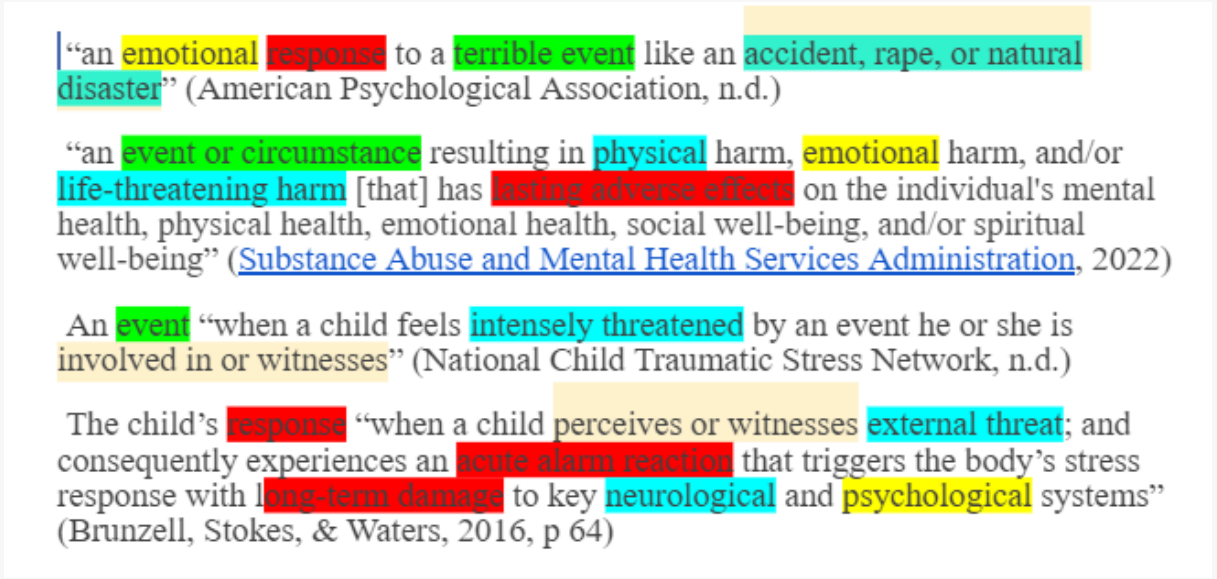
1. Apply thematic analysis (Braun & Clarke, 2006) to common definitions of trauma for generalization
2. Closed code shared student experiences as an “existence proof” of a connection between student experience and a general concept of trauma

    a. Apply thematic analysis to any connected experiences to determine similarities and differences

1. Developing a General Concept of Trauma

Four non-diagnostic definitions of trauma common to educational settings were analyzed using thematic analysis (American Psychological Association, n.d.; Brunzell et al, 2016, p. 64; National Child Traumatic Stress Network, n.d.; Substance Abuse and Mental Health Services Administration, 2022).

Developing a General Concept of Trauma

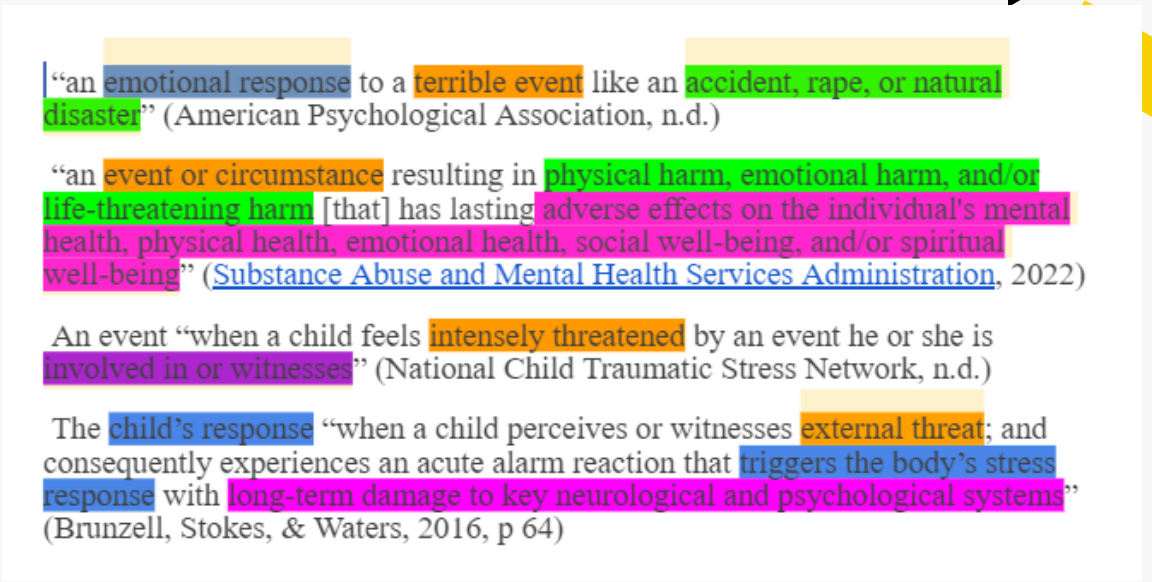


"an emotional response to a terrible event like an accident, rape, or natural disaster" (American Psychological Association, n.d.)

"an event or circumstance resulting in physical harm, emotional harm, and/or life-threatening harm [that] has lasting adverse effects on the individual's mental health, physical health, emotional health, social well-being, and/or spiritual well-being" (Substance Abuse and Mental Health Services Administration, 2022)

An event "when a child feels intensely threatened by an event he or she is involved in or witnesses" (National Child Traumatic Stress Network, n.d.)

The child's response "when a child perceives or witnesses external threat; and consequently experiences an acute alarm reaction that triggers the body's stress response with long-term damage to key neurological and psychological systems" (Brunzell, Stokes, & Waters, 2016, p 64)



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Definitions of trauma relate to an *event*, a *threat*, and a *response.*

Event, Threat, Response

- An *event* is a situation recalled by an individual that caused a *threat*.
- This *threat* could be to one's life or physical safety (as in diagnosing PTSD) but could also be threatening to one's "foundational beliefs about self" (Dalenberg et al, 2017, p. 18), and leads to...
- Some *response* in emotion or through assimilation of new information into one's "foundational beliefs," like self-efficacy or one's identity as a doer of mathematics

2. Connecting Student Experiences

An organic pattern of interest was noticed while reading student responses to some open-ended questions provided during the regular course of teaching.

The students were enrolled in a required mathematics content course intended for early-childhood and elementary education majors from Fall 2020 – Spring 2022.

Connecting Student Experiences

Prompt	Assignment	Number of Responses Collected, *n*
"Write a few sentences describing your experience with mathematics and how you see yourself as a learner of mathematics."	Homework #1, Question 1	85 (Fa20 32, Sp21 32, Fa21 17, Sp22 4)
In preparation of our discussion about addition math facts and the arithmetic properties, I'd like you to read the short article entitled "Fluency without Fear" by Dr. Jo Boaler. Then, please answer these questions: 1. What was your experience as a student with "fact fluency" (either addition or multiplication)? 2. How is what Dr. Boaler proposes in the article the same or different than your own experience?"	Discussion Prompt	63 (Fa20 32, Sp21 31)

Connecting Student Experiences

- The open responses were closed coded using *event*, *threat*, and *response*
- After initial coding we reconciled any differences to reach consensus
- Experiences that were coded with all three codes were retained for further thematic analysis; there were 21 (N = 148; *14.2%* of responses)

Students DO experience trauma centered about mathematics.

2a. Thematic Analysis of Experiences

We were interested in similarities and differences among the 21 instances of potential "math trauma" identified in our search for a connection

- Conducted thematic analysis on 21 instances

Thematic Analysis of Experiences

Events were temporally bounded.

Event	One-time (3)	A teacher making fun of a student or calling them out in front of the whole class
	Class (13)	Timed fact tests throughout third grade
	Pathway (5)	A student being forced into a differently-leveled mathematics course

Thematic Analysis of Experiences

Threats were focused internally or externally

Threat	Internal	Self (5)	A student performing at a level they considered beneath their abilities
		Peer (9)	A student performing at a level they considered beneath their peers
	External	Self (5)	A student performing at a level below the expectation of their teacher
		Peer (4)	A student compared to their peers and found wanting

Thematic Analysis of Experiences

Responses held four themes that are not mutually exclusive:

Response	Avoidance (5)	Changing majors to one that requires fewer mathematics courses
	Efficacy (12)	A student feeling as though they are incapable of doing or learning mathematics
	Emotion (8)	Feeling hatred toward mathematics or a mathematics teacher or a manifestation of math anxiety
	Identity (3)	A student no longer identifying as a "math person"

Thematic Analysis of Experiences

Findings align with the personal-meaning concept of trauma wherein the threat from an event is to one's *foundational beliefs about self* and the response is congruent with such a threat (Dalenberg et al, 2017).

Findings

In these 21 cases of potential math trauma, the identified events threatened a student's perception regarding their ability to do mathematics or their self-identification as a "math-y" person

This threat elicited a response in which the student changed their behavior accordingly through an emotional reaction or alteration of their beliefs about themselves

Findings

Frequency tables were constructed and experiences were generally well-distributed among any two categories

Threat Locus	Threat Source	Response			
		Avoidance	Efficacy	Emotion	Identity
External	Authority	2	3	2	1
	Peer	2	2	1	0
Internal	Self	2	4	1	1
	Peer	0	4	4	1

Findings

- Some experiences of learning and doing mathematics in a single grade-level or course may compound in a way distressing enough to students to be considered trauma.
- The most common reaction was an alteration of a student's self-efficacy.

Limitations

- Not a targeted data set
- No generalizability

Proposed Definition

Math trauma is the response that occurs when a person experiences an event which threatens their perceived sense of self or safety through the course of learning mathematics and results in a persistent negative change to their disposition towards the subject.

Implications

- A connection between student experiences in mathematics classrooms and a non-diagnostic concept of trauma was demonstrated in over 14% of examined student responses

Future Research

- Analysis of other non-specific open responses to lend validity to thematic results in instances of possible math trauma
- Targeted data collection to:
  - Revise the proposed definition of math trauma
  - Discern further patterns in instances of math trauma
  - Explore mitigation and/or therapeutic avenues

QUESTIONS?

THANK YOU!

Feel free to reach out with questions or comments: mgunter@ccsu.edu

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†Results from a title reading of an initial search using keywords "math*" and "trauma" in peer-reviewed articles in education
‡Results from a title reading of a search conducted for peer-reviewed articles with the terms math* and trauma* in titles
^Results from a search using the phrase "math trauma" in any field
A close reading along with snowballing provided the other four items

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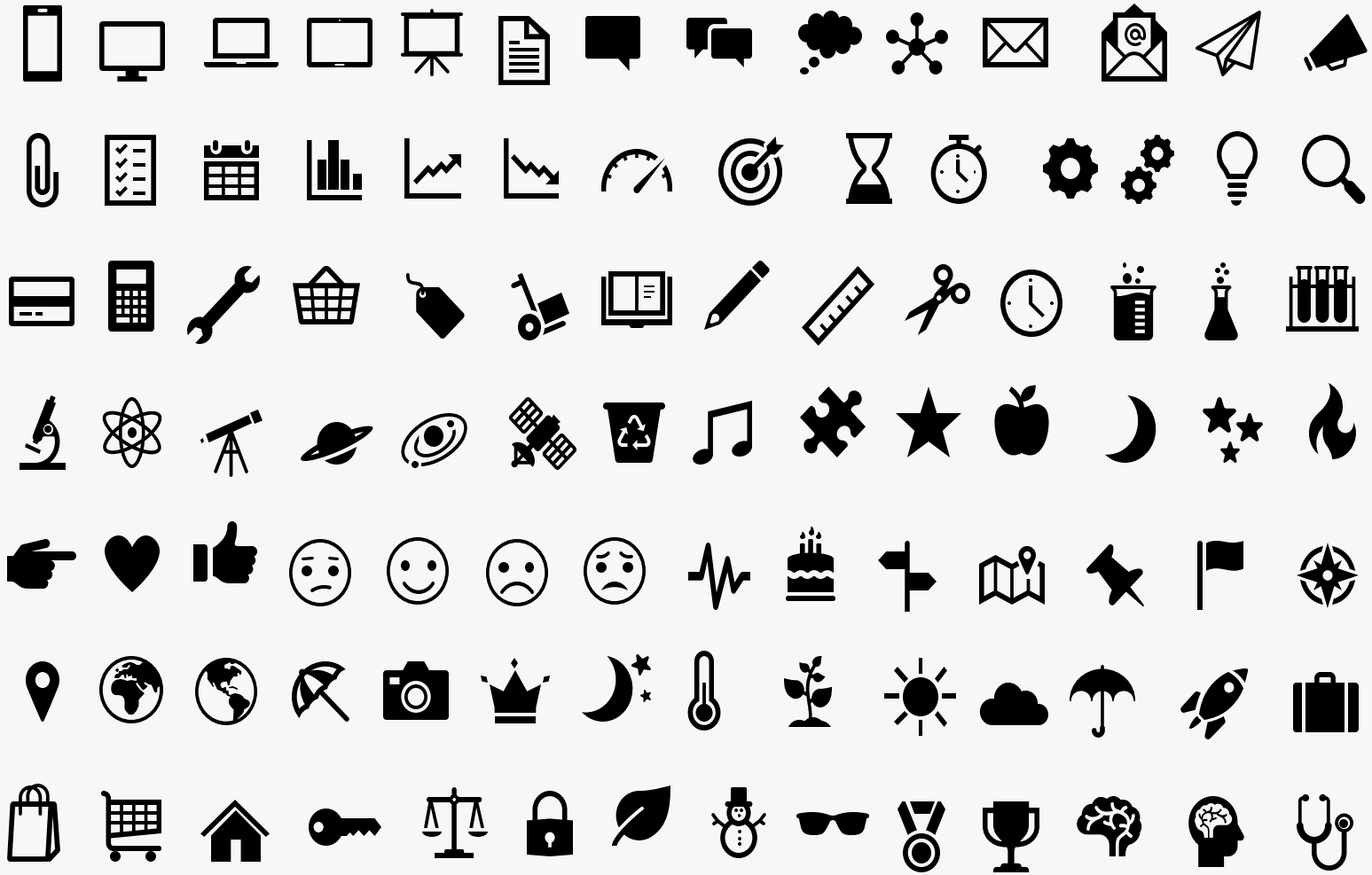

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