

Perpetuate or Disrupt?

How can a
mathematician intervene
in unjust systems?

**SONOMA
STATE
UNIVERSITY**

Ben Ford

JimFest

May 2024

Honored to visit the past, present,
and future homelands of the
Pawnee, Oto-Missouria, Omaha
and Kansa peoples

... and the city where I was born!

Me & Lincoln

Even longer connection to UNL than Jim:

- Dad was architecture/urban planning student here when I was born at Bryan Memorial; we lived on E St, 2.5 miles from this hall
- Mom taught at Huntington Elementary
 - “Lincoln was a progressive district: they had a system that allowed children to take 3 or 4 years to complete grades 1 through 3 (called it “continuous progress ” or something like that) and the best science/social studies curriculum of any other place I've taught. I have good memories of working there.”
- Left Lincoln in Aug 1969, a year before Jim arrived



Me & Jim

In 1995, as postdoc at UW, applied to 2nd cohort of MAA's Project NExT, assigned Jim Lewis as my “consultant.”

- First email from Jim: “... I am pleased to accept this role and hope that I can be of some service over the next year or so.”
- “year or so” turned into 30
- As a new Ph.D. I tried to get Jim to put me on the writing team for MET I; he & team wisely let me review & comment on early drafts instead

My context

- One of 23 campuses of the CSU
- Public liberal arts college
- “Top third” of HS grads eligible
 - “College prep” HS courses including 3 yrs math
 - HS diploma
 - 2.5 HS GPA

Recent HSI (2018)

- 41% Latine/Hispanic
- 62% female

Fantastic department

- decades-long commitment to teaching excellence
- gender parity
- persistent racial/ethnic differences

My (first-year) students & math

Say they have little interest

Unable to identify math in business other than bookkeeping

Little financial literacy, e.g. how interest works

One big problem (my opinion): Math for years has not connected to anything they wonder or care about

→ **not**: insufficient facility pushing x around

My students' math experiences

Not presenting evidence here:

- teacher & parent messages about math (it's hard, the genius myth, I always hated it)
- school math disconnected from anything they care or wonder about
- narrow opportunities to shine (& earn positive feedback)
- “you get it or you don't,” no feedback/revision/growth opportunities
- early messages that one is not a math person (explicit or not)
- perceptions of “ability” dramatically skewed by race and gender, leading to radically different opportunities

$$3 + 5 = 8 \text{ vs } 8 = 3 + 5$$

Mady, 2nd grade, 2008

PD participants
interviewing students to
understand their
thinking about “=”

For most students,
math = school math by
5th grade

SONOMA
STATE
UNIVERSITY



How might I intervene?

Preservice
Content

Teacher/Admin
Inservice

Curriculum



Number/Math
Key Components:

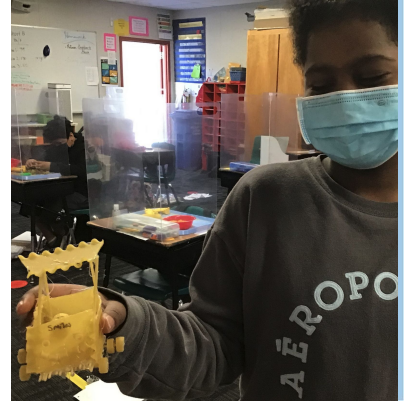
- Discussion, questions
- Giving students flexibility
- Process-oriented, share thinking about it
- Connecting vocabulary to math process
- ↑ accessibility for students

mathematics
CALIFORNIA
PROJECT
CMP

DEVELOPING MATHEMATICAL IDEAS
ALGEBRA
Patterns, Functions, and Change



Maker Learning Cycle • Grade 5
Pasta Car Derby
Authors: Sophia Nguyen & Matt Mensch (Santa Rosa City Schools)
Kathy Morris (Sonoma State University)

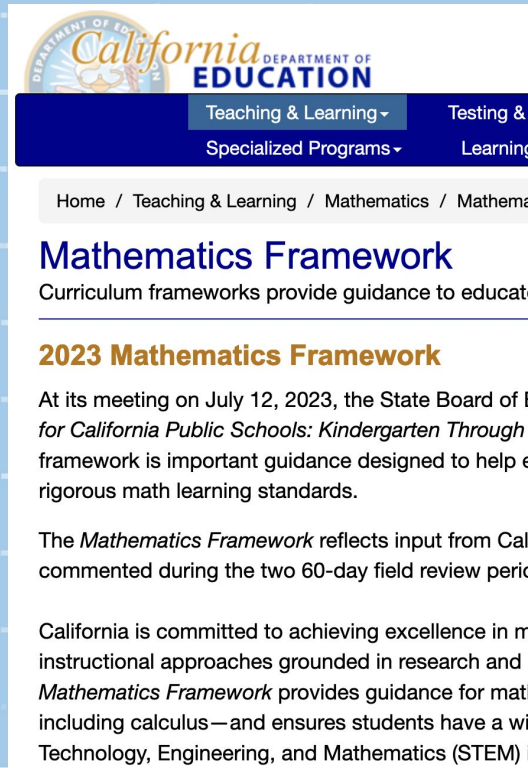


How might I intervene?

Policy

My own
teaching

Working across
boundaries



DEPARTMENT OF EDUCATION
California DEPARTMENT OF
EDUCATION

Teaching & Learning ▾ Testing & Learning
Specialized Programs ▾ Learning

Home / Teaching & Learning / Mathematics / Mathematics Framework

Mathematics Framework

Curriculum frameworks provide guidance to educators and students.

2023 Mathematics Framework

At its meeting on July 12, 2023, the State Board of Education for California Public Schools: Kindergarten Through Grade Twelve adopted the 2023 Mathematics Framework. This framework is important guidance designed to help educators implement rigorous math learning standards.

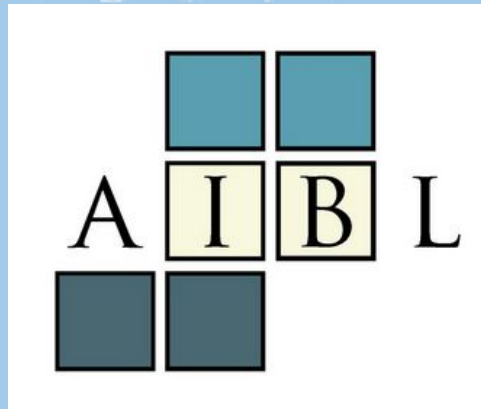
The *Mathematics Framework* reflects input from California educators who commented during the two 60-day field review periods.

California is committed to achieving excellence in mathematics instruction through instructional approaches grounded in research and practice. The *Mathematics Framework* provides guidance for mathematics instruction, including calculus—and ensures students have a wide range of opportunities to engage in STEM (Science, Technology, Engineering, and Mathematics) activities.



MAA
MATHEMATICAL ASSOCIATION OF AMERICA

Project NExT



A I B L

CLEVELAND
COLLABORATIVE
FOR MATHEMATICS
EDUCATION (C²ME)
FIVE-YEAR SITE REPORT

Collaborating
TO Teach Teachers:
Mathematicians & Educators
Team Up
By Julie Rehmeyer

And others

Family outreach

- Most common teacher conversation with parents, edited for brevity by me:

“I always hated math and was really bad at it.... [slight pause, angrily continuing] Why aren't you teaching my kid the way I was taught?”

Research: What students' experiences are, what works, etc.

Political: Supporting local educators caught in difficult politics

Enrichment programs

Postsecondary math teaching culture

Why this focus? As a mathematician:

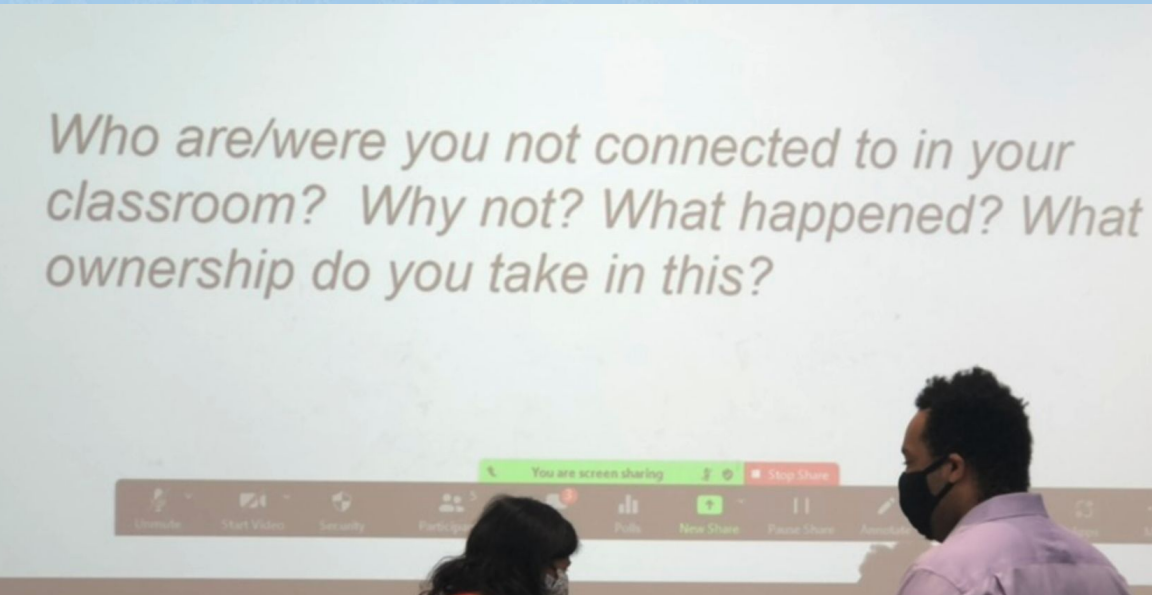
- It's my most direct way to disrupt patterns that perpetuate bad outcomes
- Our future teachers (including parents) will teach as they were taught
- Have to stop passing the buck
- We have no honest credibility in other efforts without fixing our own teaching culture
- Claiming authority outside our expertise can be destructive. Mathematicians are given a lot of deference largely because of genius myth etc.
- Must build language for, and focus on, teaching choices beyond sequence of topics or lecture vs group work

Looking in the mirror

Does the math department at your institution model a culture of teaching that you want to see broadly in the world?

I can honestly say yes now.

- In each others' classrooms
- Frequent discussions of privilege and servingness
- Collaborative change efforts



Who are/were you not connected to in your classroom? Why not? What happened? What ownership do you take in this?

Individual vs community change

Always great committed teachers

- e.g. Ginger Warfield, Steve Monk, Caspar Curjel (UW), David Singer (CWRU)

For many years:

- programs to support & bolster individuals
 - lots of good teaching, and students helped; culture change hard
 - frequent burnout, marginalization
 - not often valued in tenure/promotion

Building momentum

Individual-focused efforts can accumulate

- Project NExT: 2300+ faculty over 30 years
 - Strong community that values teaching
 - Loners in their department don't feel so alone
 - Leaders: Francis Su, Michael Dorff, Talithia Williams, Dave Kung
- Academy of Inquiry-Based Learning
- TPSEMath: Transforming Post-Secondary Education in Mathematics
 - “Post-secondary education in mathematics will enable all students, regardless of their identity, background, or chosen program of study, to develop the modern mathematical knowledge and skills...”
- RUME

At a Tipping Point?

Hoping it will help make it true, I keep saying the university-level mathematics community in the US is at a tipping point

- from
 - scattered (but connected) individual focus on quality teaching and equitable outcomes,
- to
 - a cultural norm of servingness

Some evidence

- Professional societies
- Balance of talks at meetings

Importance of the Department

Over a 2–4 (or 5 or 6...)-year college career

- a single teacher can make a big difference
- a united department can radically transform a student's perspective on and experience in a discipline
 - ...and can sustain efforts over time

STEM at a Tipping Point

PI: Brigitte Lahme
Co-PIs: Luis
Leyva, Omayra
Ortega, Ben Ford

**SONOMA
STATE
UNIVERSITY**

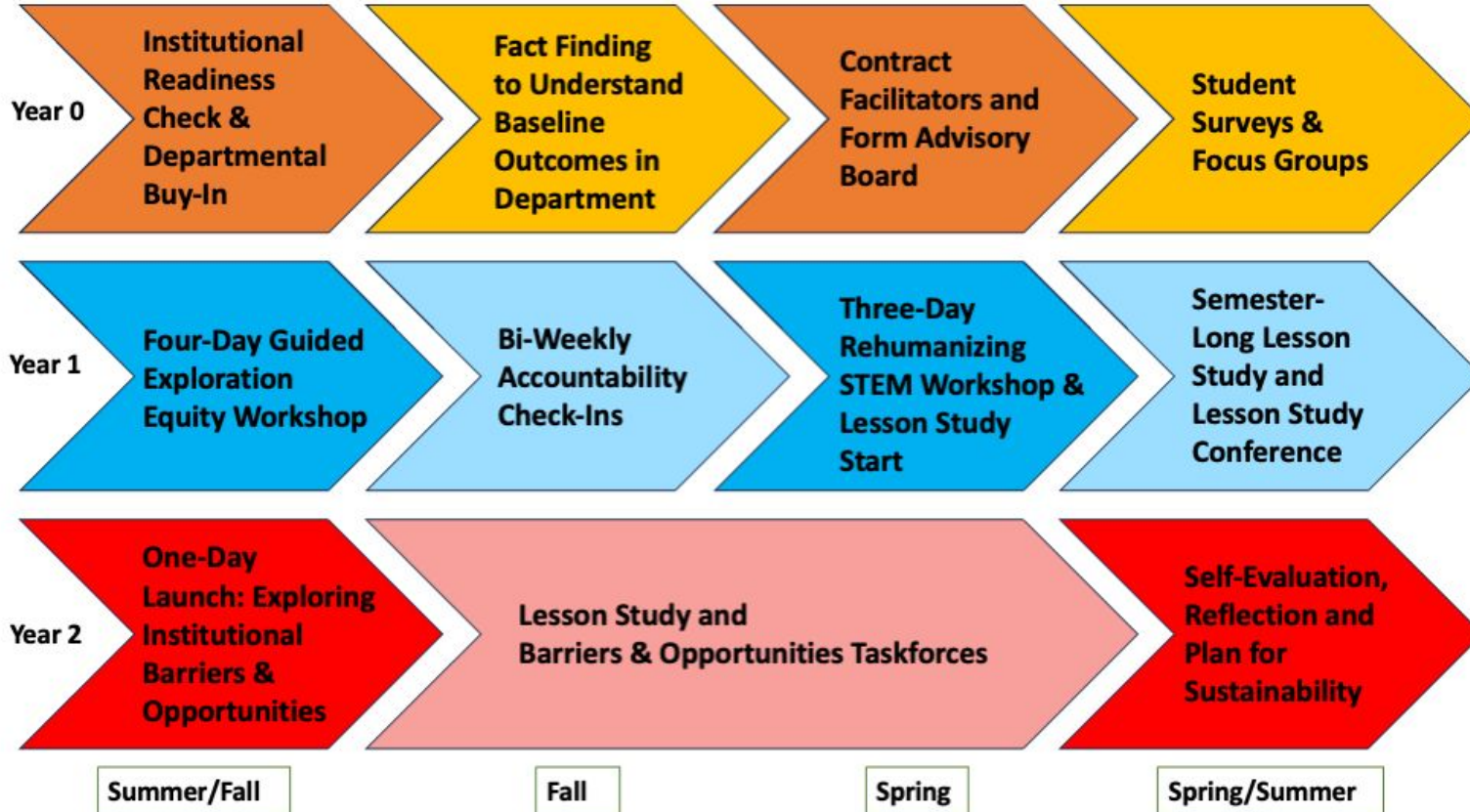
Transformative Inclusion in Postsecondary STEM: Towards Justice (TIPS Towards Justice)



TIPS: Towards Justice

- Mission: Transform the culture of teaching and learning in STEM departments at SSU and beyond in order to embrace “Serving” in our *Hispanic Serving Institution* designation:
 1. Develop, test, and publish a two-year professional development pathway (the TIPS Pathway) to guide STEM departments in transforming culture and practice, with the goal of reducing experiences of marginalization and improving persistence and graduation rates and success for Latinx STEM undergraduate students.
 2. Research students’ experience of marginalization in STEM, and effect on such experiences of department-level equity work and implementation of culturally relevant pedagogies

TIPS Pathway

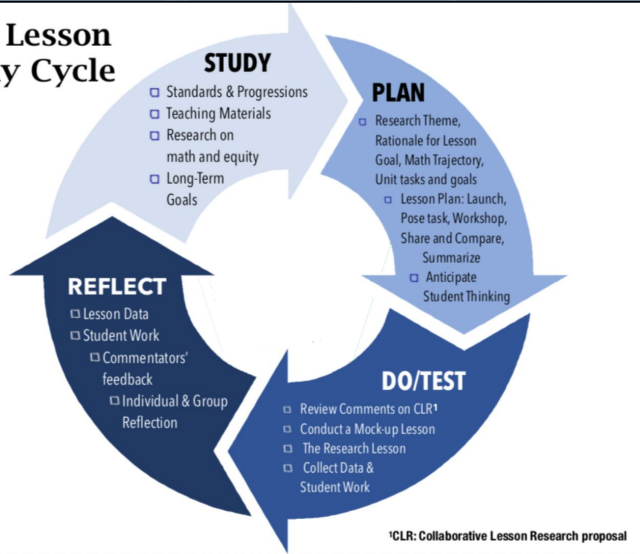


Lesson Study in college STEM!

15 teams across 6 STEM Depts so far (Math/Stats, Bio, Chem, CS, Geol, Phys/Astro)

- Team of 4–7
- Content goal
- Rehumanizing STEM goal
- Student interviews

The Lesson Study Cycle



Revised Angiosperm Lab

- Retained some dissection/microscopy
- New content:
 - Plant Connections and Memories (**Windows & Mirrors**)
 - Plants and their Pollinators (**Body & Emotion**)
 - Personal Identities & Plant Connections (**Our stories/Their stories**)

What plants did you or your family cook with most often?

Did you or anyone you know tend garden plants or houseplants? If so,

Saguaro
Carnegiea gigantea

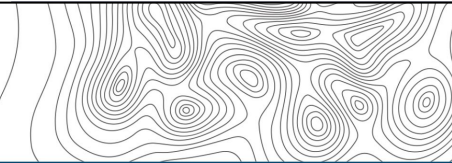
Native to the Sonoran Desert, this tree-like cactus species that can grow to be over 12 meters tall. Saguaro cacti bloom for less than 24 hours. They open at night and remain open through the next day. They only have that very short time to attract an animal to be pollinated.

Mexican

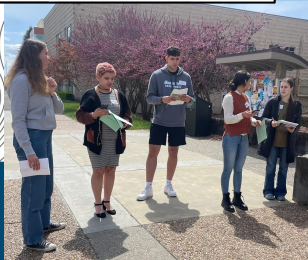
Marigolds

Leaver Long-nose
Leptonycterus perba

These small bats are found in Central and North America. They feed primarily on night-blooming plants, including multiple species of cacti.



Using *Body and Emotions* to Understand Topographic Maps



Geology 102: Our Dynamic Earth
Intro to Topographic Maps Lab



Exciting buy-in

I knew my department would be on board

Nervous about taking to other departments

- All voted to sign on
- Critical mass of faculty engaged
- Amazing engagement
- Give people support and a structure for doing the right thing and most of them want to



Bumps and Caveats

Two years doesn't fix everything. TIPS research (Luis Leyva & team) have made that clear.

- Goal is “culture of servingness” which we hope will lead to better and better practice
- People get tired and want a break from change

Most of what we (at SSU) know about changing teaching practice comes engagement with K–12 partners

- I'm still waiting for shouted “I did it” from my college students like I got from a kindergartener in Pepper Taylor's kindergarten class in Cleveland, 1995.

Wonderings

From the outside: research math departments ~10 years behind teaching institutions like mine

- Still lots of lone actors
- With some exciting Department exceptions
 - One of them right here, with Jim Lewis playing a major role in the transformation
- We teach most teachers
- R1s have most policy sway/news coverage & probably teach most future legislators

Thanks!

Jim Lewis for almost 30 years of inspiration and understated mentorship
Conference organizers!

NSF: Make Math REAL (#1850372 & #1850367); TIPS (#1953472) (Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.)

tips.sonoma.edu for more

**SONOMA
STATE
UNIVERSITY**



TIPS Math PD Team

