

DR. MIKE STEELE • [MIKE@STEELEMATHED.COM](mailto:MIKE@STEELEMATHED.COM)

CONFERENCE BOARD OF MATHEMATICAL SCIENCES

PAST PRESIDENT, ASSOCIATION OF MATHEMATICS TEACHER EDUCATORS

---

**NEW CHALLENGES AND OPPORTUNITIES:  
TAKING STOCK OF NATIONAL PROGRESS IN  
MODERNIZING MATHEMATICS PATHWAYS**

## OVERVIEW

- ▶ Highlights across the national landscape of math modernization
- ▶ Challenges on the horizon:
  - ▶ Beliefs and values
  - ▶ Messaging
  - ▶ Professional learning & teacher preparation

**THE NATIONAL LANDSCAPE**

---

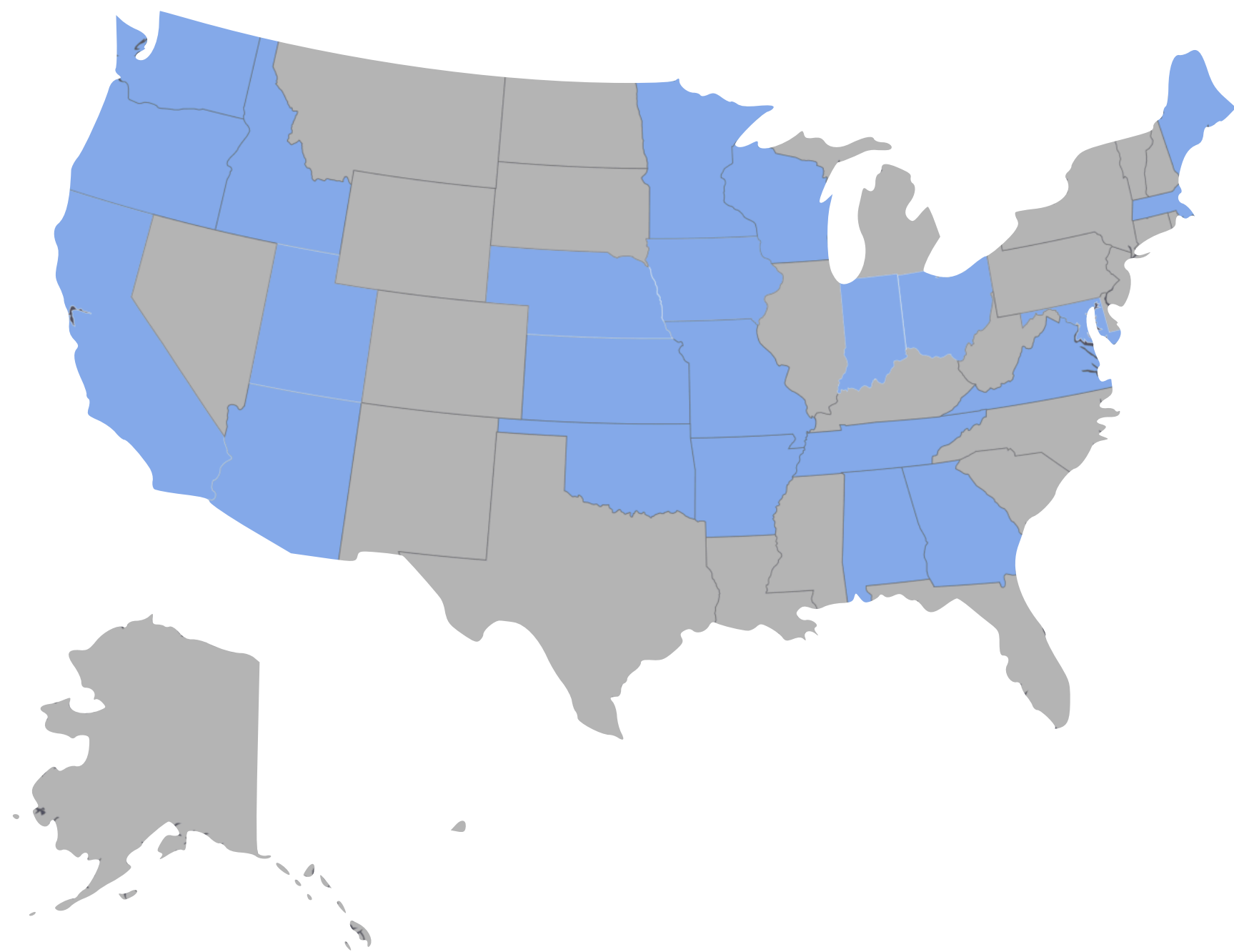
**MATHEMATICS MODERNIZATION**

## NOMENCLATURE

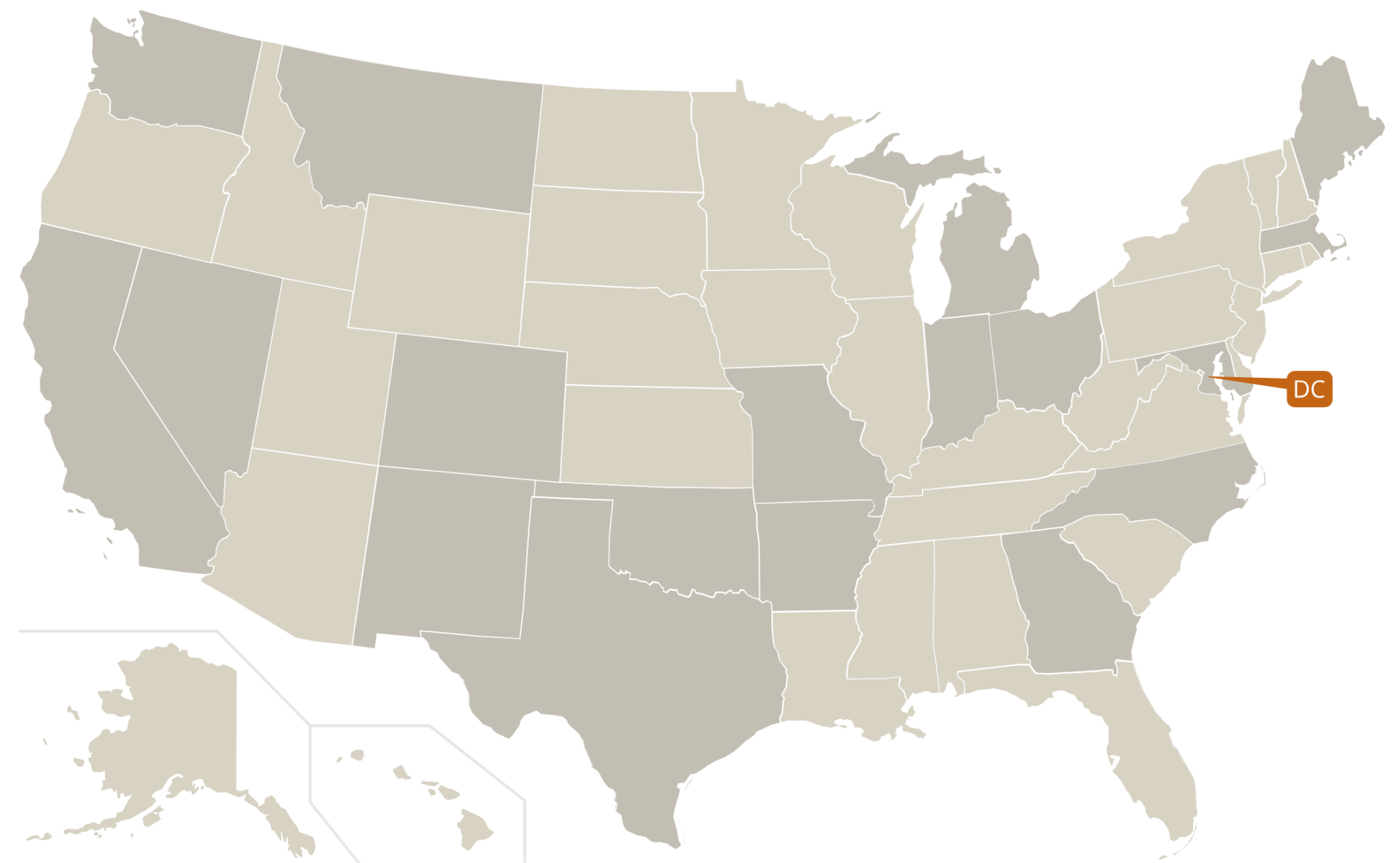
- ▶ **Mathematics Pathways Project** (*CBMS/Dana Center original work*)
  - ▶ Consideration of the 11-14 transition spaces
- ▶ **Launch Years** (*Dana Center*)
  - ▶ Focus on the K-12 aspects of the pathways work
  - ▶ **Leadership Network** (*AIMC, AMATYC, AMS, AMTE, ASSM, BBA, CBMS, MAA, NCTM, NCSM, TODOS*)
- ▶ **Catalyzing Change** (*NCTM*)
- ▶ **Mathematics Modernization**

## A NATIONAL MOVEMENT

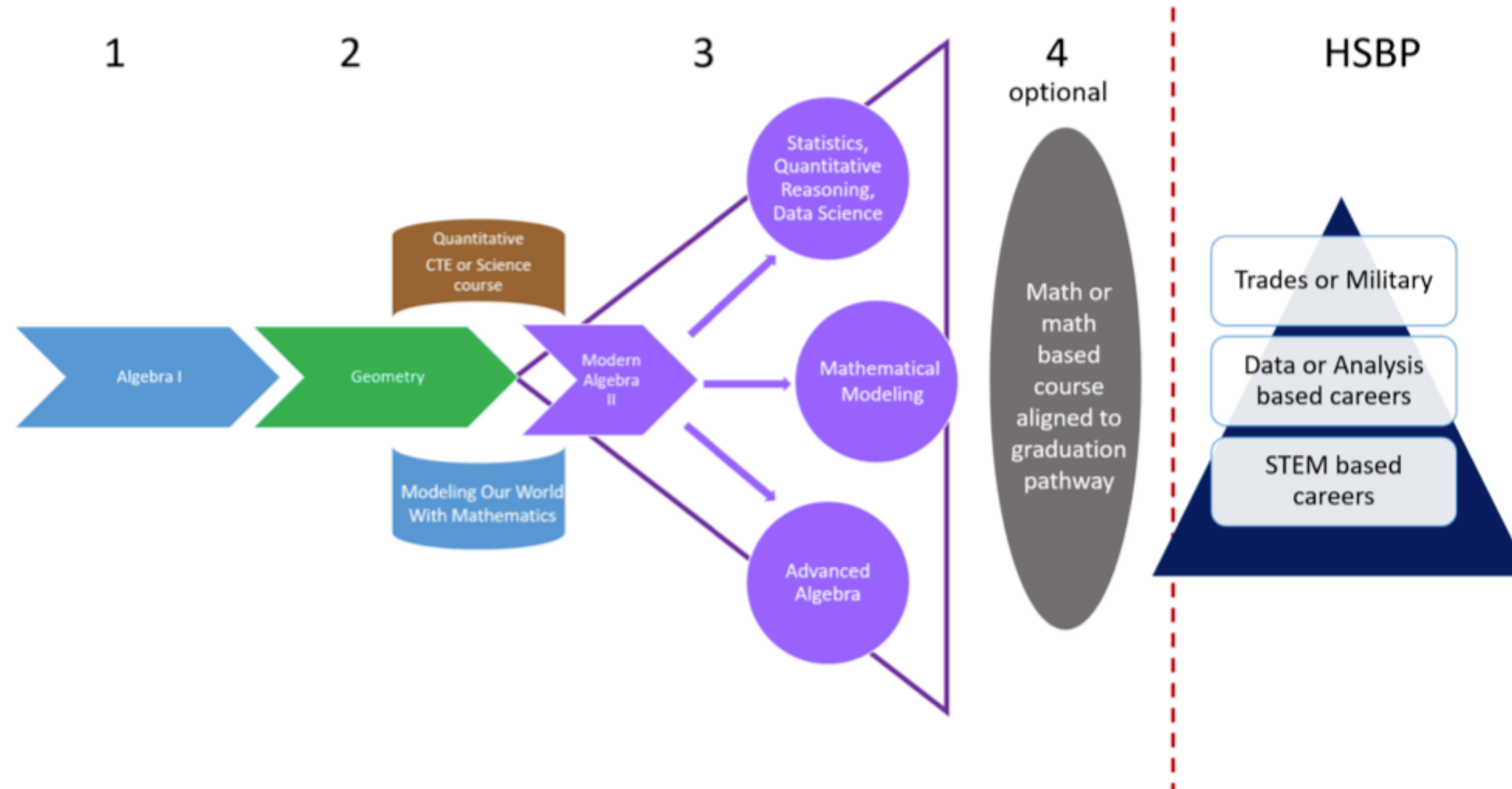
CBMS/Dana Center Pathways Forum Participants



States currently working on a K-12 Pathways initiative



# WASHINGTON (STATE)

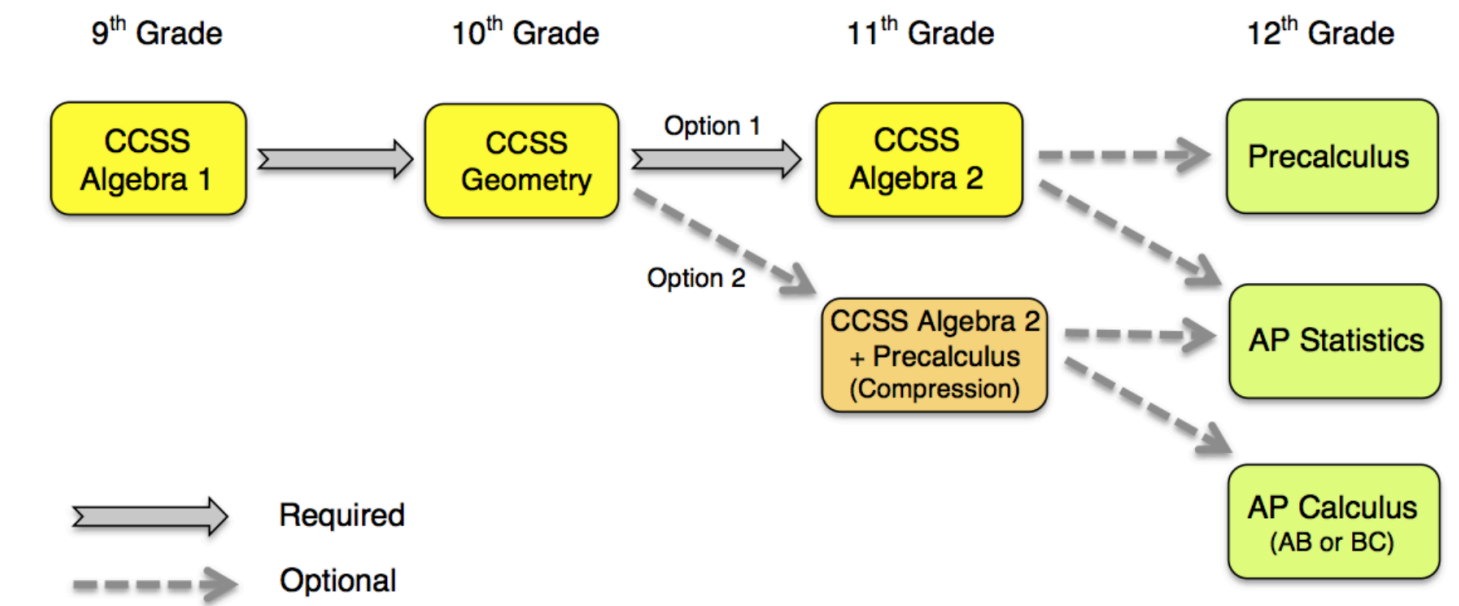


Students who take MOWWM or CTE/Science as 3<sup>rd</sup> credit may take Modern Algebra II as 4<sup>th</sup> credit

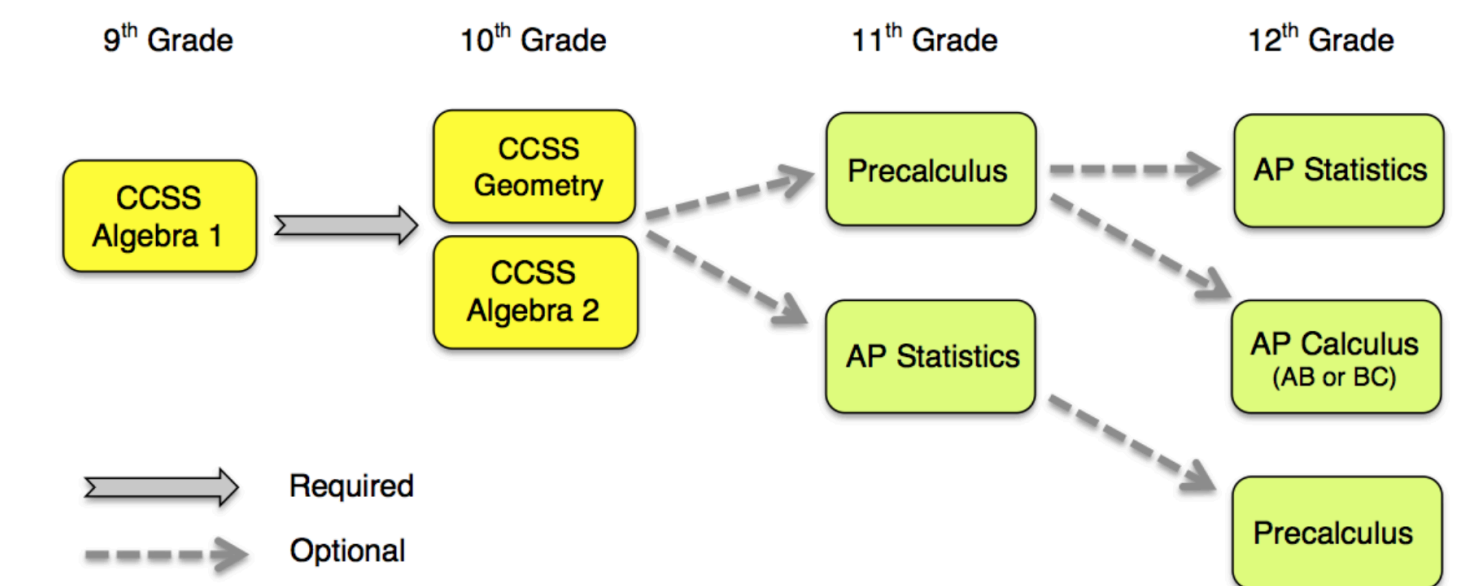
# CALIFORNIA

- ▶ California Mathematics Framework
  - ▶ Focus on equity and detracking
  - ▶ Builds from successful models like Escondido, SFUSD
- ▶ Higher education reform
  - ▶ Multiple placement measures for two-year colleges
  - ▶ CSU: repositioning quantitative reasoning courses, increasing access

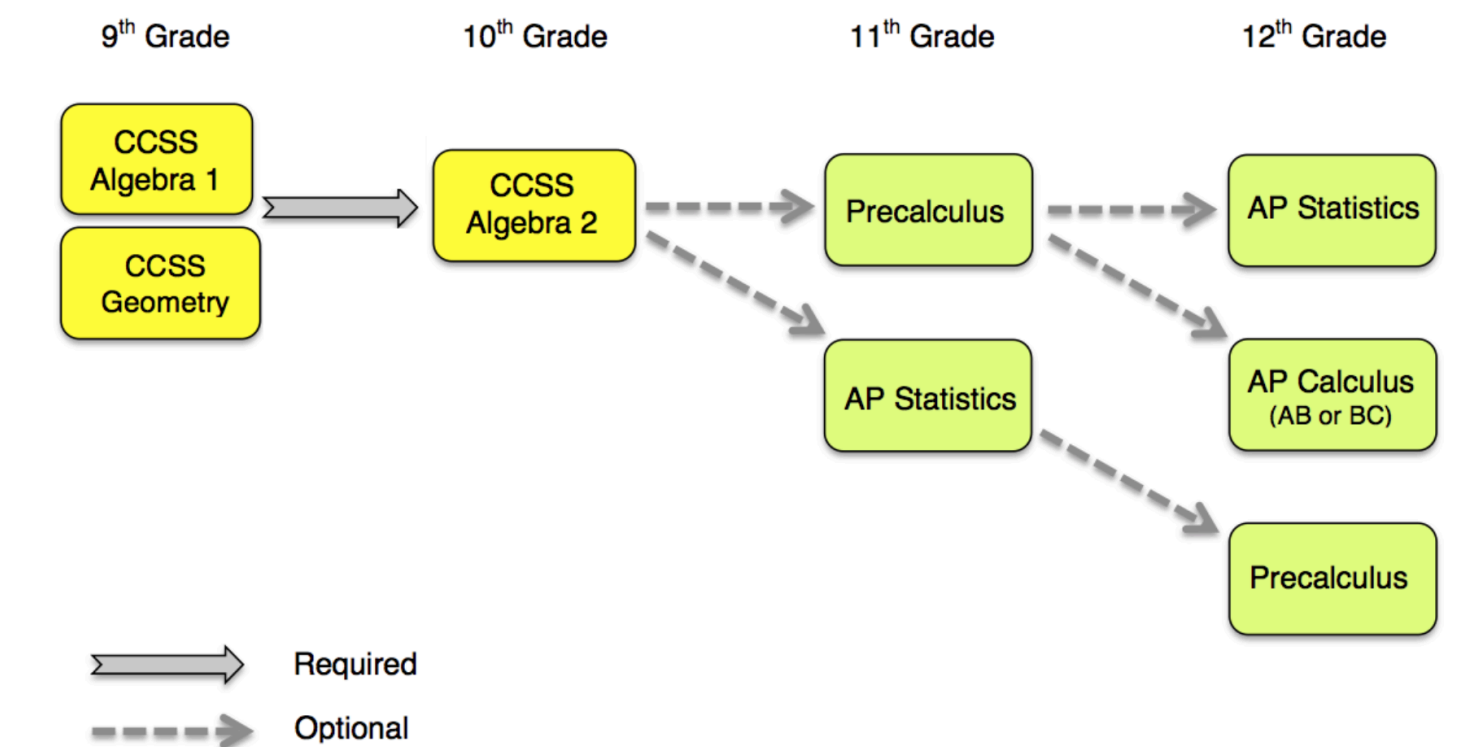
## 1. SFUSD Recommended Sequence



## 2. Doubling up in sophomore year

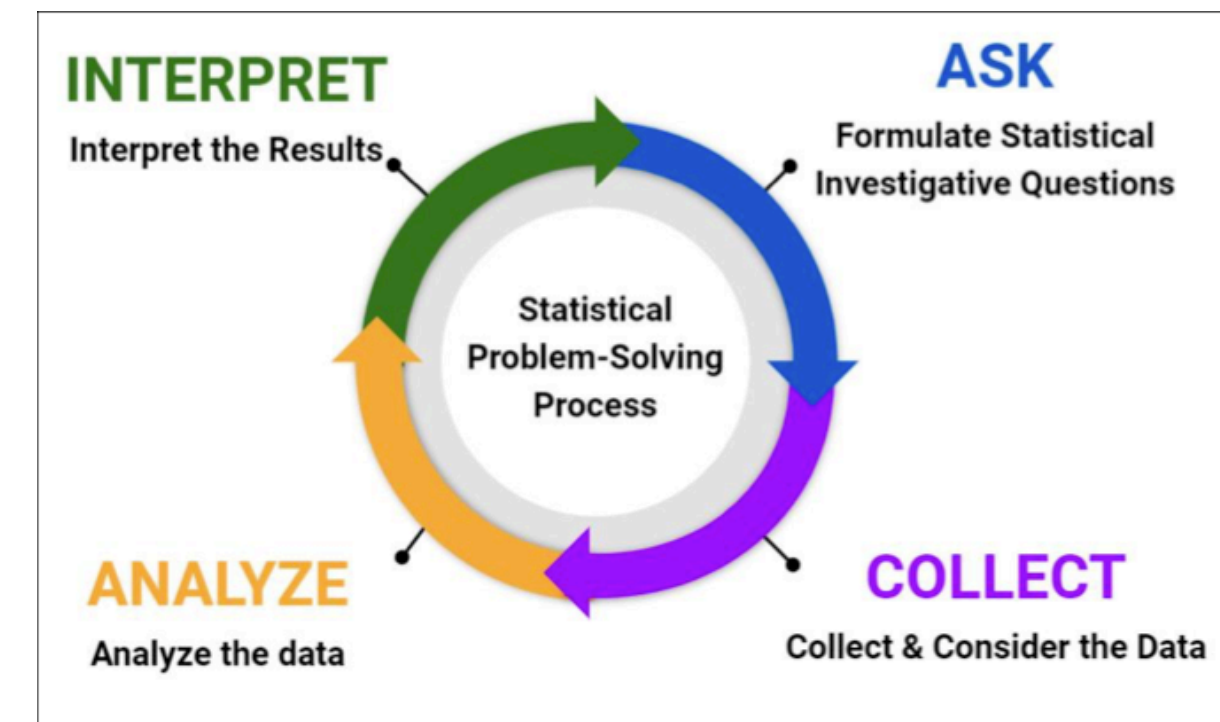


## 3. Doubling up in freshman year



## GEORGIA

- ▶ Revised state mathematics standards to
  - ▶ better incorporate statistical reasoning throughout grades
  - ▶ reduce the the number of topics covered each year
  - ▶ reposition Algebra II (“Advanced Algebra”) to better prepare students for fourth-year course options relevant to their career pursuits
- ▶ Reform of gateway courses in higher education





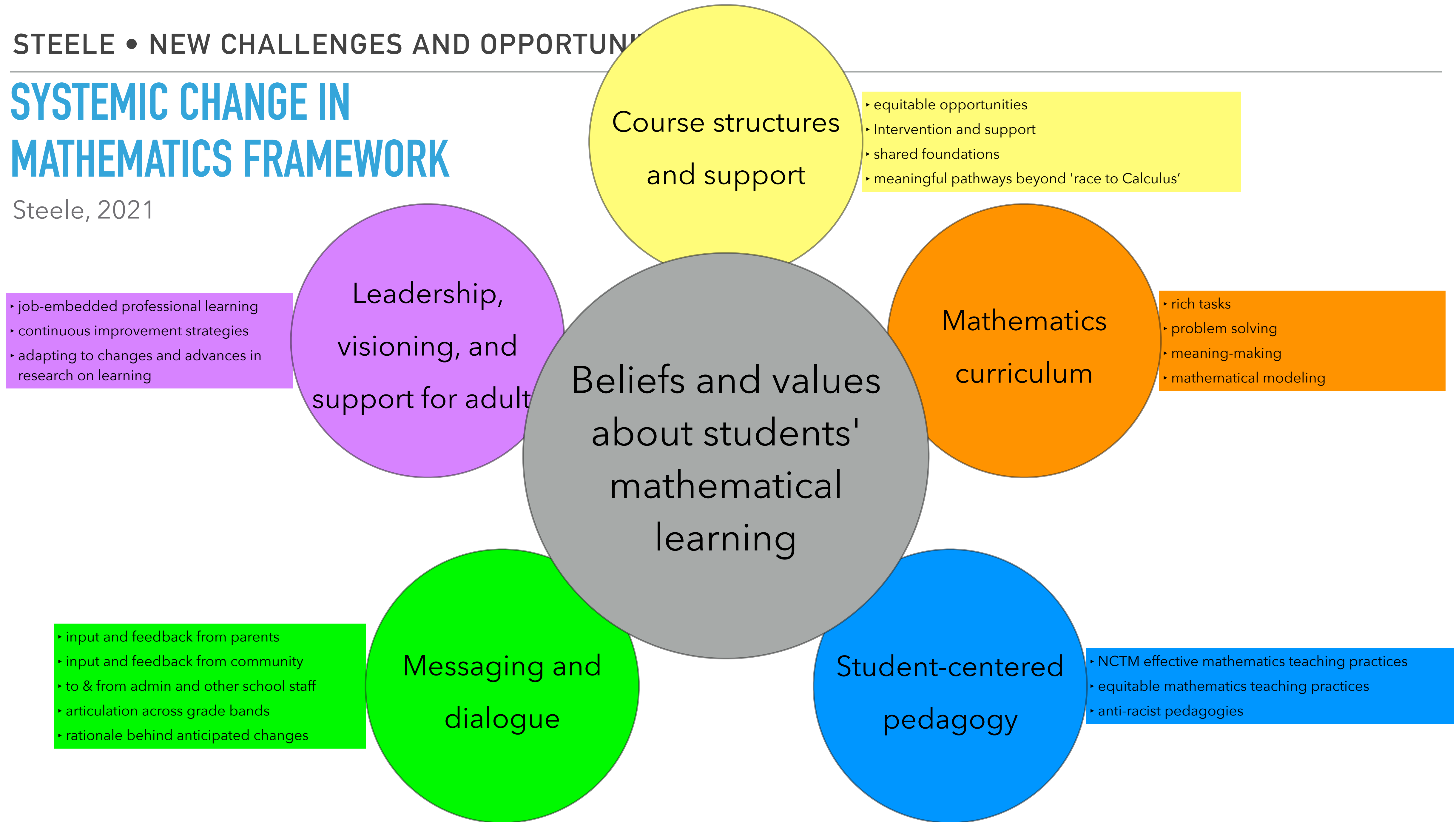
## COMMON THEMES

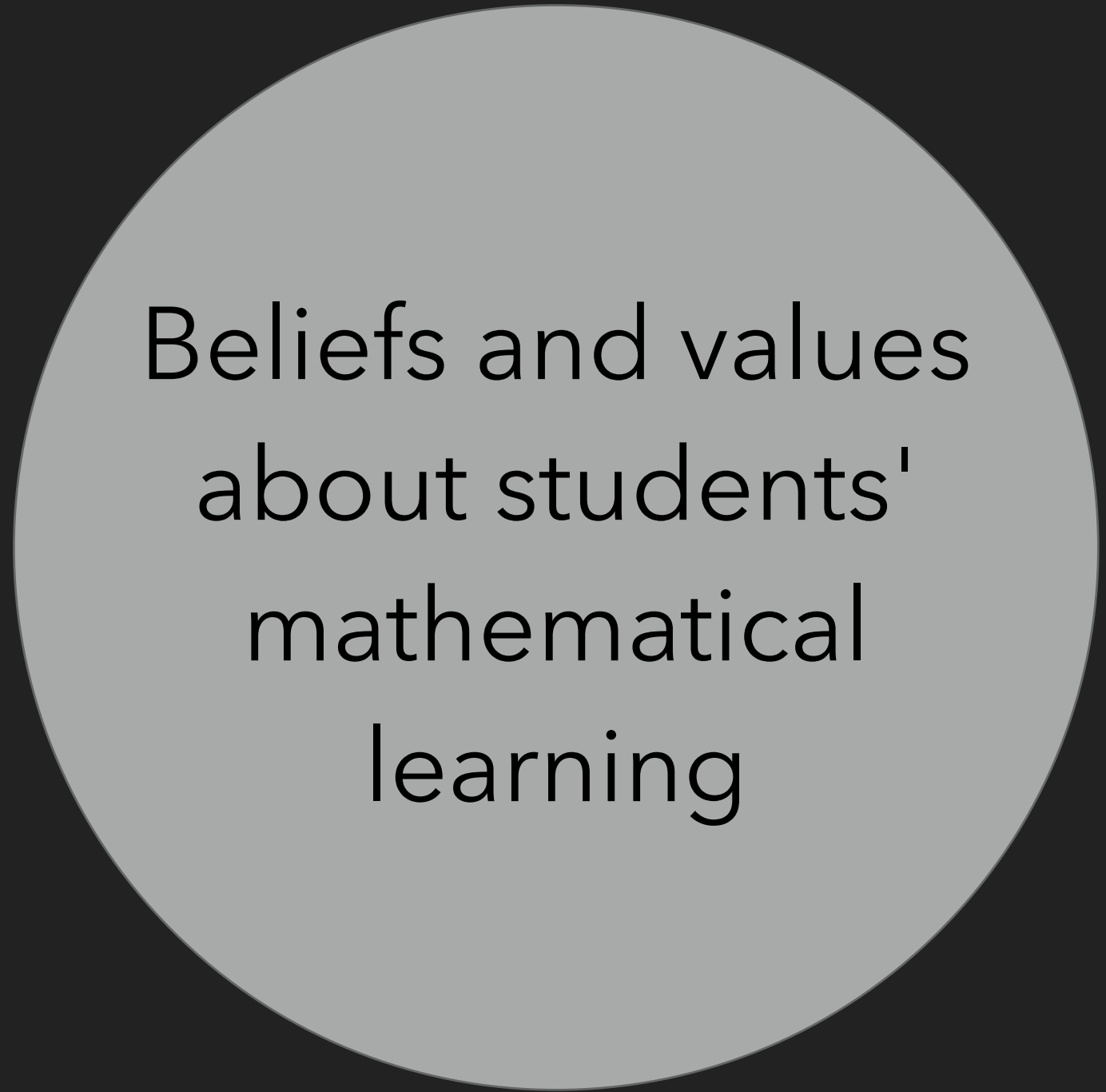
- ▶ Focusing on a common middle school & grades 9-10 mathematical experience
  - ▶ Catalyzing Change in High School Mathematics (NCTM, 2018)
  - ▶ Invigorating High School Math (Leinwand & Milou, 2021)
- ▶ Re-envisioning the content and purpose of Algebra II
- ▶ Sensible and flexible options in grades 11-12
- ▶ Expanding first-year credit-bearing college options beyond College Algebra

**CURRICULAR CHANGES  
ARE NOT ENOUGH.**

# SYSTEMIC CHANGE IN MATHEMATICS FRAMEWORK

Steele, 2021





Beliefs and values  
about students'  
mathematical  
learning

**CHALLENGES**

---

**BELIEFS & VALUES**

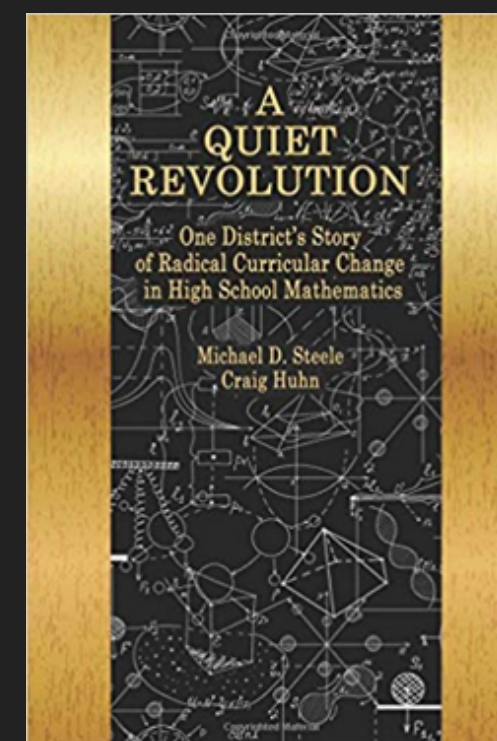
## BELIEFS AND VALUES

- ▶ Teachers' beliefs influence the decisions that they make about the manner in which they teach mathematics.
- ▶ Students' beliefs influence their perception of what it means to learn mathematics and their dispositions toward the subject.
- ▶ Without explicit and shared agreement about the beliefs and values of a school building:
  - ▶ Teachers will implement curricula in ways consistent with their beliefs
  - ▶ Administrators will evaluate and fund math in ways consistent with their beliefs

## BELIEFS AND VALUES

- ▶ Initiate critical conversations about the productive and unproductive beliefs that mathematics teachers hold in a building
- ▶ Create a shared statement of beliefs and values for the district and the building
- ▶ Use regular staff development time to explicitly discuss beliefs:
  - ▶ Discussing and analyzing teaching practice
  - ▶ Evaluating student work
  - ▶ Co-designing **and co-scoring** assessments

WHAT WE OFFER THAT IS DIFFERENT FROM OTHER TEXTS THAT DISCUSS COLLABORATION, PROFESSIONAL GROWTH, AND SYSTEMIC SUPPORTS IS A SET OF HONEST, ACCESSIBLE STARTING PLACES FOR YOU TO INSTIGATE YOUR OWN QUIET REVOLUTION USING THE LESSONS WE HAVE LEARNED IN HOLT.



Steele & Huhn (2018) p. 2



**CHALLENGES**

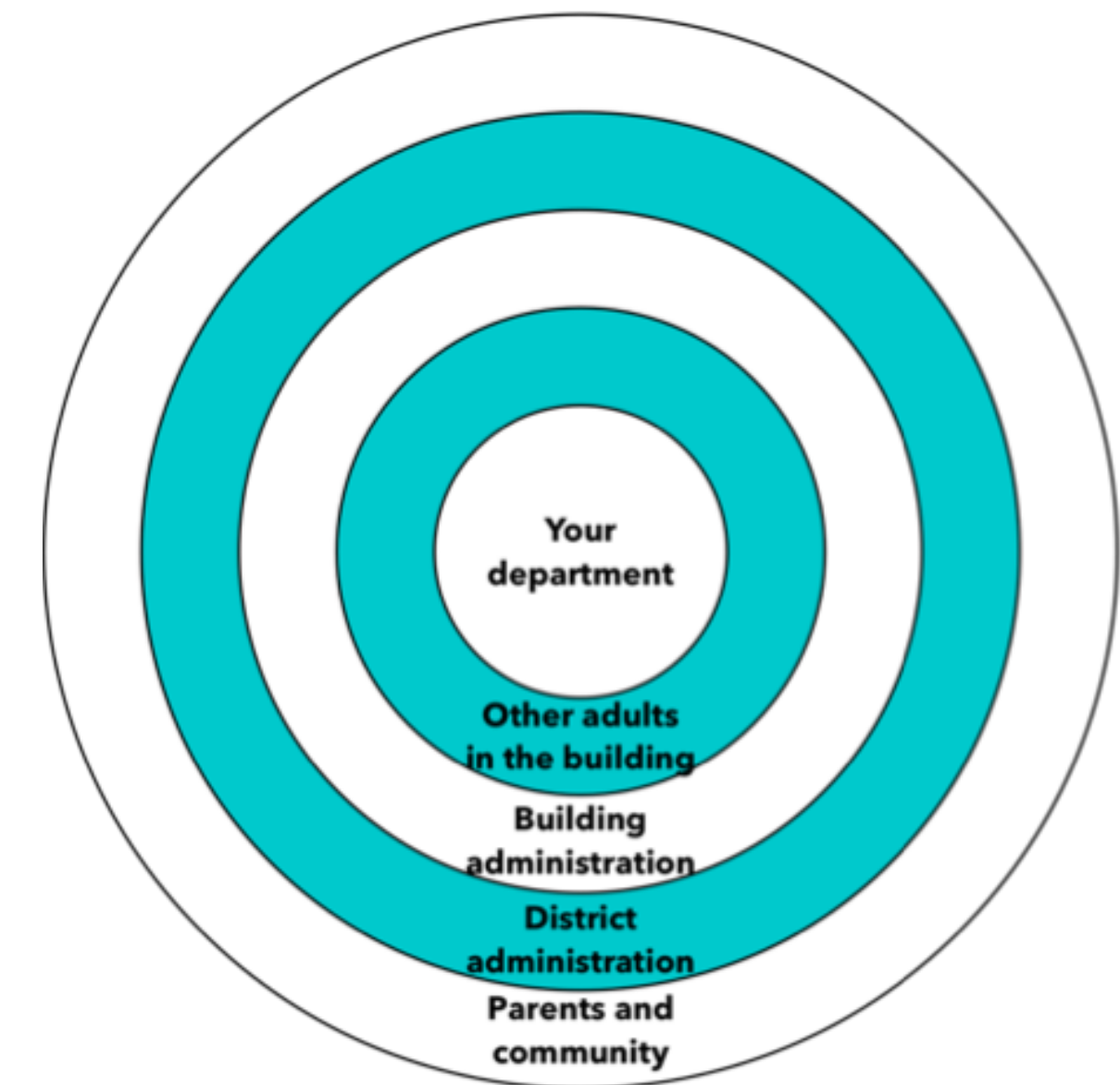
---

**MESSAGING**



## MESSAGING

- ▶ The message of 'mathematics modernization' is one of the strongest approaches across the ideological spectrum
- ▶ Community members must not see modernization efforts as taking away opportunities for students with high achievement profiles
- ▶ Focus on data-based arguments about mathematics teaching and learning
  - ▶ Over-acceleration limits opportunities for deep understanding
  - ▶ Taking calculus or better in high school is not required for STEM careers
  - ▶ Mathematics modernization is a workforce and global competitiveness issue



## MESSAGING

Wilkins, J. L., Bowen, B. D., & Mullins, S. B. (2021). First mathematics course in college and graduating in engineering: Dispelling the myth that beginning in higher-level mathematics courses is always a good thing. *Journal of Engineering Education*, 110(3), 616-635.

### First mathematics course in college and graduating in engineering: Dispelling the myth that beginning in higher-level mathematics courses is always a good thing

- ▶ Students taking Calculus I or higher as their first college math course are more likely to graduate with an engineering degree
- ▶ Starting past Calculus I (taking high school calculus and getting credit) gave no discernible advantage to students over starting at Calculus I
- ▶ When considering grade and course together, some groups of students who were more successful at courses before Calculus I were as likely to graduate as students who were less successful starting further on in the sequence

Leadership,  
visioning, and  
support for adults

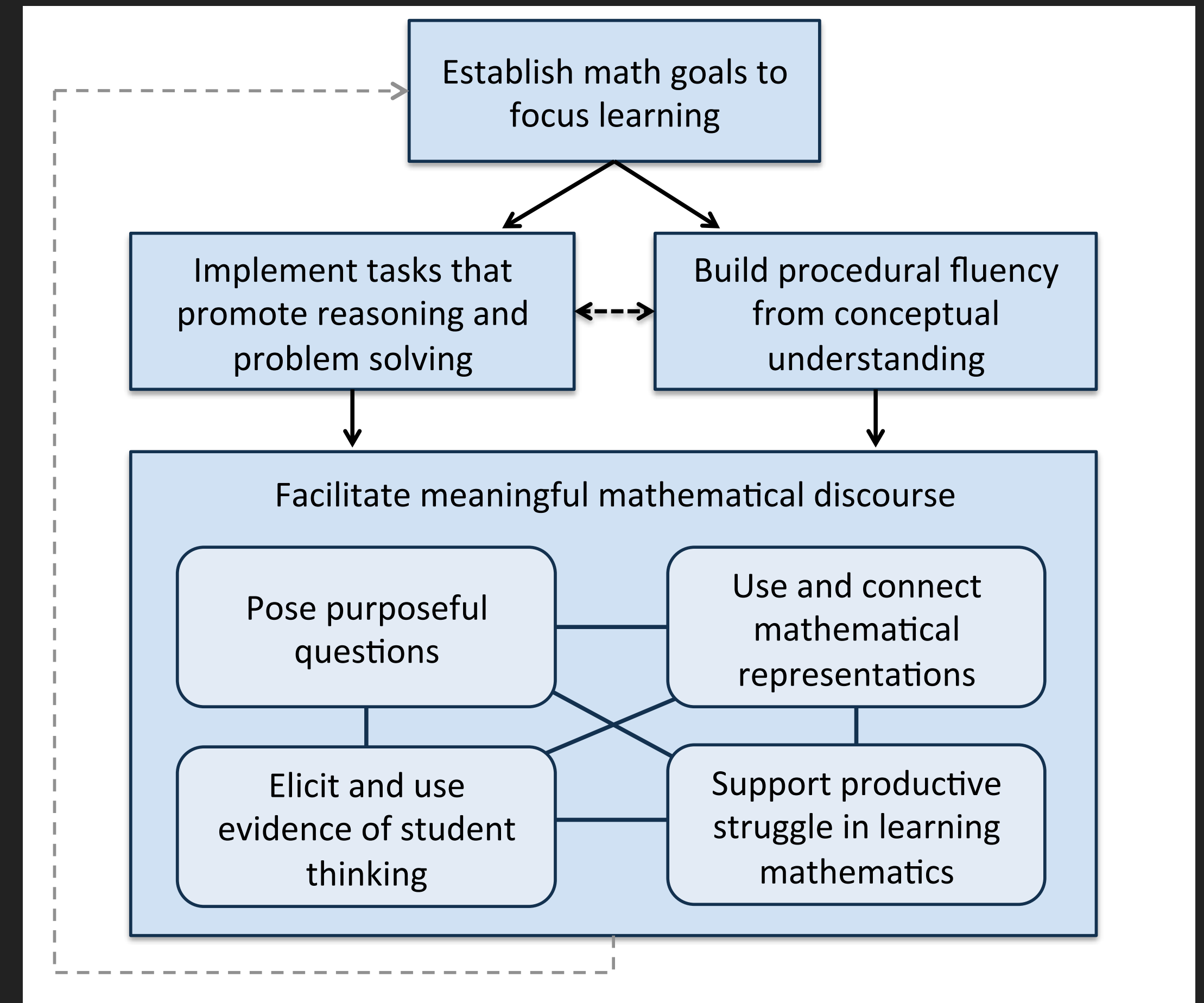
**CHALLENGES**

---

**PROFESSIONAL LEARNING**

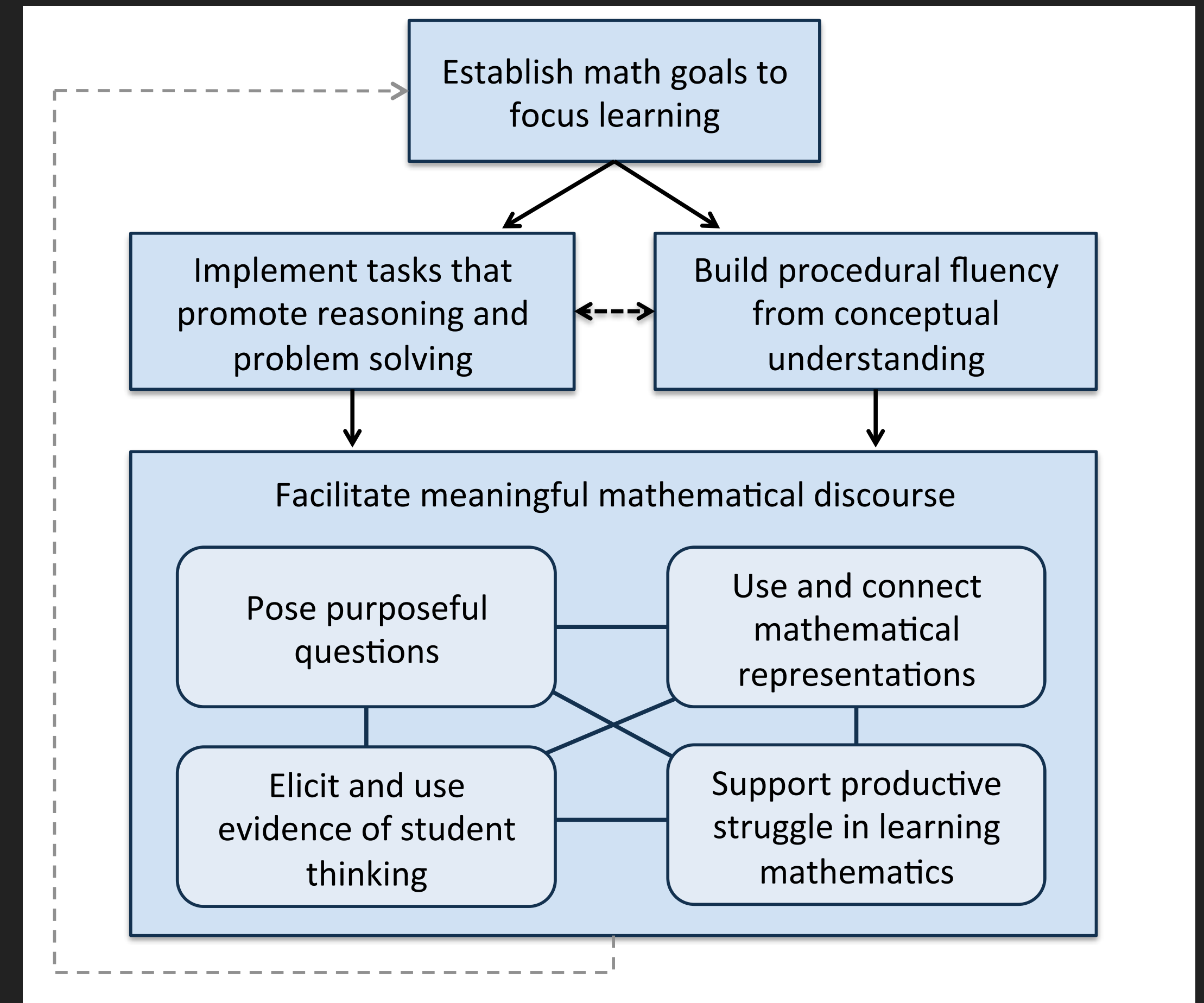
## PROFESSIONAL LEARNING

- ▶ Implementation of the curriculum is important
- ▶ Districts, states, and universities must collaborate on professional development focused on research-based instructional practices

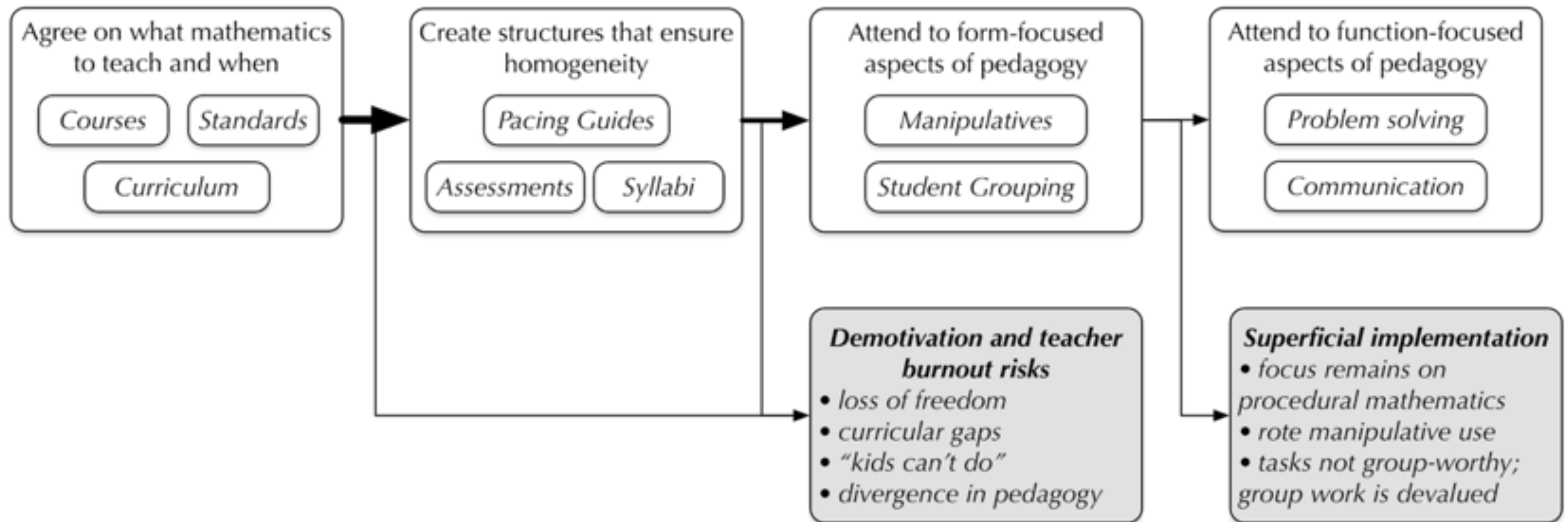


## TEACHER PREPARATION

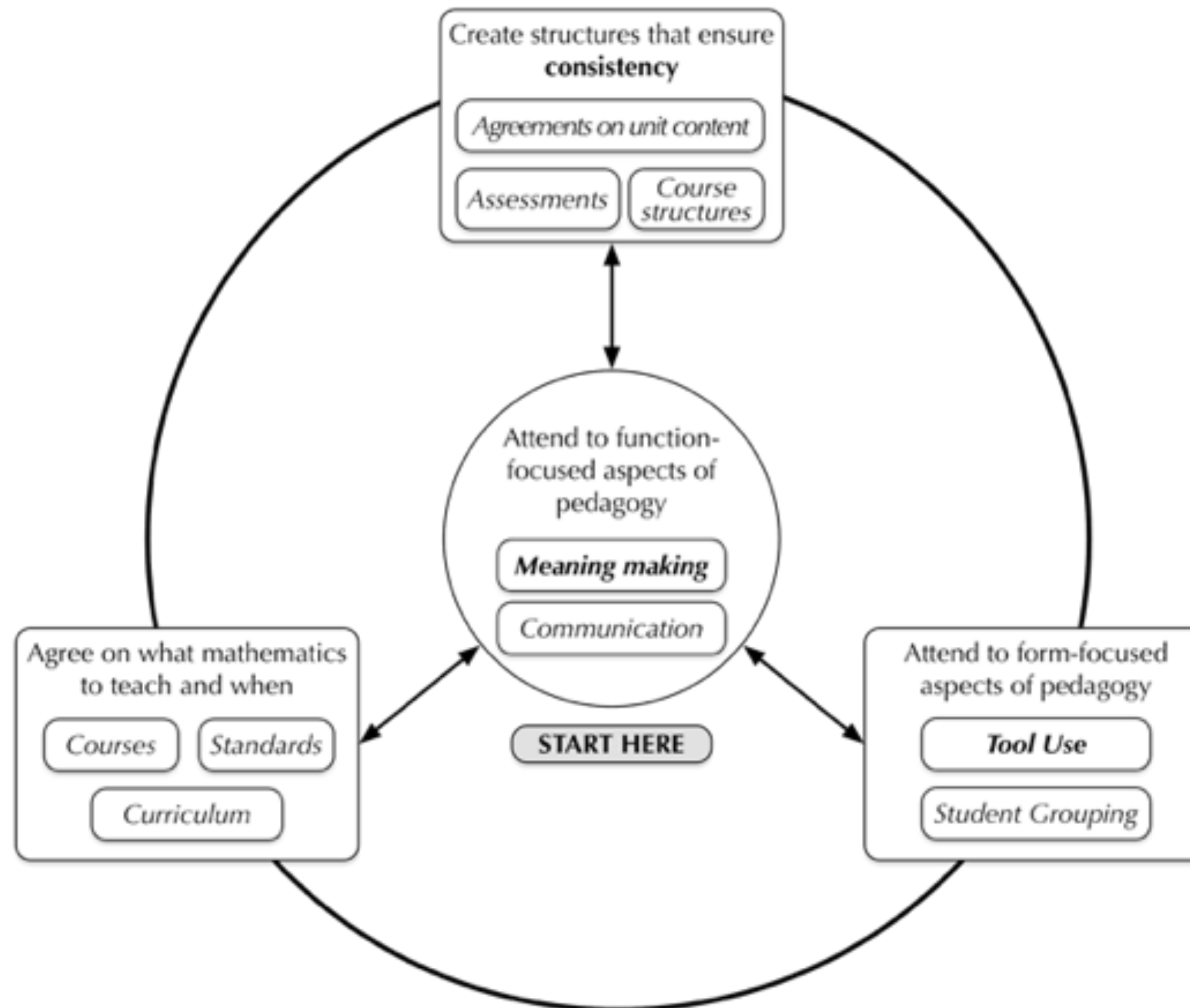
- ▶ New teachers must exit a preparation program with strong fluency in research-based effective practice
- ▶ The mathematics content for preservice teachers must evolve:
  - ▶ Statistics
  - ▶ Data science
  - ▶ Integrated secondary content



# SYSTEMIC CHANGE: A TYPICAL MODEL



# SYSTEMIC CHANGE BASED ON SHARED VALUES ABOUT TEACHING AND LEARNING



**WHAT ARE YOU  
WONDERING ABOUT?**