# Creating Sustainable Math Reform

Nicole Berg, Nebo School District, nicole.berg@nebo.edu
Sterling C. Hilton, Brigham Young University, hiltons@byu.edu

# Introduction to the Context

Vision of mathematical understanding

- Sense making
- Reasoning
- Problem solving
- Seeing and making connections to the world

# Introduction to Context

## Current definition of mathematics

- Rules and procedures,
- Calculations and facts,
- Relevant to a small percentage of students (GEEKS)

## Current definition mathematical understanding

- Memorized facts and procedures,
- Right answers,
- SPEED--faster is better

# Introduction to Context

Typical description of math instruction

- Teachers clearly and carefully describing the rules and steps of procedures
- Teachers helping students *remember*
- Students ‘learning’ the rules and steps of procedures
- Students trying to *remember*

# Educational System

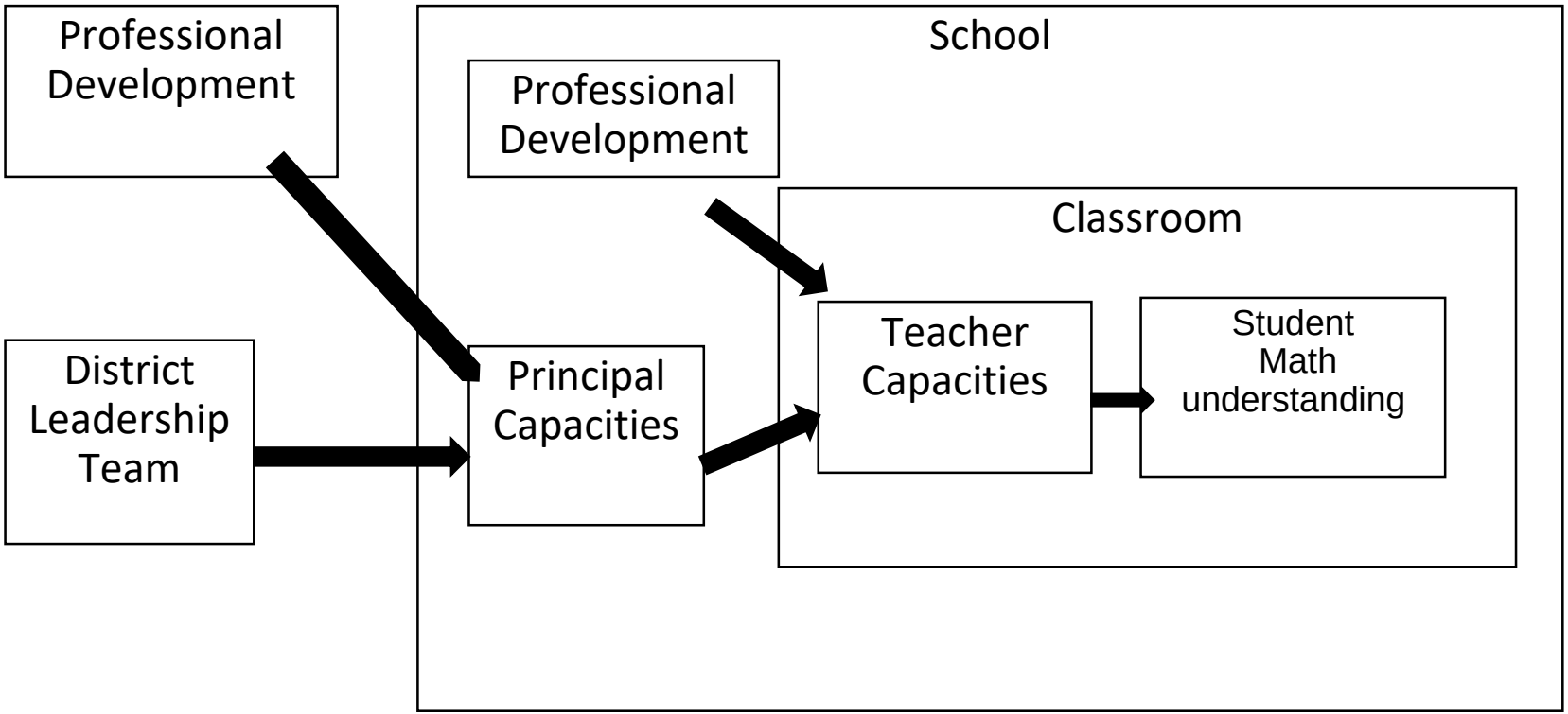
Characteristics of our educational system which we characterize as follows:

- The core system is the classroom
- The most impactful influence on student learning is classroom instruction
  - Teacher
  - Student
- Classrooms exist in the system of a school
- The most impactful influence on the school is the principal
- Schools exist in the system of a district
- The most impactful influence on the district is the district leadership

# Systemic Educational Improvement

Our mission is to realize our vision of student mathematical understanding through professional development of teachers and principals designed with a lens of systemic improvement.

- Professional development for teachers
  - Whole school receives the PD together
  - Extensive (2 ½ years)
  - Intensive (bi-weekly, 2-hour sessions)
  - Builds capacity in three essential areas
    - Beliefs and values about math, math understanding, & math instruction
    - Math understanding (conceptual, procedural, & representational)
    - Math pedagogy (CMI Framework which is built on principles of guided-inquiry)
- Professional development for leaders
  - To be described later in the presentation


Professional Development
School
Professional Development
Classroom
Teacher Capacities
Student Math understanding
District Leadership Team
Principal Capacities

# Significant Sytemic Barriers

Systemic barriers to sustained improvement in student mathematical understanding.

- Inertia of a 100+ year old educational system that has created a perception of math in our society that is widespread and inaccurate.
- Expectations of key stakeholders in the educational system
  - Principals -- what should I expect when I observe teaching/learning in math classrooms?
  - Teachers -- what should I expect of myself and of my students?
  - Students -- what should I expect when I'm in math?
  - Parents -- what should I expect when my students are 'doing' math homework?


1.
A
C
5) $28 \cdot \left(\frac{1}{7}\right)^2 + 2 \cdot \frac{3}{14}$
6) $x^2 + 8x - 33 = 0$
2)
3)
4)
$\sqrt{5} \cdot \sqrt{3} \cdot \sqrt{5} \cdot \sqrt{3}$
60°
1
$\leq 0$
5

# AUGUST 2008

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 Pg. 12-16 #'s 1-24 | 26 Pg. 20-24 #'s 1-31 | 27 Pg. 28-31 #/s 1-25 | 28 Pg. 37-40 #'s 1-22 | 29 Quiz 1.1-1.4 | 30 |
| 31 | | | | | | |

Day 1: Chapter 1, Lesson 1, Rates
Day 2: Chapter 1, Lesson 2, Complex Fractions and Unit Rates


FCAT
Florida Comprehensive Assessment Test®


WELCOME
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
LUNCH

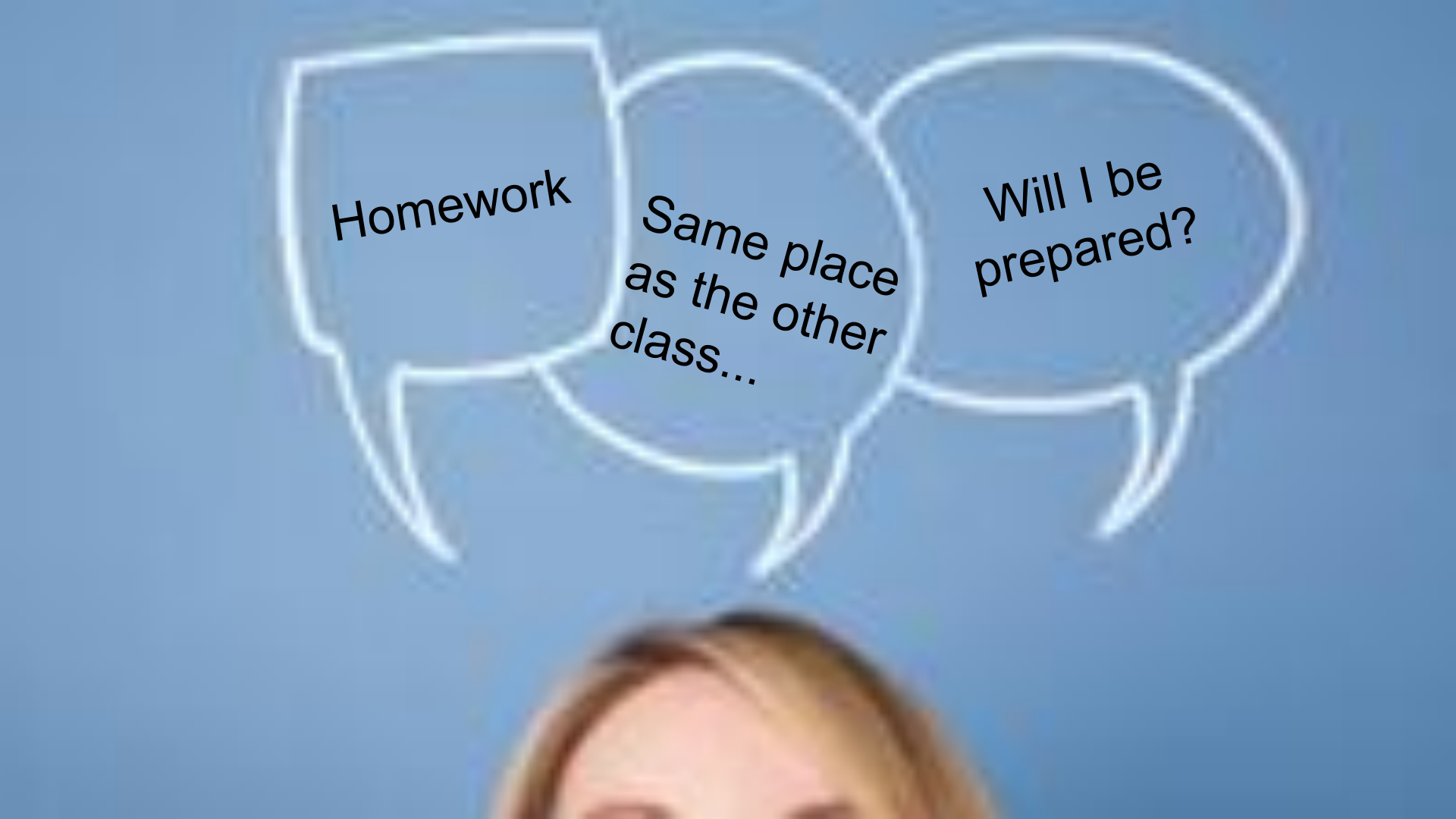
# Comprehensive Mathematics Instruction

# AUGUST 2008

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | | | | | 1 | 2 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25<br>Pg. 12-16<br>#'s 1-24 | 26<br>Pg. 20-24<br>#'s 1-31 | 27<br>Pg. 28-31<br>#/s 1-25 | 28<br>Pg. 37-40<br>#'s 1-22 | 29<br>Quiz 1.1-1.4 | 30 |
| 31 | | | | | | |

Day 1: Chapter 1, Lesson 1
Day 2: Chapter 1, Lesson 2


remember
Connections
What
if...


Homework
Same place as the other class...
Will I be prepared?

**Exhausting:**

- Solitary Teacher
- PLC’s/Collaboration
- Stakeholders
  - Administrators
  - Students
  - Parents
- Difficult to sustain

**Energizing:**

- Students making sense
- Understanding at deep levels
- Connections
- Math was relevant

# Defining Leadership

## Transformational Leadership vs. Instructional Leadership

Transformational leader

Motivate

- Reward, Punishment, Inspiration

Facilitate

Provide Resources and Time

Set up Processes and Structure

Instructional Leader

Engage in instructional decisions

- Curriculum
- Assessment
- Pedagogy

Establish Common Vision

Monitor

# Defining Leadership

Learning Centered Leadership - Blend of the two

“The more leaders focus their relationships, their work, and their learning on the core business of teaching and learning, the greater their influence on student outcomes” (Robinson, Lloyd, and Rowe 2008).

# Capacities for Systemic Improvement

| Types of Capacity | Group | | |
|---|---|---|---|
| | District Leadership Team | School Administrative Leaders | Teachers |
| Specialized Instructional Practices | High | Moderate | High |
| Content Knowledge | High | Moderate | High |
| Building Trust | High | High | Moderate |
| Solving Complex Problems | High | High | Moderate |

# Leadership Tasks for Systemic Improvement

1. Build a shared vision

1. Recognize instructional best practices

1. Lead professional discussions

1. Support implementation

1. Build leadership in others

# Components of Leadership Training

- Principals Cohort
  - Principals and Assistants from 3 schools
  - Monthly 90 minute meetings
  - Experienced learning math, book study, and leadership discussions
- Attend Teacher Professional Development
- Book Study - *Mathematical Mindsets*
- Lesson Study
- Site visit

# Results

Principals Reported:

- Increased ability to respond to parent concerns
- Increased confidence in discussing math with teachers
- Increased comfort and enjoyment in visiting math classes - Some reported that math classes went from their least favorite observation to their most favorite.
- Increased ability to solve implementation problems
- Increased willingness to use resources to support implementation

# Principal

“I am able to identify things from a different perspective. For example, had I gone into a [task-based] lesson without this background, I would have questioned the approach, saying, ‘You are a little off-base here!’”

“I see now that this is a process with a clear destination. At the beginning of the process, teachers know this destination, but students don’t. This is alright because I see that *telling* students of the destination robs them of their understanding of that destination.  This is a paradigm shift for me, because I always wanted to concretely know that students understood that destination from the beginning.”

# Results

Teachers Reported:

- Increased levels of trust in administration
- Appreciation for support when facing parental concerns
- Appreciation for the effort to discuss pedagogical practice, even if it was not always perfect
- Permission to try new methods even if it was not immediately successful
- Increased resources in time to meet and curriculum resources
- Increased interest in their work

# Teacher

“For a principal to begin to understand mathematics and our specialized instructional practices is a big, huge piece.  For a principal to see that what we’re learning in the math department can enhance instruction throughout *all* of the departments is even bigger.”

# Student

“Hey!!! My math teacher here is boring. We do the same thing every day: review homework from last time, take notes, then start new homework. She teaches everything straight out of the book. I'm pretty sure that she doesn't even prepare a lesson she just turns to a page and starts reading from it.

“Your way of teaching is way better and I learned way more from it. Still using growth mindset that you taught me about last year. You're my all time favorite teacher.

“That class was my favorite! I bet that you have never had a class as cool as that. I was thinking today and I finally realized why your method of teaching is so much better than other teachers. Other teachers tell us how to think while you let us think for ourselves. Slash I felt really smart when I thought that.”