Improving Mathematics Instruction for ELLs through (In)formative Assessment and Leadership

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Phoenix, AZ

Today's agenda:

- **Introduce our essential questions;**
- Introduce some background on working class students, students of color and English language learners (ELLs);
- Present background on formative assessment;
- Introduce the DAP, an example of a formative assessment format; and
- Explore the role of leadership to support formative assessment practices for ELLs.

Essential Questions for today's session:

- How can formative assessment support ELL students to meet standards for mathematical content and practices?
- What role does leadership play to bring best practices in formative assessment to scale in a school/district?

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Background

- Working class students and students of color have generally been denied opportunities to participate in mathematical learning communities in which students regularly engage in mathematical reasoning and discourse to solve complex tasks (Flores, 2007; Kitchen, Burr, & Castellón, 2010; Téllez, Moschkovich, & Civil, 2011).
- Educators of working class students and students of color often make the memorization of math facts, algorithms, vocabulary and procedures the focal point of their instruction, rather than teaching students through the use of complex, challenging problems (Davis & Martin, 2008; Kitchen, DePree, Celedón-Pattichis, & Brinkerhoff, 2007; Lattimore, 2005).

Deficit perspectives about multilingual learners (ELLs)

- Controlled forms of instruction teach working class students and students of color that little is expected from them except compliance to a rigid classroom environment (Knapp & Woolverton, 1995).
- In schools that serve large numbers of ELLs who speak with an accent, use English words incorrectly or speak Spanish as a means to express themselves, educators, peers and community members may assume they lack the capacity to perform well in mathematics (Gutiérrez, 2008; Moll & Ruiz, 2002; Moschkovich, 2007).

Some info about ELLs

- The number of ELLs enrolled in schools in the U.S. increased 57% from 1995 to 2006. (NCELA, 2007)
- ELLs often enter U.S. schools performing below their English speaking peers and their academic progress usually is measured with inadequate tools that do not accurately represent their learning (Abedi & Gándara, 2006; Abedi & Lord, 2001).
- ELL students are learning content, academic skills, and language simultaneously, and are more likely than non-ELL students to develop misconceptions (Abedi, 2011; Bailey et al., 2010).

What inspires us!

- Instead of pigeonholing students as “limited English proficient” (Valenzuela, 1999), we can view the language resources that ELLs bring as “Spanish dominant” or as potential bilinguals.
- Research offers instructional strategies and insights into how to position working class students of color as mathematically competent (See, for example, Turner, Celedón-Pattichis, & Marshall, 2008).
- Kitchen, Burr, and Castellón (2010) describe how culturally relevant assessment formats can be used as a means to develop trusting and affirming relationships that allow teachers to mathematically inspire their students.

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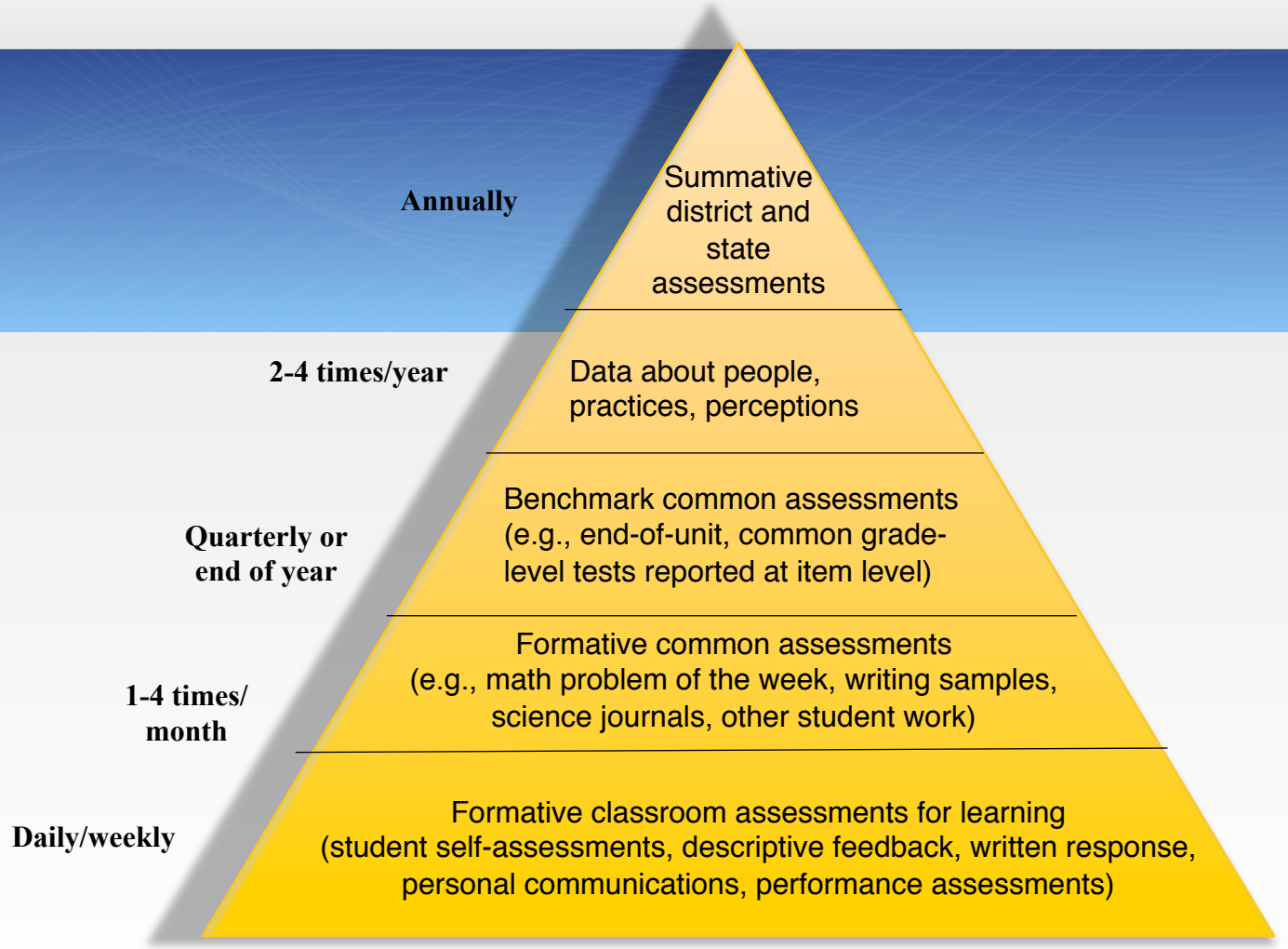
On a 3 X 5 card, jot down your ideas about the reasons we assess students:

- What should assessments be used for?
- How should assessment information be used to support instruction?

The different purposes for assessment (NCTM Assessment Standards, 1995)

- Student assessments should be aligned with, and integral to, instruction;
- Multiple sources of assessment information should be used;
- Assessment methods must be appropriate for their purposes;

The Data Pyramid



N. Love, K. E. Stiles, S. Mundry, and K. DiRanna, 2008

Formative Assessment

- An assessment is considered as "formative" when the feedback from learning activities is used to adapt teaching to meet the learner's needs. (Wilson & Kenney, 2003)
- "In"formative assessment…
- Examples of formative assessment (Shepard, 2000; Wilson & Kenney, 2003)
  - Math journals
  - Student portfolios
  - Analyzing student work together
  - Individual interviews

Formative assessment in action . . .

"...teachers generally listen for the 'correct' answer instead of listening for what they can learn about the students' thinking; they listen evaluatively rather than interpretively. The teachers with whom we have worked have tried to address this issue by asking students questions that either prompt students to think or provide teachers with information that they can use to adjust instruction to meet learning needs."

Leahy et al, 2005

More on formative assessment

After examining 250 research studies on classroom assessment, Black and Wiliam (1998) found that when teachers focus on formative assessment, student achievement gains are larger than when using other types of interventions.

Demands of formative assessment

"Because formative assessment is a dynamic process of *evidence elicitation*, *analysis and action*, it clearly makes demands on teachers' content and pedagogical knowledge…

Without such foundational knowledge, teachers' formative assessment may yield faulty decisions that could divert rather than promote student progress."

(Herman, et al., 2011)

Sam the Snail....

- A snail is climbing out of a well. The well is 20ft deep. Every day the snail climbs up 3 ft and every night he slips back 18 in.
- How many days will it take the snail to get out of the well?

Many students got hung up on converting feet to inches and the teacher did not intervene to help them focus on solving the problem using proportional reasoning.

Fennell, Kobett, & Wray, 2013

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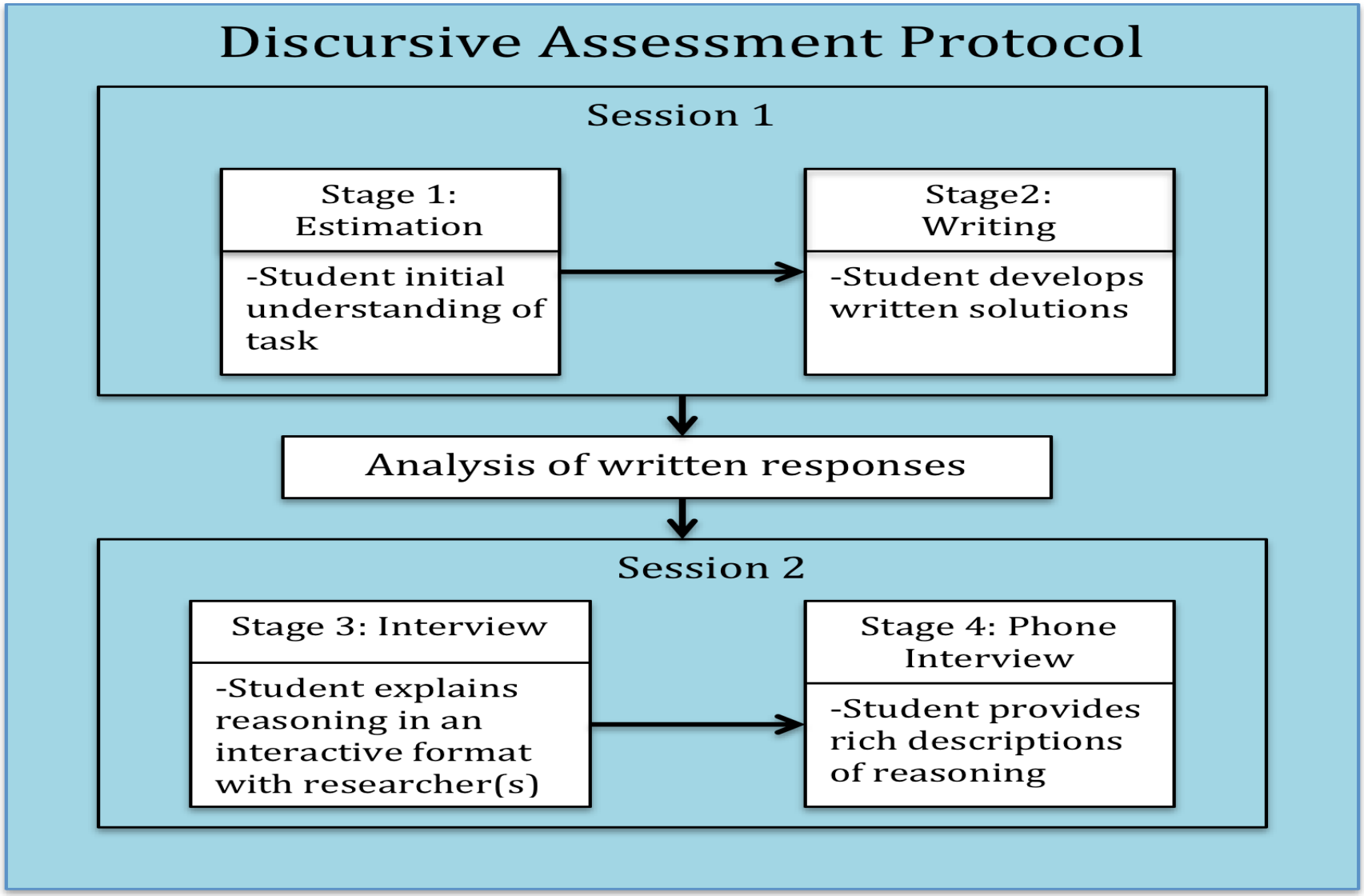
Test prep privileged over formative assessment

- At a highly diverse high school in the Denver area, much attention is given to improving the performance of “bubble students,” students who scored Partially Proficient on last year’s test.
- Lots of pressure on mathematics teachers to prep their students for “the test,” which is pushing them to focus more on summative assessment rather than formative assessment.
- Heavy focus on test prep equates with lots of traditional math instruction.

"Algebra class will be important to you later in life because there's going to be a test six weeks from now."

Discursive Assessment Protocol

- As part of CEMELA at the University of New Mexico, a formative assessment tool referred to as the Discursive Assessment Protocol (DAP) was designed with the specific goal of accurately assessing and supporting the learning of ELLs in middle school mathematics classrooms.
- *The protocol is an example of formative assessment through use of interviews.*


Discursive Assessment Protocol
Session 1
Stage 1: Estimation
-Student initial understanding of task
Stage2: Writing
-Student develops written solutions
Analysis of written responses
Session 2
Stage 3: Interview
-Student explains reasoning in an interactive format with researcher(s)
Stage 4: Phone Interview
-Student provides rich descriptions of reasoning

DAP conceptual framework

- Socio-constructivist Learning (Shepard, 2000) based on:
  - Cognitive psychology (Cobb, 2007) – internal cognitive structures & processes.
  - Constructivism (Vygotsky, 1979) – mental construction & sense making.
  - Socio-cultural theory (Forman, 2003) – learning through social interactions.
- Classroom expectations foster dispositions such as students' willingness to **persist** in trying to solve difficult problems.
- In this paradigm, assessment can be used
  - As a means to understand what students know
  - As a means to promote students' mathematical thinking
  - To inform instruction on an on-going basis.

(Shepard, 2000)

Task solving protocol

- Solve task with partner,
- Share out solution strategies with small group, and
- Be prepared to share out group solution strategies with whole group.

Task #1:

- Ariel drove his bike 39 1/6 meters and Nick drove his bike 28 5/9 meters. How many more meters did Ariel drive than Nick?

Protocol for viewing video:

(1). Observe video clip with intent of answering the following questions:

What mathematics does the student appear to know?

How does the facilitator support the student to make sense of the mathematics?

What strategies do you notice she's using to support the student?

(2). Discuss observations and analyses of the video clip with a partner vis-à-vis the three questions posed.

(3). Groups share out their collective analyses of clips.

Video #1

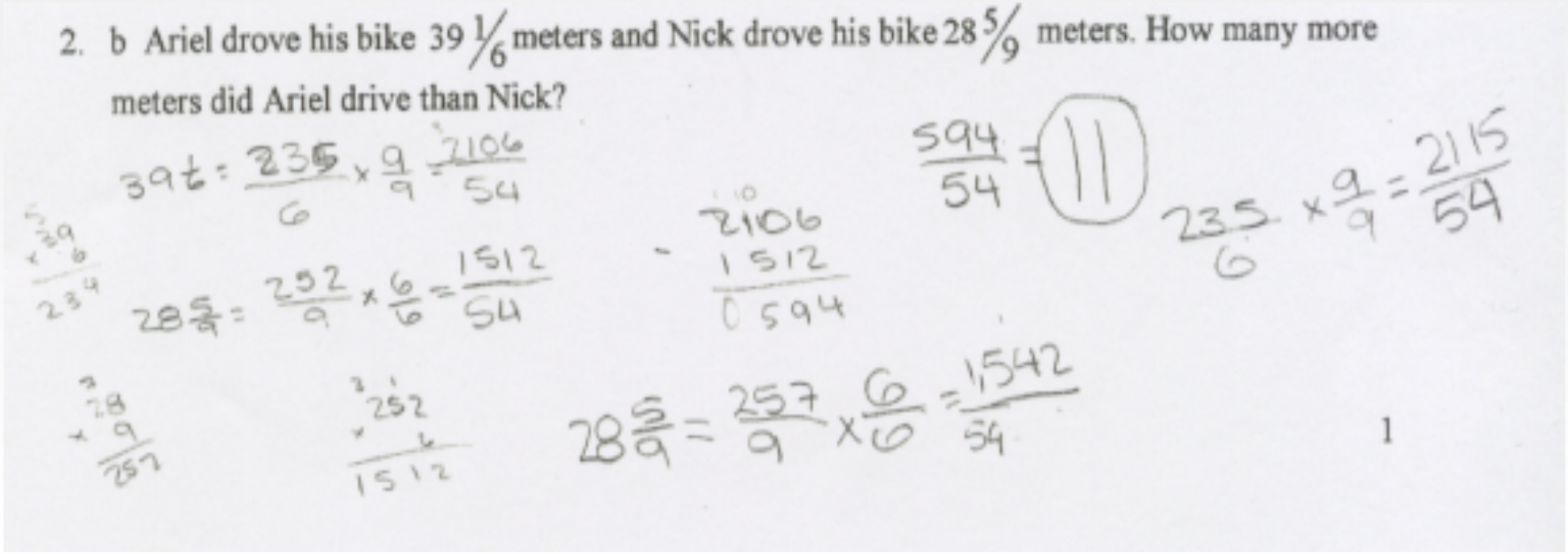
Questions to consider:

What mathematics does the student appear to know?

How does the facilitator support the student to make sense of the mathematics?

What strategies do you notice she's using to support the student?

Student's written response



2. b Ariel drove his bike $39\frac{1}{6}$ meters and Nick drove his bike $28\frac{5}{9}$ meters. How many more meters did Ariel drive than Nick?

$39\frac{1}{6} = \frac{235}{6} \times \frac{9}{9} = \frac{2106}{54}$

$28\frac{5}{9} = \frac{257}{9} \times \frac{6}{6} = \frac{1512}{54}$

$2106 - 1512 = 594$

$\frac{594}{54} = 11$

$\frac{235}{6} \times \frac{9}{9} = \frac{2115}{54}$

$28\frac{5}{9} = \frac{257}{9} \times \frac{6}{6} = \frac{1542}{54}$

1

Video #2

Zenia's problem solving strategies:

Big idea with fractions: Any common multiple of two denominators (e.g., 6 and 9) can be used to create a common denominator.

Big idea with whole numbers: Subtraction as difference.

Subtraction strategy: Subtract whole numbers and fractions separately and then combine to find difference. Alternatively, she could have kept one number whole, moved to a landmark & added up the pieces that comprise the difference.

Task #2: Try to imagine some strategies an emergent learner may use to solve:

$$\frac{1}{6} - \frac{2}{3}$$

Some questions to consider in your group:

1. How different were your strategies?
2. Did anyone at your table use a mathematical model to solve this subtraction problem?
3. What might constitute an *efficient solution* to this subtraction problem?

Video #3

We found through the interviews that students:

- Developed and used invented procedures and algorithms,
- Found and addressed their own errors, and
- Discovered what they did and did not understand well through their explanations.

Advantages of the DAP

- Provided a more thorough understanding of what ELLs know,
- Gave students an opportunity to express what they know using multiple representations,
- Supported students to develop positive mathematical identities, and
- Informed instruction.

Implementing formative assessment with ELLs

- Step 1: Elicit students' mathematical ideas.
- Step 2: Understand students' ideas through assessment.
- Step 3: Build instruction on students' mathematical ideas (when possible) and give them credit for these ideas.
- Step 4: Continually articulate and develop mathematical ideas and repeat steps 1-3.

Challenges to implementing formative assessment practices with ELLs

- TIME!!!
- Pedagogical Content Knowledge for Mathematics
  - Knowledge of mathematics
  - Knowledge of formative assessment practices, questioning techniques, planning, rubrics, etc.
  - Knowledge of students' cultural and linguistic backgrounds
- Assessing students' mathematical understandings in context of the demands of the larger classroom.
- Pressure from administrators (test prep) and parents (grades).

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On a 3X5 card, write your ideas about:

What is the role of leadership to support “in-formative” assessment practices in every classroom?

The role of leadership in promoting effective "in"formative assessment practices for ELLs

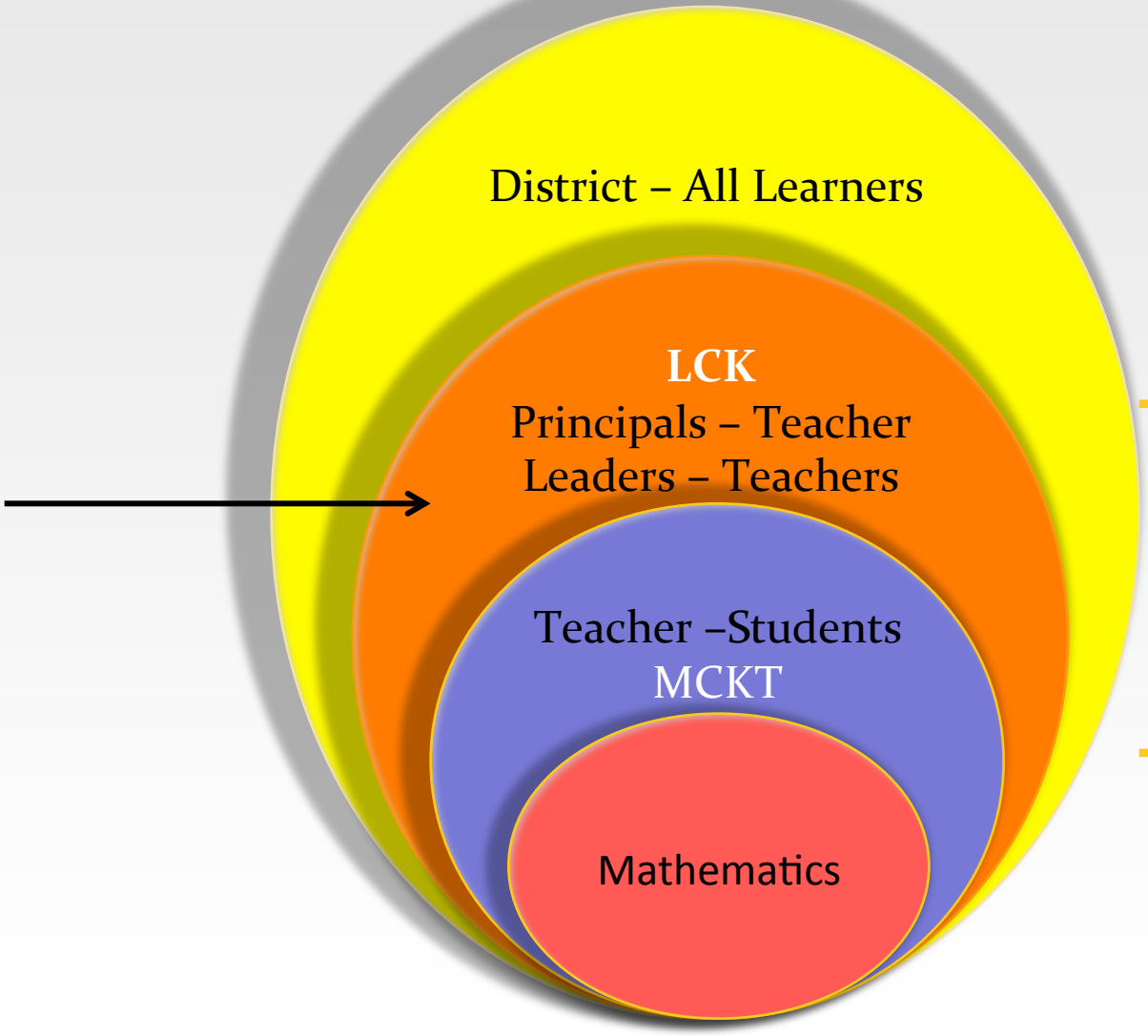
- **Support** teachers to develop and improve assessment practices,
- **Redesign** systems to align with emphasis on reforms, and
- **Hold** teachers **accountable** to implement reforms.

Domain 3 of Teacher Evaluation – Assessment

(Charlette Danielson FfT, 2013)

- Students indicate that they clearly understand the characteristics of high-quality work, and there is evidence that students have helped establish the evaluation criteria.
- The teacher is constantly "taking the pulse" of the class; monitoring of student understanding is sophisticated and continuous and makes use of strategies to elicit information about individual student understanding.
- Students monitor their own understanding, either on their own initiative or as a result of tasks set by the teacher.
- High-quality feedback comes from many sources, including students; it is specific and focused on improvement.

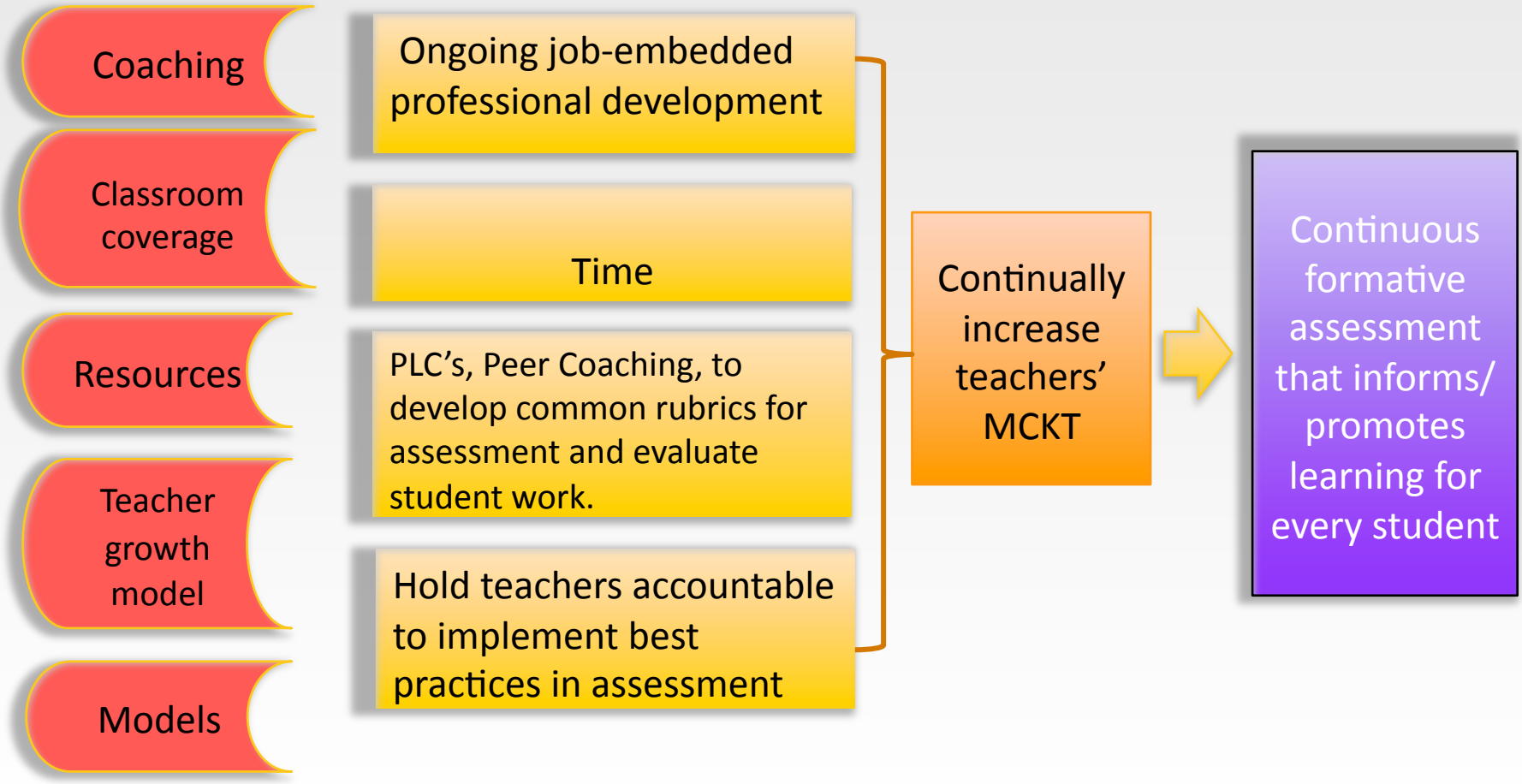
Leadership Content Knowledge + NCSM PRIME



PRIME:
Teach/Learn
Curriculum
Assessment
Equity

Stein & Nelson, 2003

Theory of Change



Jemez Valley Day School Case Study

- 49% Limited English Proficient (US Bureau of Indian Education, 2012),
- K-6,
- Math Science Academy professional development year-round,
- Weekly PLCs looking at student work, with assessment rubric,
  - Principal or math coach attends every PLC, facilitated by MSA coach
  - During duty day
- Peer coaching cycle for all teachers following lesson evaluation protocol, and
- All teachers have classroom assistant to cover.

Professional Learning Communities and Peer Coaching

- Looking together at student work,
- Using common assessment tools,
- Raising expectations,
- Holding one another accountable,
- Using the language of instruction, and
- Observing one another teach a lesson.

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