

# FACILITATORS GUIDE: WORK SMARTER, NOT HARDER TO IMPROVE MATHEMATICS TEACHING!

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# DESIGNING PROFESSIONAL DEVELOPMENT TO SUPPORT MATH TEACHING AND LEARNING

## 1. Effective mathematics Teaching focuses on **student learning**

- Ability to **adapt** teaching to meet students' needs using standards-based approaches
- Focus teaching by building student reasoning
- Use formative and summative assessment to inform instruction
- Using Standards for Mathematical Practice (CCSSM, 2010)

The graphic features a light blue header with the title 'Standards for Mathematical Practice'. Below the title is a table with two columns: 'Mathematics Practice Standards for Students' (green header) and 'Mathematics Teaching Practices' (blue header). The table lists eight standards on the left and their corresponding teaching practices on the right, separated by a vertical black bar. The background of the graphic includes a stylized graphic of a blue and grey ribbon on the left side.

Mathematics Practice Standards for Students	Mathematics Teaching Practices
Make sense of problems and persevere in solving them.	Establish mathematics goals to focus learning.
Reason abstractly and quantitatively.	Implement tasks that promote reading and problem-solving.
Construct viable arguments and critique the reasoning of others.	Facilitate meaningful mathematical discourse.
Model with mathematics.	Use and connect mathematical representations.
Use appropriate tools strategically.	Pose purposeful questions.
Attend to precision.	Build procedural fluency from conceptual understanding.
Look for and make use of structure.	Support productive struggle in learning mathematics.
Look for and express regularity in repeated reasoning.	Elicit and use evidence of student thinking.

2. Why is there a disconnect between what teachers learn in PD and what gets implemented in the classroom?
- Lack of seeing the “big picture” and how new ideas connect to old practices
  - Too busy, not enough time to integrate anything new
  - Does not fit into daily teaching routines
  - PD does not build a coherent vision (Fragmented information)

The framework below answers the question of “what do I do?” These are explicit strategies that teachers can implement. It takes about 1 year for teachers to create shifts in their teaching. Teachers should use it as a tool to self-reflect and monitor shifts in their teaching. They can self-identify areas of growth and use the strategies in a meaningful way to embed into teaching. The framework takes into account the process of teaching.

**Whole Class Discussion Framework: Tool for Teachers**

- Naturally integrates the Nevada Academic Content Standards for Mathematical Practice into teaching routines.
- Answers the question “What do I do?”

**WORK SMARTER, NOT HARDER**

A FRAMEWORK FOR MATH TEACHING AND LEARNING

TERUNI LAMBERG

*Whole Class Discussion Framework*

Please indicate the level of implementation (rate 0–4)

0—Not implemented

1—Starting to implement—still figuring out how to implement this part of framework

2—Implemented—becoming more comfortable using these strategies in teaching, using some of the time

3—Implemented—implemented strategies—using most of the time

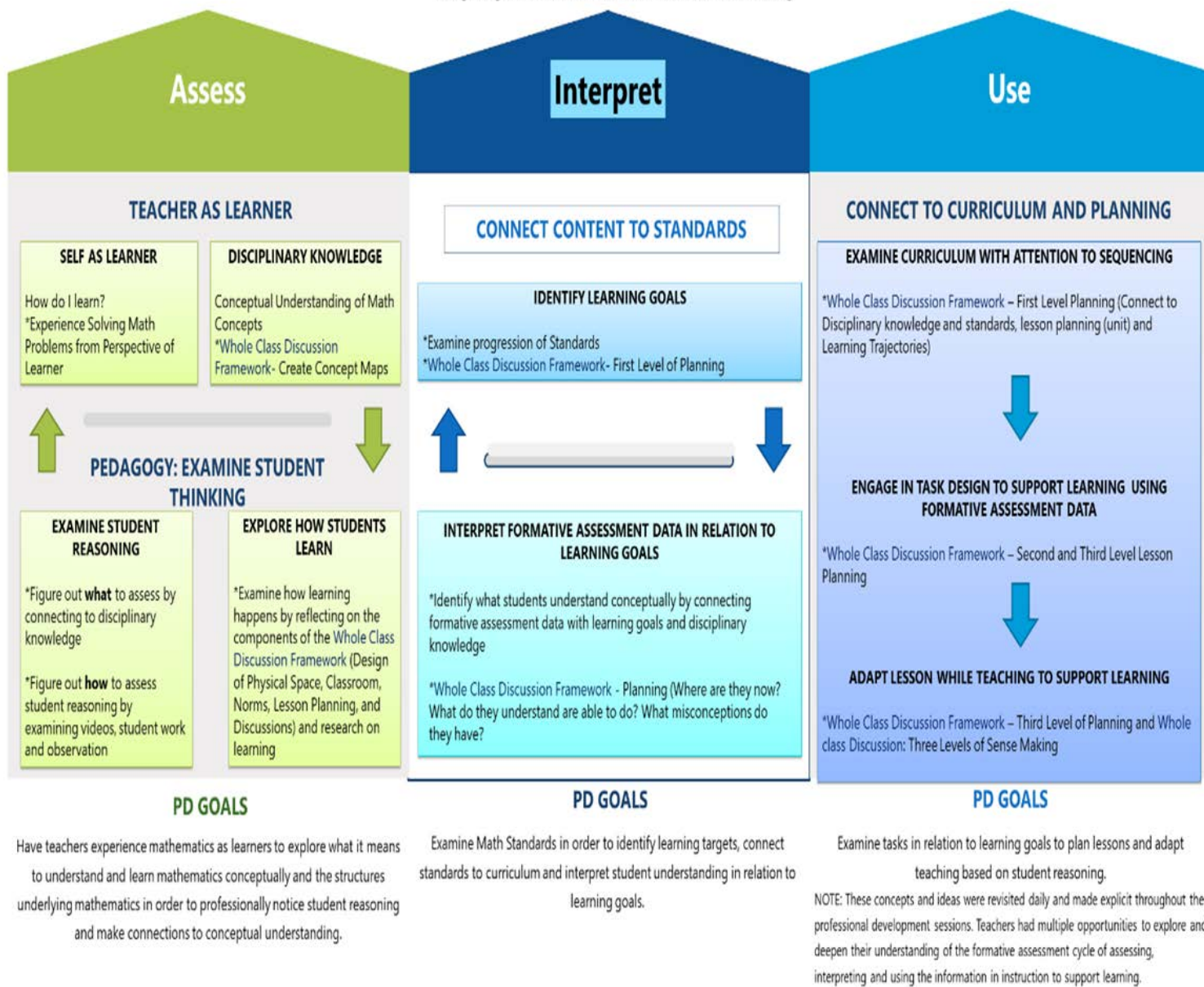
4—Fully implemented—consistently using these strategies as a regular part of my teaching

	Not implemented				impl
	0	1	2	3	
<b>Setting up the classroom</b>					
Setting up physical space					
<b>Cultivating classroom environment/routines</b>					
Routines for preparing for discussion					
Routines for communicating					
Routines for listening/reflecting					
<b>Lesson planning</b>					
<b>First level planning (long-term &amp; short-term goals)</b>					
Concepts (big ideas)					
Unit plan (sequencing/learning trajectory)					
<b>Second level of planning</b>					
Lesson plan (anticipating student reasoning/ misconceptions errors, format for using a problem-solving approach to teaching and structuring time)					
<b>Third level of planning (adapting discussion to support student understanding/needs)</b>					
Making decisions on what to talk about based on student reasoning during lessons					
<b>Teacher questioning/supporting mathematical connections</b>					
<b>Three levels of sense making</b>					
Phase I: making thinking explicit					
Phase II: analyzing each other's solutions					
Phase III: developing new mathematical insights					

\*Lamberg (2019) *Work Smarter, Not Harder: A Framework for Math Teaching and Learning*

# Professional Development Design

Integrating Formative Assessment into the Process of Teaching



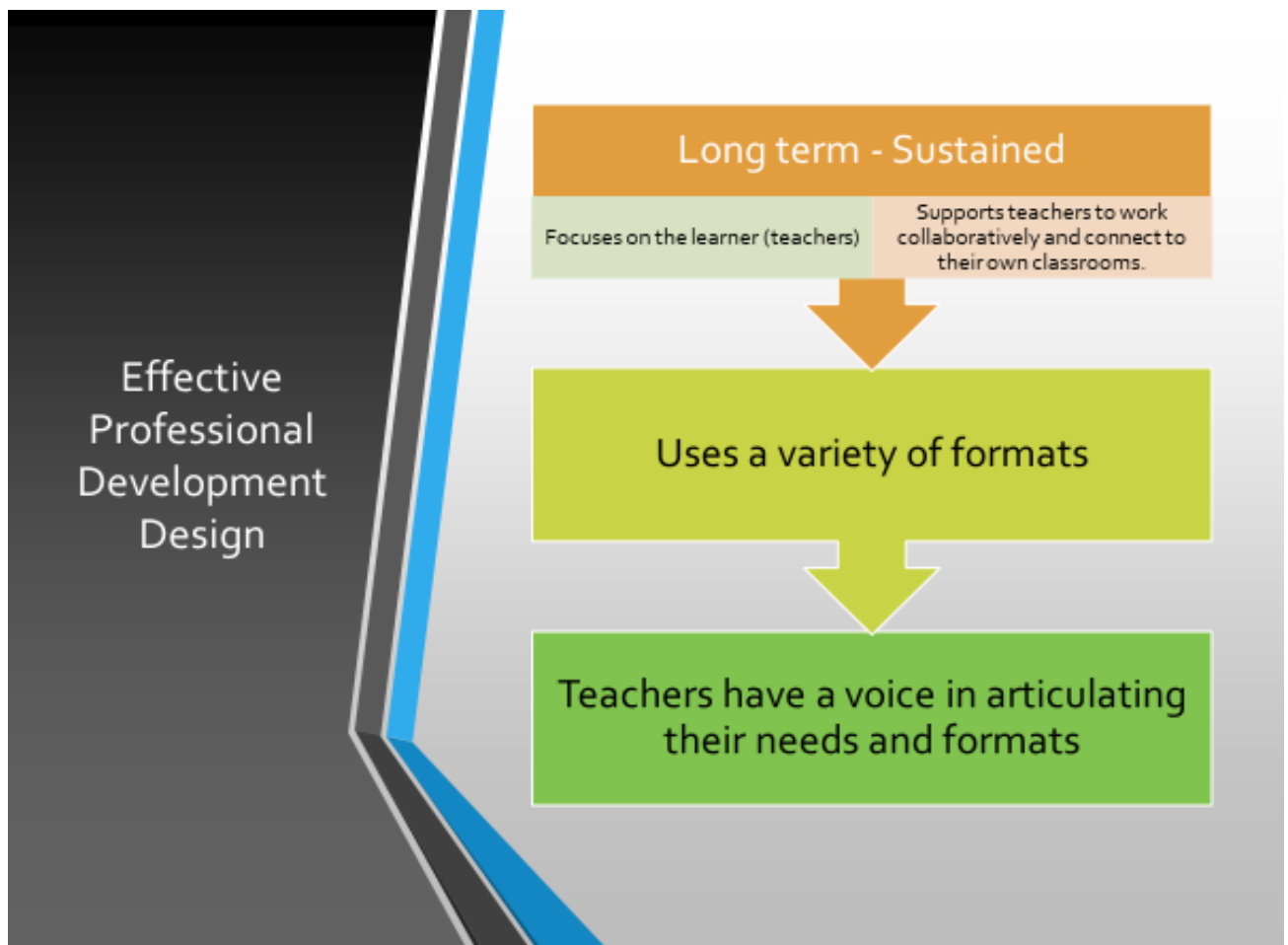
\*Lamberg, Gillette-Koyen & Moss (2020). Supporting Teachers to Use Formative Assessment for Adapting Decision Making. Mathematics Teacher Educator, Vol 8 (2).

\*This framework should be used as a guide to think about the kinds of knowledge that teachers need in order to optimize opportunities for student learning.

### 3. Creating a coherent vision for professional development to create system wide change

- Research indicates a need for a coherent vision (Learning goals and instructional vision.)
  - a. Need to align teacher learning, Curriculum and assessments and supports for struggling students
- Nevada Academic Standards
  - a. (Standards for Mathematical Practice- how to teach)
  - b. Content standards-What to teach?
- *What do teachers need to learn and be able to do?*

## SUPPORTING TEACHERS BY BUILDING ON CURRENT TEACHING PRACTICES



- Meeting teachers needs at where they are at:
  - Use *Whole class Discussion Framework* for teachers to self-identify current practices after they have had PD on the framework
  - Use framework for monitoring shifts in teacher practices (Does not replace evaluation data and classroom visits that provide additional information)
  - Connect all PD to the framework as an anchor
- Teachers need to know how the strategies they learn naturally fits into the “*process of teaching*” (*Planning and facilitating lessons*)
  - ii. Design PD so that teachers see connections within the framework so that PD is not fragmented.
  - iii. Develop PD over time that builds a body of knowledge

4. Deciding on a professional development format that meets needs of teachers and resources

- i. Summer institutes
- ii. Professional learning communities (grade levels, within schools)
- iii. Coaching
- iv. Workshops

# DESIGNING PROFESSIONAL DEVELOPMENT

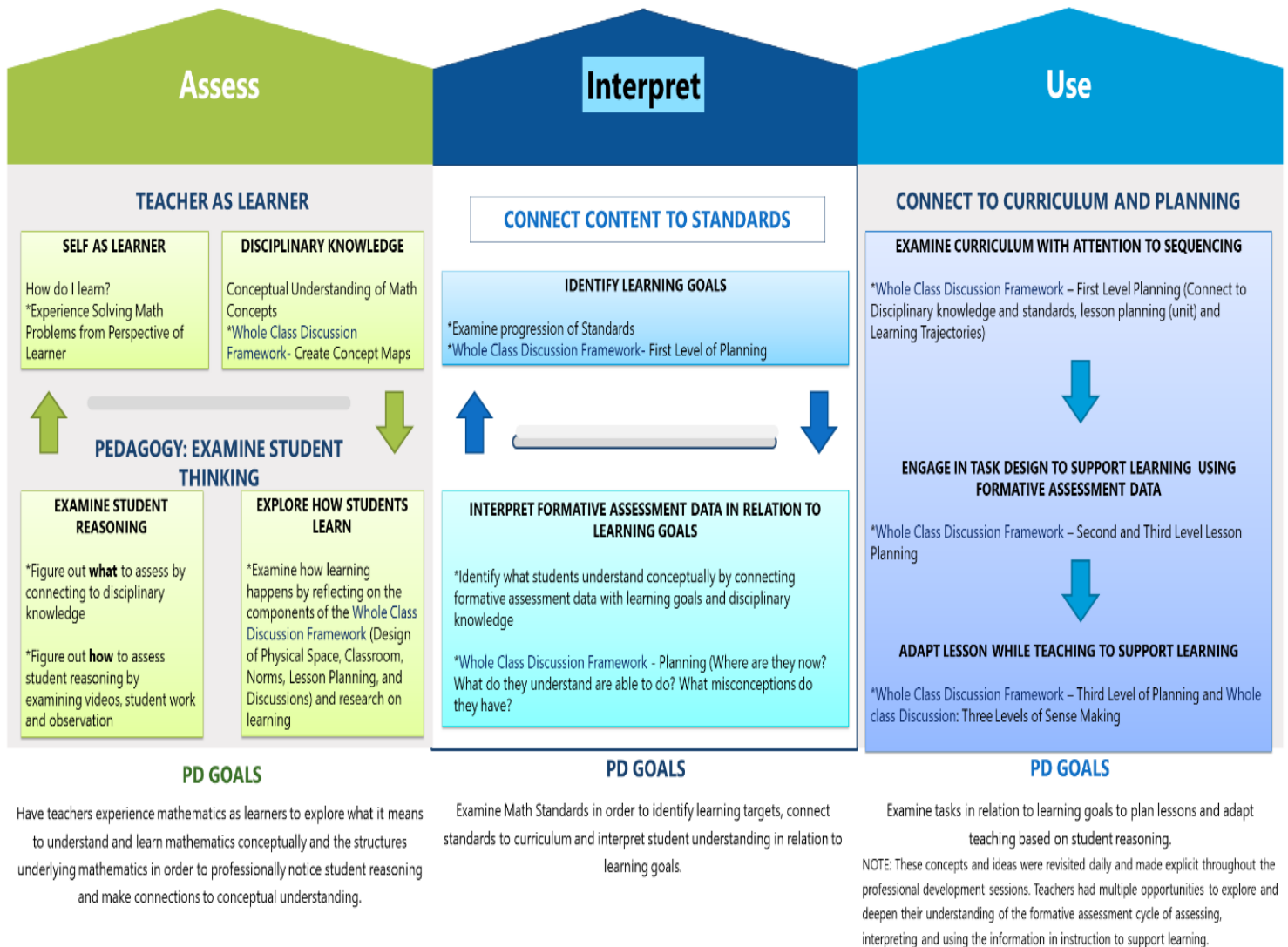
- Design professional development to address the *process of teaching*.
  - i. Embedding professional development in the daily work of teaching
  - ii. Designing professional development for increasing content and pedagogical content knowledge
  - iii. Thinking short term and long-term professional development
  - iv. Creating system wide change, what do we need to think about?
- Why we also need to consider the supports within the school context in which teachers teach?
  - i. Are evaluation systems aligned with standards-based teaching?
  - ii. Do teachers get supported for using standards-based teaching or does the school context work against it. (E.g. Evaluation system)
  - iii. Is there a support system for teachers to improve teaching?
    - Grade level PLC, school level support, math coaches (Networks)
    - Are PD facilitators trained?



# PROFESSIONAL DEVELOPMENT FRAMEWORK

## Professional Development Design

Integrating Formative Assessment into the Process of Teaching



The following section provides an explanation on the components of the framework. Check out the <http://www.mathdiscussions.wordpress.com> for video explanations on the components of the framework. Please contact [Terunil@unr.edu](mailto:Terunil@unr.edu) if your district needs individualized support

## **Professional Development Framework: ASSESS STUDENT REASONING**

### **Teacher -As -Learner**

**Goal:** *Have teacher experience mathematics as learners to explore what it means to learn and understand mathematics conceptually and the structures underlying mathematics in order to professionally notice student reasoning and make connections to conceptual understanding.*

#### **Self as Learner:**

- How can we help teachers make more effective instructional decisions?
  - Focus on teacher's deepening teacher understanding on how *learning* takes place.
    - a. Connect their learning experiences with research on how people learn
  - Have teachers *experience* mathematics from the perspective of learner in order to think about how learning takes place.

#### **Explore How to Facilitate Learning**

- Examine how *standards-based teaching makes teaching easier*
  - a. Contrast and compare video of traditional and standards- based lesson (Connect to Whole Class discussion Framework Unpack videos to see how the design of physical space, classroom routines, lesson planning and discussions support student learning)
  - b. Make connections to research on teaching and learning math
- Help teachers make personal connections between their own learning to thinking about how their students learn? (*Reflect on components of the Whole Class discussion framework and how it supports their learning experiences*)
  - Design teacher experiences so that teachers can create a *bridge* between their own learning experiences and thinking about how students learn?
  - Examine videos of teaching and focus on student learning
  - Reflect on their own classroom teaching

### **Examine student work to interpret what they are learning (formative assessment)**

- Focus on interpreting *strategies* students are using (typically 2-5 strategies within a class). Teachers need to be able to identify how students are understanding the concepts than simply looking at right or wrong answers.
- Support teachers to connect disciplinary knowledge to interpret student work (see below)
- Identify errors and misconceptions

### **Disciplinary Knowledge:**

- Explore what it means to *conceptually* understand mathematics and its relationship to procedural knowledge
  - a. Teachers need to experience learning math and make this distinction
- Support teachers with PD to improve content knowledge conceptually so that they know *what* to assess and *how* to modify tasks to support student understanding.

## ***Professional Development Framework: INTERPRET Formative Assessment Data***

### **Connect Content to Standards**

*Examine Math Standards in order to identify learning targets, connect standards to curriculum and interpret student understanding in relation to learning goals*

**Identify Learning Goals:** PD must help teachers make mathematical connections to the content they teach. They need to be able to read the standards to identify learning goals.

- ❖ Examine standards across the grades and see progression of how concepts build on each other.
- ❖ Identify learning goals for the academic year and connect to planning.
  - *Whole class discussion Framework- Levels of Planning (see big picture)*
- ❖ Provide opportunities for joint planning in grade level teams.

## **Connect Standards to Curriculum**

- ❖ Have teachers examine how the standards are laid out in the Curriculum. (Helps with pacing and planning)

Whole Class Discussion Framework: Three levels of planning

*Long term:* What do students need to learn during the academic year

*Short terms goals:* What unit am I teaching and how do the concepts build on each other

The lesson: Adapting teaching to meet students' needs

*Note: the goal is to use the curriculum and standards as a tool to support learning.*

## **Interpret Student Understanding in Relation to Learning Goals: Figure out what students know and can do so that a bridge can be built between prior knowledge and new information.**

- ❖ Once learning goals are identified. Evaluate and interpret student work to identify what students understand in relation to learning goals.
- ❖ Identify errors, misconceptions
- ❖ Have students connect assessment of student reasoning to the Unit/lesson they are teaching?
  - What do the students know and able to do?
  - What misconceptions/errors/ are anticipated
  - How tasks should be sequenced and adapted to meet needs of students.

## Professional Development Framework: Use Interpreted data to Make Targeted Decisions to Support Learning

### **Connect to Curriculum and Planning**

*Examine tasks in relation to learning goals to plan lessons and adapt teaching based on student reasoning. The key is to use formative assessment data to make instructional decisions by taking into consideration student reasoning, standards, curriculum and content.*

### **Examine Curriculum with Attention to Sequencing:**

#### **Sequencing is key to helping students make connections by building on prior knowledge**

Teachers need to be able to make connections between standards and understand how concepts build on each other. (Whole Class Discussion Framework First Level of planning)

- Have teachers take the concept maps they created, their curriculum and map out the unit for the week with a focus on how concepts build on each other.
- Have teachers evaluate student work and think about how they might adjust a lesson to support understanding to support learning.

#### **Engage in Task Design to Support learning Using Formative Assessment Data**

- Evaluate math problems in lesson and think about the problem types in relation to formative assessment of students. Have teachers bring student work.

#### *Whole Class Discussion Framework – Second and Third Level Planning*

#### **Adapt Lesson while teaching to Support Learning**

#### *Whole Class Discussion Framework -Three Levels of Sense Making*

## PROFESSIONAL DEVELOPMENT AT SCALE

- Teachers need to understand how to Work Smarter to get results. The goal is to make teaching easier.
- As a state we become a learning community to learn from each other, develop resources.
- Build in networks of support within school and district to improve teaching so that it naturally fits with the work of teaching and to teachers' schedules
- Create a Professional Development Plan where teachers can see how all the pieces fit together over time. Note: It takes about a year to see shifts in teaching and see impact on student achievement.

MAP out PD for the year and see how they connect

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What Resources Do you have at the District level that Teachers can Access?

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Communication Network: Do teachers have a voice to state their needs? What kind of communication loop exists in the school and what can be done to improve communication and support?

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## Goals of the Nevada Mathematics Initiative

- <https://www.unr.edu/education/centers-and-student-resources/centers/nevada-mathematics-project>
- Formalize the existing statewide network for communication, collaboration and dissemination of knowledge and resources
- Provide high quality research-based professional development to improve STEM learning in Nevada
- Research innovative and effective ways to design and deliver professional development that supports student learning
- Develop tools and resources to support school districts, Nevada teachers and students
- Develop expert leaders in STEM education in Nevada
- Build an interdisciplinary team of experts through *collaborative relationships across the country and internationally* to raise the level of knowledge and expertise
- Generate research to improve teacher education in STEM disciplines

### Resources

<http://www.mathdiscussions.wordpress.com>

<http://www.nevadamathproject.com>

<http://www.optimizedlearning.net>

HOW CAN WE BUILD A STATEWIDE LEARNING COMMUNITY TO CREATE  
SYSTEM WIDE CHANGE BY WORKING SMARTER?

1. How do we build a learning community as a state?
2. What kinds of expertise and resources do you have that you can share with others?
3. What kinds of research and tools is needed to improve math education?
- 4 .Communication system: Nevada Math Network-funds for people to meet once a year
5. Resources/Tools that we need to develop?



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LIST THREE ACTION ITEMS TO IMPROVE MATH INSTRUCTION AT YOUR DISTRICT

1. \_\_\_\_\_  
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2. \_\_\_\_\_  
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