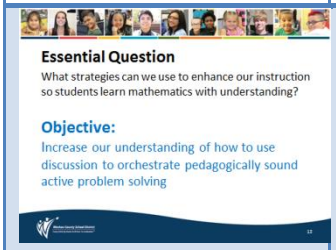
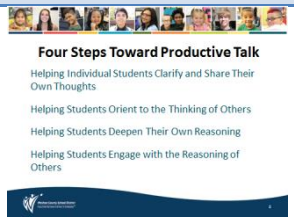
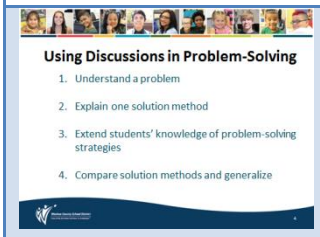
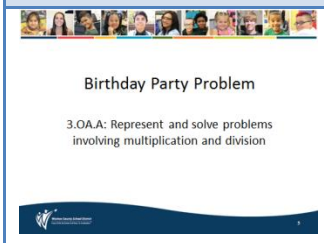
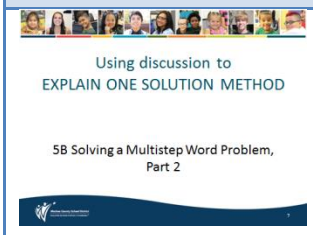
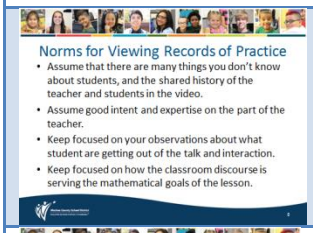
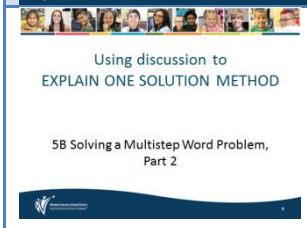
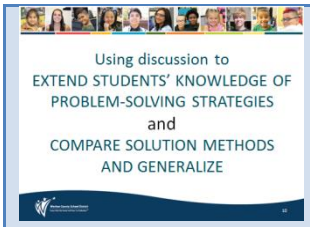
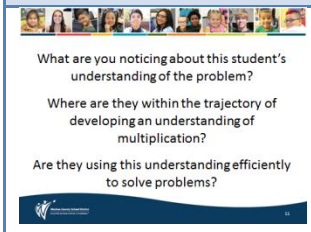
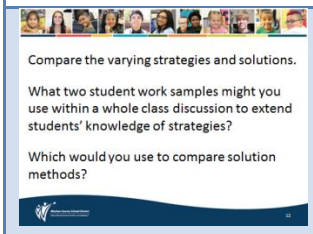
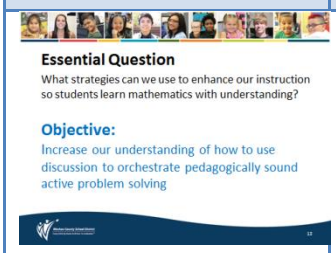
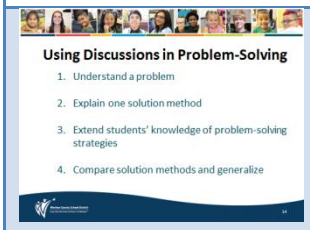
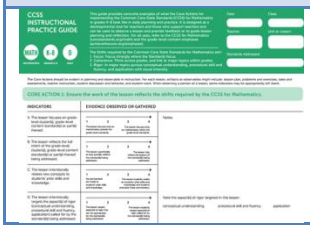
Implementing the Nevada Academic Content Standards

Talking About Solution Methods and Problem Solving Strategies

Slides	Slide Notes	Additional Notes
	**Background for Facilitator:** The essential question has been maintained throughout the year. Please read Chapter 5 (p. 152-186) prior to planning/presenting. **Presentation:** Provide an overview for the session. Explain that in today's sessions participants will talk about problem solving. Then they will watch video clips showing students using talk to develop an understanding of a problem and its different solutions.	
	**Background for Facilitator:** The purpose of this slide is to connect to prior learning. **Presentation:** Connection to the work that we have engaged in. The four steps provide a structure for analyzing and planning for components of productive classroom discussion. Consider having participants think about the 'talk moves' they have been using to support the productive classroom discussion and moving student thinking and reasoning between these four steps. The ***talk moves*** themselves are the ***strategies*** to assist students in thinking, clarifying, and extending their reasoning. Turn-and-Talk, Say More, Stop and Jot, Revoicing, Wait Time Who can repeat?, Who can put it in their own words? Why do you think that?, What is your evidence?, Can you prove it or explain step by step? What do you think about that?, Do you agree or disagree and why?, Who can add on?	
	**Background:** Chapter 5, p.152 Note: Depending upon the task and the mathematical outcome that it was designed for there will be more or less time spent within each of these suggestions. This will vary depending upon many factors including student understanding, misconceptions that occur, mathematical development and connections of relationships and supporting for generalization. For example, "…at the start of the school year, teachers begin each problem-solving session by conducting a discussion about the givens in the problem. Sometimes this will be a lengthy discussion due to their being complex vocabulary or hard-to-understand relationships in the problem statement." (p. 154) **Presentation:** Click once to display slide title. • Consider having the teachers read p. 152: (Provided to you copied in yellow- to establish a common foundation from which we will build.) **Turn and Talk:** Why are solution methods and problem solving a good focus for discussion in mathematics? Subsequent clicks will display each component under "Using Discussions in Problem-Solving".	
	**Background for Facilitator:** Discuss math content: Standards are being addressed "Cluster Level", depending upon what the students do they will engage in one or more of the standards within that cluster. Please refer participants to the "Operations and Algebraic Thinking" progression document for more information regarding these standards (This document was given out to K-3rd grade teachers during the CORE Connections Courses; thus not all participants will have it). **Presentation:** 3 minutes to solve this problem. • Copy yellow sheet with the problem for each participant. • Solve in more than one way if finished early thinking about different strategies or solutions. 1-2 minutes to share possible solutions with your partner/table. Ask the question, "Did you find at your table/with your partner that some individuals came to a different solution due to their interpretation of the problem?"	

	**Background for Facilitator:** "Good problem solvers spend a lot of time trying to understand a problem and all the relevant relationships, while novices rush to try a plan without really thinking through the plan's effectiveness. Good problem solvers ask themselves key questions about the given and unknown information in the problem." (p. 153). Novice behaviors: Finding numbers and performing operation, using key words and phrases without taking context into account. **Presentation:** Click 1: Split the participants in partners. As teachers to help our students better understand, we need to anticipate and consider problem solving goals or requirements and the features of the problem that might cause confusion. • One group lists the problem-solving goals or requirements. • Other group lists the features of the problem that might cause confusion. Click 2: **Stop and Jot** Click 3: **Turn and Talk** Facilitate a whole-group discussion based upon the requirements of the problem and the anticipated confusion. This may look a little different than what it would look like in a classroom. *Requirements*: Apple juice comes in 6-packs, grape juice comes in 4-packs, must buy both types of juice, at least 26 cans but no more than 30 cans *Anticipating Confusion*: How to use 4- and 6-packs, the phrase *at least 26 but no more than 30*, multiple solutions, cans vs. packs, connections between different methods. What would this look like in the classroom? Quickly make a reference and connection to the Standards for Mathematical Practice (MP1). Connect to ideas expressed in the "Mathematical Terminology, Symbols, and Definitions" session.	
	**Background for Facilitator:** This is continuing to the second suggestion of "Explain One Solution Method". **Presentation:** Reference the second suggestion for using discussion in problem solving to prepare for showing the video. The idea of this slide is to bridge the second suggestion to explain one solution method using the "Birthday Party" problem in a video.	
	**Background for Facilitator:** Just a reminder of norms for viewing records of practice. A record of practice is a way for us to have a discussion around a common source of information. They are not examples or non-examples, yet just a clip from practice for us to use to discuss the guiding questions.	
	**Background for Facilitator:** Why might the teacher be using "Who can repeat?" regularly throughout this discussion? "The goal in this case is to help all students understand one solution method and to connect the solution and method to specific mathematical concepts from the problem." p. 160. Considering the standard, why would the teacher spend so much time explaining this one solution method? "The teacher used talk moves to focus students' attention on the relationship between the multiplication equations in the solution method to the concept of putting equal groups of juice together. In other words, the point of all the repeating is for students to think, 'Oh, I get it. I can use multiplication to figure out the number of cans of each type of juice.' " (p. 165). 3.OA.1 Repeated addition made the problem accessible to all students. In the video the teacher did not address 10x2 but made a mental note to return to it later. (p. 166). **Presentation:** As you watch the video, consider these questions: • Why might the teacher be using, **"Who can repeat?"** Talk Move regularly throughout this discussion? • Considering the standard, why would the teacher spend so much time explaining this one solution method? Watch video. Facilitate discussion around the above questions, taking into consideration the mathematical goal.	

	**Background for Facilitator:** While informal strategies are important starting points for making sense of the problem, one of the responsibilities of a teacher is to support students in learning and then using more sophisticated and efficient strategies. Sometimes during discussions, teachers ask many students to share their solution methods and representations. The focus is simply on reporting what one did to solve a problem and sharing as many different methods as possible. In general, this emphasis rarely leads to deeper understanding unless the discussion directly connects the methods and highlights the underlining mathematical ideas. Talk can be used productively to get students to ask questions about what these forms of representation mean, and how their meanings are connected. (p. 175). **Presentation:** In order to orchestrate pedagogically sound instruction we need to be able to plan and anticipate what students will do and what might be preventing them from moving to more sophisticated and efficient strategies. Planning, adjusting instruction and reflecting on student work, is in integral part of the instructional process. Analyze student work samples. (These are copied in white.)	
	**Background for Facilitator:** **Presentation:** **About 3-5 minutes:** We are going to jigsaw some student work. Each table will form an expert group (one color) looking at one student's work. Use the guiding questions to analyze that work sample. Guiding questions for posting as teachers analyze student work samples. Before showing the next slide, have participants move to their numbered tables to form "rainbow groups". Thus, all of the number 2's will move to the table labeled with a 2. There will be one person from each expert color group in the "rainbow" group jigsaw.	
	**Background for Facilitator:** "Teachers must consider which methods and representations are worth sharing with the whole class, and in what order they should be shared during the problem solving discussions. Not all methods are created equal!" (p. 174). Some possible mathematical outcomes may include: • Understanding the concept of a unit (and unitizing). • Moving from repeated addition to interpreting multiplication contexts (groups of …) 3.OA.1 • Mathematical Modeling [students modeling with equations the mathematics that they created in their representations, for example (2x6)+(4x4)=28]. This will depend on several factors to be considered during instruction including mathematical outcome/objective, student's misconceptions/partial understandings, communicating mathematical ideas or even be able to generalize and use prior knowledge to solve less familiar problems. **Presentation:** Provide time for participants to compare and analyze student work using the guiding questions. Have teachers note the progression of understanding within the samples; as well as, solutions and strategies as that are reviewing. (Note: These samples do not represent an equal distribution of the work that was submitted for the whole class.) Facilitate whole class discussion using specific Talk Moves.	
	**Background for Facilitator:** Return to the essential question. **Presentation:** Quickly return to the essential question and summarize the four suggestions.	

	**Background:** NCTM Research Brief *Why is Teaching with Problem Solving Important to Student Learning*: "[Problem Solving] can promote student's conceptual understanding, foster their ability to reason and communicate mathematically, and capture their interests and curiosities." This brief recognizes four worthwhile problem criteria: 1. Important mathematics 2. Higher level thinking 3. Conceptual development 4. Opportunities to assess learning "It is important to point out that we are not saying that every task that students encounter must be problematic." Sometimes practice is necessary (not drill and kill). "Students actual opportunities to learn depend not only on the type of mathematical tasks that teachers pose, but also on the kinds of classroom discourse that takes place during problem solving." The brief notes that problem solving shouldn't be taught as a series of strategies in isolation (make a table, guess and check) but rather as part of an interwoven and natural process to understanding the mathematics at hand. **Presentation:** Differentiation option: Consider using the NCTM research brief with teachers, have teachers make connections between the brief and the ideas in the four suggestions posted on this slide focusing on purposely planned for discussion.	
	**Differentiation Option:** Consider connecting ideas in Core Actions 1-3 with the ideas explored in this session.	

Additional Notes:

School Level Essential Question:

What strategies can we use to enhance our instruction so students learn mathematics with understanding? What does this look and sound like?

<u>Talk Moves & Strategies</u>

Turn & Talk
Think, Pair, Share & Revoice
Who can add on?
Revoice/Restate
Stop & Jot (then revise)

Additional Notes & Support- Chapter 5: Talking About Solution Methods and Problem-Solving Strategies

Videos to support:
5A Solving a Multi-Step Word Problem, Pt. 1(6:21)
5B Solving a Multi-Step Word Problem, Pt. 2 (9:35)
5C The Newspaper Club Problem (3:39)

Preparing for the session: (Copies and Materials List)

Chapter 5, p. 152 (yellow) one for each participant.
Student Work Samples (Sets for small groups)
NCTM Research Brief *Why is teaching with Problem Solving Important to Student Learning?*