# RESPeCT Summer Institute Professional Development Leader Guide (PDLG)

| Grade Level | K | Day | 4 | STeLLA Strategy | STL Strategy 6: Use and Apply New Science Ideas | Subject Matter Focus | Weather and Seasons |
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| **Focus Questions** | • Why is it necessary to engage students in using and applying new science ideas in a variety of ways and contexts?<br>• How will the Student Thinking Lens strategies help you teach the lessons on weather and seasons?<br>• Why isn't weather the same everywhere all of the time?<br>• Why do we use graphs? |
| **Main Learning Goals** | Participants will understand the following:<br>• In order to develop meaningful understandings of science ideas, students need multiple opportunities to try using and applying new science ideas in a variety of ways and contexts.<br>• There are many factors that explain why weather is different in different places at different times of the year. These factors include the angle of sunlight striking Earth's curved surface, the tilt of Earth in relation to Earth's orbit around the Sun, elevation, and proximity to large bodies of water or mountains.<br>• Content representations, such as graphs, are useful for identifying and analyzing patterns in data. They also help clarify science ideas and make them more real or concrete for students.<br>• Presenting data as clearly and accurately as possible is essential for preventing misleading or deceptive statistics and data displays. |

## Preparation

### Daily Setup Tasks

- Check that video clips are correctly linked to PowerPoint (PPT) slides.
- Make sure video clips play correctly with good sound.
- Set up PowerPoint.
- Arrange furniture and food.
- Arrange participant materials.
- Put up posters and charts.

### Planning and Preparation Tasks

- Study the PDLG, PowerPoint slides (PPTs), video clips, and handouts. Make changes to PPTs if needed.
- Review the reflections from day 3 and create a summary slide.
- Watch video clips and anticipate participant responses.
- Prepare charts for the day's agenda and focus questions.
- Using PPT slide 24 as a model, prepare a

## Materials

### Posters and Charts

- STeLLA Framework and Strategies poster
- Day-4 Agenda (chart)
- Day-4 Focus Questions (chart)
- Norms for Working Together (chart)
- Strategy charts from days 1–3 (STL strategies 1–5)
- Chart of STL strategies highlighted in Weather and Seasons lesson plans (see PPT 24 for model)
- Parking Lot poster

### Handouts in RESPeCT PD Binder Front Pocket

- Z-fold summary chart: Student Thinking Lens Strategies

### Handouts in RESPeCT PD Binder, Day 4

- 3.7 Uneven Heating (from day 3)
- 4.1 Importance of Engaging Students in Constructing Scientific Explanations (task sheet)
- 4.2 Student Work from Zembal-Saul Book *What's*

## Videos

- Hershberger video clip, *Introducing the CER* (on companion DVD for Zembal-Saul book *What's Your Evidence?*)
- Video Clip 4.1: Johnson classroom (use and apply, strategy 6); 4.1_mspcp_kinder_weather_johnson_L5_c1–2
- Video Clip 4.2: Gaines classroom (review Student Thinking Lens strategies); 4.2_mspcp_kinder_weather_gaines_L2_c3–4

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| chart of the STL strategies highlighted in the Weather and Seasons lesson plans.<br>• For content deepening:<br>  • Make sure participants will be able to access the Internet (using their phones or laptops) for the use-and-apply activity for three cities (Pomona, Hiroshima, and Casablanca).<br>  • Preview the Kids' Zone Create a Graph graphing tutorial on the National Center for Education Statistics (NCES) and check the link to make sure it's working: https://nces.ed.gov/nceskids/help/user_guide/graph/howto.asp.<br>  • Run through the ruler activity to make sure you understand what participants are being asked to do. (This activity takes at least 20 minutes, so make sure you leave enough time for it during the session.) | *Your Evidence?*<br>• 4.3 Benefits of Engaging Students in Constructing Scientific Explanations<br>• 4.4 Transcript for Video Clip 4.1<br>• 4.5 Transcript for Video Clip 4.2<br>• 4.6 Identifying Student Thinking Lens Strategies<br>• 4.7 Climb to Cold<br>• 4.8 Space Shuttle *Challenger* Historical Launch Data: Temperatures and O-ring Condition<br>• 4.9 Daily Reflections—Day 4<br><br>**Supplies**<br>• Science notebooks<br>• Chart paper and markers<br>• For content deepening:<br>  • Globe or world map that shows Hiroshima, Japan; Casablanca, Morocco; and Pomona, California<br>  • NCES Create a Graph (online tutorial)<br>  • 30-cm rulers (1 per pair)<br><br>**PD Resources**<br>• STeLLA strategies booklet<br>• RESPeCT PD program binder<br>• RESPeCT lesson plans binder<br><br>**Resources in Lesson Plans Binder**<br>*Resources section:*<br>• Weather and Seasons Content Background Document<br>• Common Student Ideas about Weather and Seasons | |

**DAY 4 SESSION OUTLINE**

| Time | Activities | Purpose |
|---|---|---|
| 8:00–8:15<br>15 min | **Getting Started: Housekeeping, Agenda, Day-3 Reflections, Focus Questions** | • Build community by sharing participants' reflections from day 3.<br>• Set the stage for a day of learning. |
| 8:15–8:50<br>35 min | **Importance of STL Strategy 5: Constructing Explanations** | • Develop an appreciation for the multiple ways in which engaging students in constructing scientific explanations can have an impact on student learning within and beyond science. |
| 8:50–9:10<br>20 min | **Introducing Student Thinking Lens (STL) Strategy 6** | • Develop an initial understanding of the purpose and key features of strategy 6: Engage students in using and applying new science ideas in a variety of ways and contexts. |
| 9:10–10:10<br>60 min | **Lesson Analysis: STL Strategy 6** | • Use lesson analysis of classroom videos to better understand strategy 6.<br>• Deepen science-content knowledge of weather through lesson analysis. |
| 10:10–10:55<br>45 min<br>(Includes 10-min break) | **Review: STL Strategies 1–6** | • Review and deepen understandings of key similarities and differences among STL strategies 1–6. |
| 10:55–12:00<br>65 min | **Weather and Seasons Lesson Plans Review** | • Understand why the Weather and Seasons lesson plans are so scripted and how they should be used before and during the lessons.<br>• Understand the conceptual flow within and across the Weather and Seasons lessons.<br>• Understand the focus question, main learning goal, and main activity in each lesson.<br>• Understand how STL strategies 1–6 are embedded in the lessons. |
| 12:00–12:45<br>45 min | **LUNCH** | |
| 12:45–3:15<br>150 min<br>(Includes 10-min break) | **Science and Math Content Deepening: Weather and Seasons** | • Understand why weather is different in different places at various times of the year.<br>• Understand the importance of representing data in clear, accurate, and concrete ways and consider the problem of deceptive statistics. |
| 3:15–3:30<br>15 min | **Wrap-Up: Summary, Homework, and Reflections** | • Summarize and reflect on key ideas from today's learning and preview the transition to the Science Content Storyline Lens (SCSL) strategies. |

**DAY 4**

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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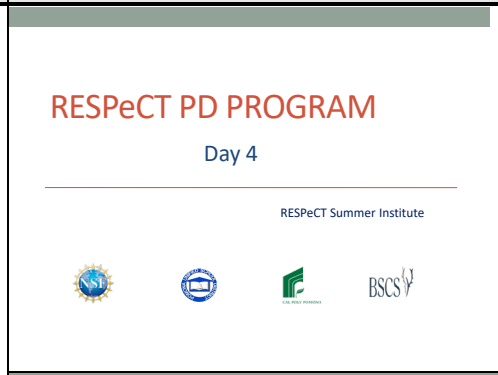
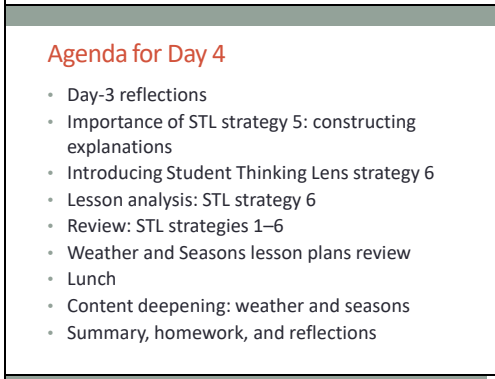
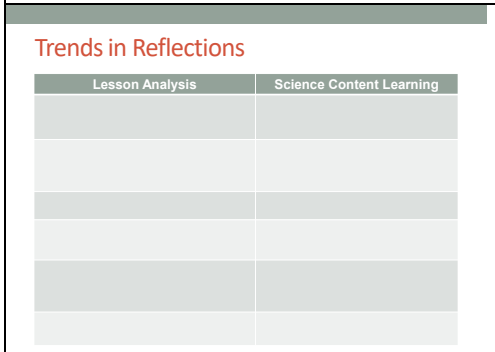
| 8:00–8:15<br><br>15 min<br><br>**Getting Started**<br><br>Slides 1–5 | **Purpose**<br>• Build community by sharing participants' reflections from day 3.<br>• Set the stage for a day of learning.<br><br>**What Participants Do**<br>• Review the day's agenda.<br>• Discuss the reflections from day 3.<br>• Read today's focus questions.<br><br>**Posters and Charts**<br>• STeLLA Framework and Strategies poster<br>• Day-4 Agenda (chart)<br>• Day-4 Focus Questions (chart) |  | **Display Slide 1.** RESPeCT PD Program (5 min)<br><br>a. Take care of any housekeeping issues. |
| | |  | **Display Slide 2.** Agenda for Day 4 (3 min)<br><br>a. Talk through the agenda for the day. |
| | |  | **Display Slide 3.** Trends in Reflections (5 min)<br><br>a. Invite participants to look at your feedback on their reflections from day 3 and offer reactions, comments, or follow-up questions. |

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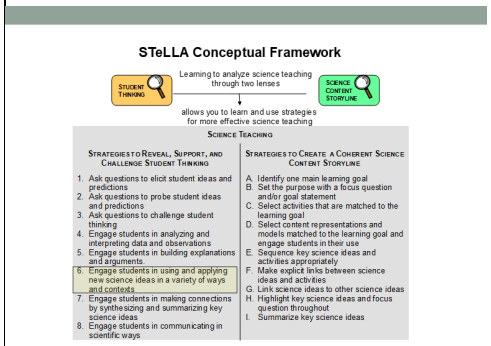
| | | Today's Focus Questions<br>• Why is it necessary to engage students in using and applying new science ideas in a variety of ways and contexts?<br>• How will the Student Thinking Lens strategies help you teach the lessons on weather and seasons?<br>• Why isn't weather the same everywhere all of the time?<br>• Why do we use graphs? | **Display Slide 4.** Today's Focus Questions (1 min)<br><br>a. Introduce the focus questions that will guide today's work.<br><br>b. "Like STeLLA strategies 4 and 5, the goal of strategy 6 is to move student thinking forward toward deeper understandings of science ideas." |
| | |  | **Display Slide 5.** STeLLA Conceptual Framework (1 min)<br><br>a. Draw participants' attention to the new strategy highlighted on the slide.<br><br>b. "Strategy 6 is the third STL strategy that is a type of activity designed to move student thinking forward." |
| 8:15–8:50<br><br>35 min<br><br>**Importance of STL Strategy 5: Constructing Explanations**<br><br>Slides 6–7 | **Purpose**<br>• Develop an appreciation for the multiple ways in which engaging students in constructing scientific explanations can have an impact on student learning within and beyond science.<br><br>**Content**<br>• Engaging students in constructing scientific explanations helps them develop meaningful understandings of science ideas | The Importance of Engaging Students in Constructing Scientific Explanations<br><br>Read handout 4.1 and your group-specific handout. Then complete the assigned task:<br><br>**Group 1:** Analyze a student explanation (handout 4.2).<br><br>**Group 2:** Summarize benefits for students of constructing scientific explanations (handout 4.3).<br><br>**Group 3:** Summarize the benefits for teachers of engaging students in constructing scientific explanations (handout 4.3). | **Display Slide 6.** The Importance of Engaging Students in Constructing Scientific Explanations (25 min)<br><br>**Note:** If you need some time to catch up on day-3 activities, you can skip this slide. However, this activity is beneficial for reviewing strategy 5 (constructing explanations) and helping participants understand why explanation building is such important work in science and beyond.<br><br>**Timing note:** For this segment, allot 5 minutes for reading, 10 minutes to prepare for a group share-out, and 10 minutes for the share-out. |

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| | and how scientists work.<br><br>**What Participants Do**<br>• Review jigsaw-strategy readings about the importance of scientific explanations and examine a sample of student work.<br>• Share key ideas about constructing scientific explanations.<br>• Watch and discuss a lesson video in which the teacher explicitly teaches 3rd graders how to construct explanations that include a claim, evidence, and reasoning that connects to science ideas.<br><br>**Posters and Charts**<br>• STeLLA Framework and Strategies poster<br>• Strategy charts from days 1–3 (STL strategies 1–5)<br><br>**Videos**<br>• Hershberger video clip, *Introducing the CER*<br><br>**Handouts in PD Binder**<br>• 4.1 Importance of Engaging Students in Constructing Scientific Explanations (task sheet)<br>• 4.2 Student Work from Zembal-Saul Book *What's Your Evidence?*<br>• 4.3 Benefits of Engaging Students in Constructing Scientific Explanations<br><br>**PD Resources**<br>• STeLLA strategies booklet | | a. Divide participants into three groups or pairs. Assign each group a number (1, 2, 3).<br><br>b. Direct participants to three handouts:<br>1. Importance of Engaging Students in Constructing Scientific Explanations (handout 4.1 in PD program binder) (This handout describes what groups are to do with the following two handouts.)<br>2. Student Work from Zembal-Saul Book *What's Your Evidence*? (handout 4.2 in PD binder) (Group 1's task is linked to this handout.)<br>3. Benefits of Engaging Students in Constructing Scientific Explanations (handout 4.3 in PD binder) (Tasks for Groups 2 and 3 are linked to this handout.)<br><br>c. After participants have read the designated handouts for their groups and completed their assigned tasks, invite them to share out. |
| | | The CERA Framework for Constructing Scientific Explanations<br>• Next, we'll watch video clip of a 3rd-grade teacher instructing students how to construct scientific explanations.<br>• Think about ideas this clip gives you for helping your students learn to construct scientific explanations by making a claim, supporting it with evidence and reasoning, and considering alternative explanations and strategies (CERA).<br>Link to *Introducing the CER* video clip. | **Display Slide 7.** The CERA Framework for Constructing Scientific Explanations (10 min)<br><br>**Note:** This activity is optional but powerful.<br><br>a. "Let's watch how one 3rd-grade teacher taught her students to construct scientific explanations. This is the teacher whose student writing Group 1 just read about. The class in this video clip has been studying simple machines (such as pulleys and levers)."<br><br>b. "We're not going to analyze this video clip in terms of STeLLA strategies. Instead, think about ideas this clip gives you as to how you might introduce your students to the CERA framework for constructing scientific explanations, which involves making a claim, supporting it with evidence and reasoning, and considering |

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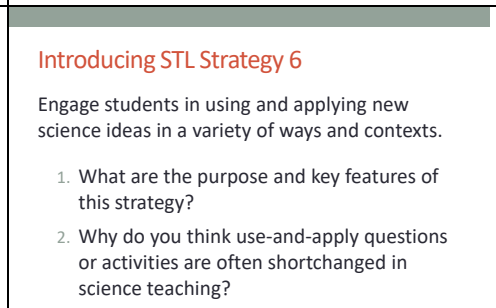
| | | | alternative explanations and strategies."<br>b. After watching the clip, discuss participants' reactions and any ideas it gave them about how they might help their students learn to construct strong scientific explanations.<br>**Note:** Make sure participants are aware that in addition to using the CERA framework as a tool for teaching students how to develop scientific explanations and arguments (STeLLA strategy 5) in the classroom, they will be using the same framework for videocase-based lesson analysis of their science teaching in RESPeCT study groups throughout the school year. |
| 8:50–9:10<br><br>20 min<br><br>**Introducing Student Thinking Lens (STL) Strategy 6**<br><br>Slide 8 | **Purpose**<br>• Develop an initial understanding of the purpose and key features of strategy 6: Engage students in using and applying new science ideas in a variety of ways and contexts.<br>**Content**<br>• After students encounter new science ideas, they need opportunities to practice them and see their usefulness in explaining a variety of phenomena. Activities that challenge students to use and apply new ideas give them the time and space to really make sense of the concepts.<br>**What Participants Do**<br>• Make and discuss charts highlighting the purpose and key features of strategy 6.<br>**Supplies** |  | **Display Slide 8.** Introducing STL Strategy 6 (20 min)<br><br>a. **Small groups (10 min):** Divide participants into two groups to make charts highlighting the purpose and key features of strategy 6: Engage students in using and applying new science ideas in a variety of ways and contexts. Encourage participants to refer to the STeLLA strategies booklet and STL Z-fold summary chart for this activity.<br>b. **Whole group (10 min):** Have groups present their charts in a whole-group share-out and compare them. Ask participants, "What differences and similarities do you notice when you compare your charts with those of other groups?"<br><br>**Key ideas:**<br>• Strategy 6 is a time for "strategic telling" and making sure students are using science ideas accurately.<br>• A use-and-apply question or activity is introduced *after* students have experienced/encountered a |

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| | • Chart paper and markers<br><br>**PD Resources**<br>• STeLLA strategies booklet<br>• STL Z-fold summary chart (front pocket of PD binder) | | new science idea. It provides an opportunity for students to use and apply the idea in a new context or novel way and/or link two or more science ideas together.<br>• A common misconception is that use-and-apply questions or activities *assess* student learning. Teachers often talk about asking these kinds of questions on tests. However, according to research findings published in *How People Learn* (National Academy of Sciences, 2000), *application* is part of the learning process, or developing a conceptual framework. If application is treated like assessment, students may encounter a use-and-apply question on a test without ever having had the opportunity to practice this way of thinking as part of their learning. |
| 9:10–10:10<br><br>60 min<br><br>**Lesson Analysis: STL Strategy 6**<br><br>Slides 9–14 | **Purpose**<br>• Use lesson analysis of classroom videos to better understand strategy 6.<br>• Deepen science-content knowledge of weather through lesson analysis.<br><br>**Content**<br>• Strategy 6 involves engaging students in using and applying new science ideas in a variety of ways and contexts. | Lesson Analysis: Focus Question 1<br><br>Why is it necessary to engage students in using and applying new science ideas in a variety of ways and contexts? | **Display Slide 9.** Lesson Analysis: Focus Question 1 (Less than 1 min)<br><br>a. Highlight the focus question that will guide the lesson analysis work during this phase. |

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| | **What Participants Do**<br>• Watch a classroom video clip to identify strategy 6 and analyze student thinking that is revealed and challenged from using this strategy.<br>• Check their understandings of strategy 6 by taking a quick multiple-choice quiz.<br>**Videos**<br>• Video Clip 4.1, Johnson classroom<br>**Handouts in PD Binder**<br>• 4.4 Transcript for Video Clip 4.1<br>**PD Resources**<br>• STeLLA strategies booklet<br>**Resources in Lesson Plans Binder**<br>*Resources section:*<br>• Content background document | Lesson Analysis: **Review** Lesson Context<br>Read the lesson context for this video clip at the top of the transcript (handout 4.4 in your PD program binder). | **Display Slide 10.** Lesson Analysis: Review Lesson Context (2 min)<br>a. "Read the lesson context at the top of the video transcript (handout 4.4 in your PD program binders)."<br>b. Make sure participants understand the science content and activity that are the focus of this video clip.<br>c. **Note:** Refer to the content background document as needed throughout the lesson analysis. |
| | | Lesson Analysis: **Identify** Strategy 6<br>1. What makes this a **use-and-apply** task? (Focus on task.)<br>2. What do you notice about the types of questions the teacher asks during the clip?<br>Link to video clip: 4.1_mspcp_kinder_weather_johnson_L5_c1-2 | **Display Slide 11.** Lesson Analysis: Identify Strategy 6 (25 min)<br>a. "As you watch the video, think about what makes the activity in this clip a use-and-apply task. What science ideas should students be using and applying in each scenario? Also notice what kinds of questions the teacher asks."<br>b. Show the video clip.<br>c. **Individuals:** "Think about the questions on the slide and mark the transcript as you identify the use of strategy 6."<br>d. **Whole group:** Discuss participants' responses to the questions. |

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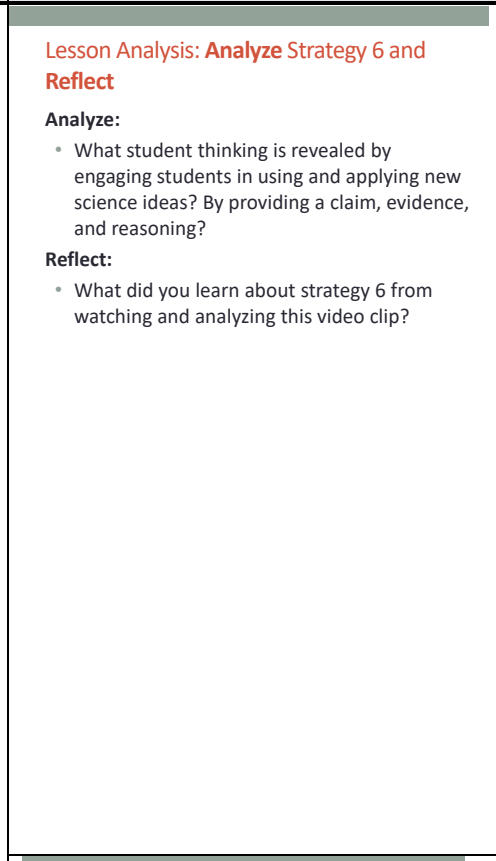
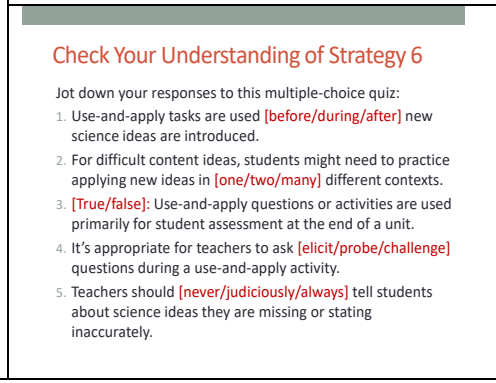
| | |  | **Display Slide 12.** Lesson Analysis: Analyze Strategy 6 and Reflect (25 min)<br><br>a. **Individuals:** "For the analysis questions on the slide, study the video transcript and come up with a claim, evidence, and reasoning to support your claim."<br><br>b. **Whole-group share-out:** As participants share their claims, evidence, and reasoning, encourage them to challenge one another by asking questions, disagreeing, and suggesting improvements or alternative explanations and arguments. (Refer to the norms at the heart of the RESPeCT program.)<br><br>**Note:** You may also want to ask participants whether they noticed in the transcript any missed opportunities for engaging students in using and applying new science ideas.<br><br>c. **Reflect (1 min):** Give participants time to think about the reflection question on the slide.<br><br>d. **Whole-group discussion:** Discuss the reflection question as a group. Make sure participants note specifically what they learned about strategy 6 from watching and analyzing this video clip. |
| | |  | **Display Slide 13.** Check Your Understanding of Strategy 6 (5 min)<br><br>**Note:** This activity is optional if time is running short.<br><br>a. "To check your understanding of STL strategy 6, jot down your responses to this multiple-choice quiz."<br><br>b. Have participants discuss their answers either in pairs or as a group. (If time is short, just read the |

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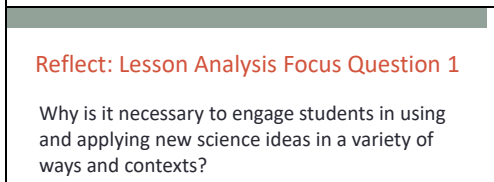
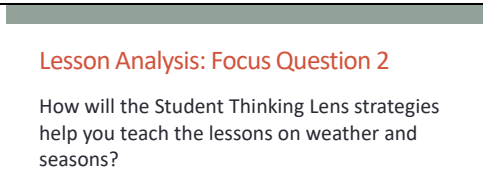
| | | | answers aloud.)<br><br>**Answer key:**<br>1. After<br>2. Many<br>3. False<br>4. Challenge (and probe)<br>5. Judiciously (defined as "good or discriminating judgment; wise, sensible, or well advised") |
| | |  | **Display Slide 14.** Reflect: Lesson Analysis Focus Question 1 (3 min)<br><br>a. **Individuals (1 min):** "Think for a moment about how you would answer the focus question on this slide."<br>b. **Whole-group share-out (2 min):** Have a few participants share their ideas. |
| 10:10–10:55<br><br>45 min<br><br>(Includes 10-min break)<br><br>**Review: STL Strategies 1–6** | **Purpose**<br>• Review and deepen understandings of key similarities and differences among STL strategies 1–6.<br><br>**Content**<br>• STL strategies 1–6 reveal, support, and challenge student thinking.<br><br>**What Participants Do** |  | **Display Slide 15.** Lesson Analysis: Focus Question 2 (Less than 1 min)<br><br>a. **Transition:** "Now we'll shift our attention to the second lesson analysis focus question and spend some time summarizing what we've learned so far about Student Thinking Lens strategies 1–6. Then we'll review the Weather and Seasons lesson plans and highlight how these strategies are used in the lessons you'll start teaching in January." |

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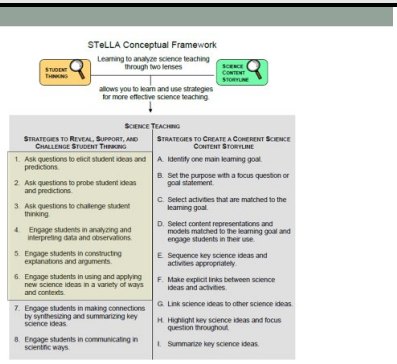
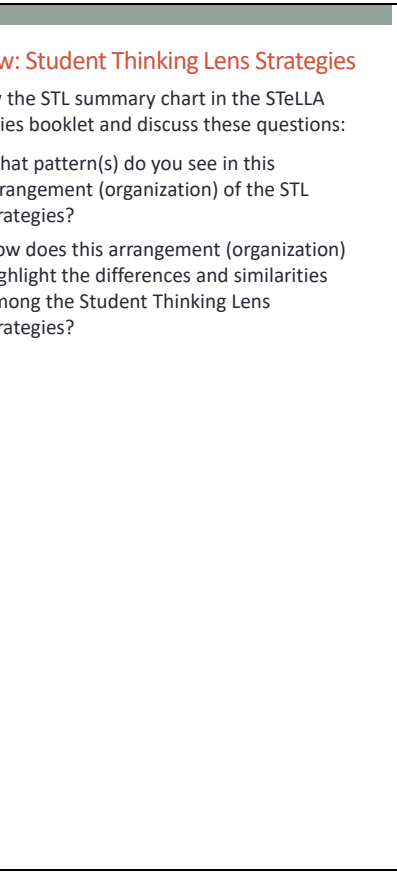
| Slides 15–19 | • Study the Summary of STeLLA Student Thinking Lens Strategies chart in the STeLLA strategies booklet.<br>• Discuss patterns, similarities, and differences among STL strategies 1–6.<br>• Watch a classroom video clip and identify any STL strategies used during the lesson. Discuss observations and missed opportunities.<br><br>**Posters and Charts**<br>• Strategy charts from days 1–3 (STL strategies 1–5)<br><br>**Videos**<br>• Video Clip 4.2, Gaines classroom<br><br>**Handouts in PD Binder**<br>• 4.5 Transcript for Video Clip 4.2<br>• 4.6 Identifying Student Thinking Lens Strategies<br><br>**PD Resources**<br>• STeLLA strategies booklet |  <br>  | **Display Slide 16.** STeLLA Conceptual Framework (Less than 1 min)<br><br>a. "These are the Student Thinking Lens strategies we've explored so far. You'll get practice using them as you teach the lessons on weather and seasons and plants and animals next year."<br><br>**Display Slide 17.** Review: Student Thinking Lens Strategies (3 min)<br><br>a. **Individuals:** Have participants review STL strategies 1–6 on the summary chart in the strategies booklet (Summary of STeLLA Student Thinking Lens Strategies).<br><br>b. **Whole group:** Discuss the questions on the slide.<br><br>**Key ideas:**<br>• Strategies 1–3 are types of questions, and strategies 4–6 are activities designed to move student thinking forward toward more-scientific understandings.<br>• Some strategies are used at any time during the lesson (e.g., probe questions); others are used at specific times (e.g., elicit questions used *before* students have been introduced to new science ideas; use-and-apply activities used *after* students have been introduced to new science ideas).<br>• Each strategy has its own specific purpose(s), but the strategies are closely connected to one another. That is, these strategies aren't used in isolation; they're complementary. |

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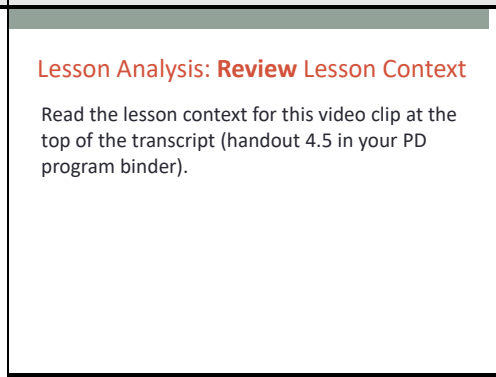
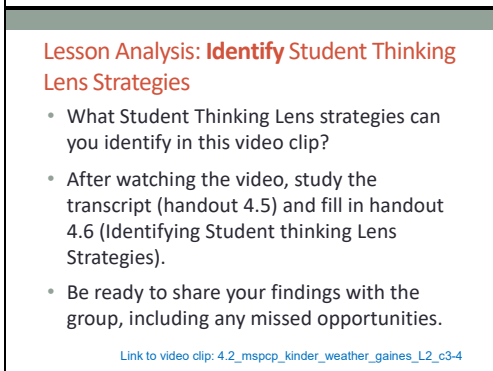
| | |  | **Display Slide 18.** Lesson Analysis: Review Lesson Context (1 min)<br><br>a. "Read the lesson context at the top of the video transcript (handout 4.5 in your PD program binders)."<br>b. Make sure participants understand the science content and activity that are the focus of this video clip. |
| | |  | **Display Slide 19.** Lesson Analysis: Identify Student Thinking Lens Strategies (30 min)<br><br>**Note:** If absolutely necessary, you can skip this video analysis.<br>a. Orient participants to handout 4.6, Identifying Student Thinking Lens Strategies.<br>b. Make sure participants understand the context of the video clip (from the transcript).<br>c. Show the video clip.<br>d. **Individuals:** "Study the video transcript and complete handout 4.6, Identifying Student Thinking Lens Strategies."<br>e. **Whole group:** "What STL strategies did you identify in the video transcript? Did you spot any missed opportunities?" |
| 10:45–10:55<br>10 min | **BREAK** | | |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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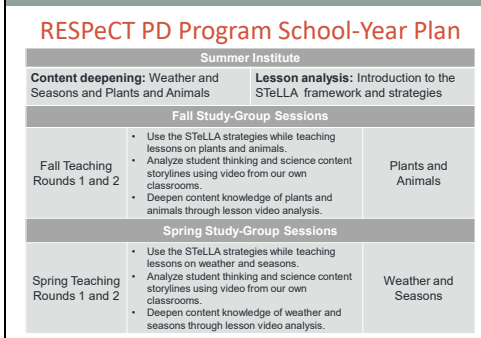
| 10:55–12:00<br><br>65 min<br><br>**Weather and Seasons Lesson Plans Review**<br><br>Slides 20–24 | **Purpose**<br>• Understand why the Weather and Seasons lesson plans are so scripted and how they should be used before and during the lessons.<br>• Understand the conceptual flow within and across the Weather and Season lessons.<br>• Understand the focus question, main learning goal, and main activity in each lesson.<br>• Understand how STL strategies 1–6 are embedded in the lessons.<br><br>**Content**<br>• All lessons are designed to support the science content storyline within and across lessons. Each lesson contains a focus question, a main learning goal, and an activity.<br>• The Student Thinking Lens strategies work together across lessons according to the following pattern:<br>  • Elicit and probe strategies are very important in lesson 1.<br>  • Probe and challenge strategies are used throughout all the lessons.<br>  • Strategies 4 and 5 are highlighted in the middle lessons.<br>  • Strategy 6 is highlighted toward the end of the lesson, after students encounter new science ideas but before final unit assessments. |  | **Display Slide 20.** RESPeCT PD Program School-Year Plan (1 min)<br><br>a. "Before we share our reports about each of the Weather and Seasons lesson plans and how they support you in practicing these Student Thinking Lens strategies, let's review the plan for the school year."<br><br>b. "In the fall you'll teach the **Plants and Animals** lessons, and we'll meet in our study group to analyze video clips and student work from these lessons. This analysis will help us deepen our understandings of the STeLLA strategies, the science content, the lesson plans, and our students' thinking and learning."<br><br>c. "Starting in January, you'll teach the **Weather and Seasons** lessons, and we'll meet in our study group to analyze video clips and student work from these lessons. Do you have any questions?"<br><br>d. **Important reminder:** "Remember that we're analyzing video clips of our own classroom teaching to help us all learn, not to evaluate and critique one another. Everyone is learning to use both new strategies and new lesson plans, so it's predictable that our first attempts at teaching these lessons will have rough spots. We need to appreciate and acknowledge the courage each of us is demonstrating in sharing our initial efforts to teach these lessons. Please be assured that our analyses of the videos will focus on the strategies, the science content, and most importantly, how students are making sense of the lessons. We're not going to focus on rough spots or management problems. We're here to support one another and to learn and grow as science teachers." |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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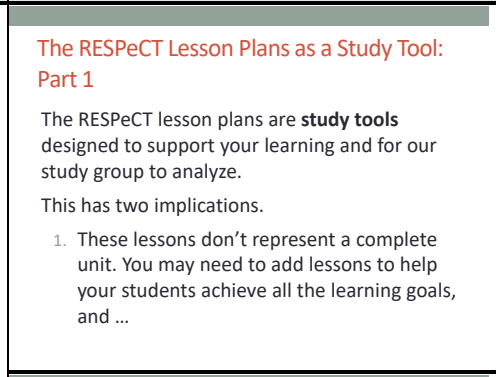
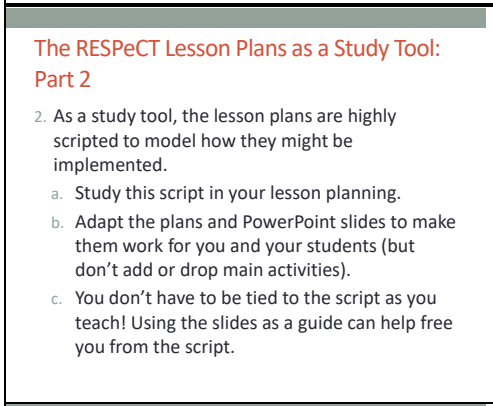
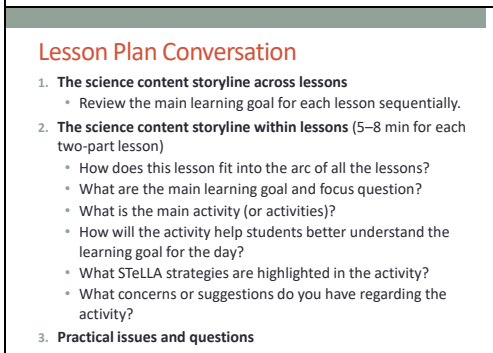
| | **What Participants Do**<br>• Review the plans for school-year study groups.<br>• Listen to the PD leaders describe the lesson plans for the study groups and how they should be used/adapted.<br>• Present a summary of an assigned lesson plan to help their peers understand the lesson.<br>• Raise questions and concerns about the lesson plans and make suggestions.<br>**Supplies**<br>• Chart paper and markers<br>**PD Resources**<br>• RESPeCT lesson plans binder |  | **Display Slide 21.** The RESPeCT Lesson Plans as a Study Tool: Part 1 (2 min)<br>a. Read through the information on this slide.<br>b. Elicit and respond to any comments or questions from participants. |
| | |  | **Display Slide 22.** The RESPeCT Lesson Plans as a Study Tool: Part 2 (2 min)<br>a. Read through the information on this slide.<br>b. Elicit and respond to any comments or questions from participants. |
| | |  | **Display Slide 23.** Lesson Plan Conversation (60 min in conjunction with next slide).<br>a. For step 1 on the slide, have participants describe the main learning goal for their assigned two-part lesson (parts A and B) and how it connects to the lessons that precede and follow it. (5 min)<br>b. For steps 2 and 3, have participants report on their assigned two-part lesson.<br>**Note:** Rather than walking through every step in the lesson plan, participants should present the *big picture* using the questions in step 2 on |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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| | | | the slide. They should bring up details only when they have some concern, question, or suggestion about a modification.<br><br>c. As participants give their reports, mark on a chart the Student Thinking Lens strategies that are highlighted in each lesson. (Use the chart on the next slide as a model.)<br><br>**Note:** Encourage participants to pick just one or two Student Thinking Lens strategies that are highlighted in the lesson. (Several strategies may be used in a lesson.)<br><br>d. Highlight the following ideal pattern and how the STL strategies work together across lessons:<br><br>• Elicit and probe strategies are very important in lesson 1.<br>• Probe and challenge strategies are used throughout all the lessons.<br>• Strategies 4 and 5 are highlighted in the middle lessons.<br>• Strategy 6 is highlighted toward the end of a lesson, after students encounter new science ideas but before final unit assessments.<br><br>**Timing note: Make sure you limit the time allotted for each lesson** so you can get through them all. If you have 6 two-part lessons, you'll have approximately 8 minutes for each lesson (4 minutes for part A, and 4 minutes for part B). If your lesson series has more than 6 two-part lessons, or has more than two parts per lesson, you'll have to decrease the time for each lesson. |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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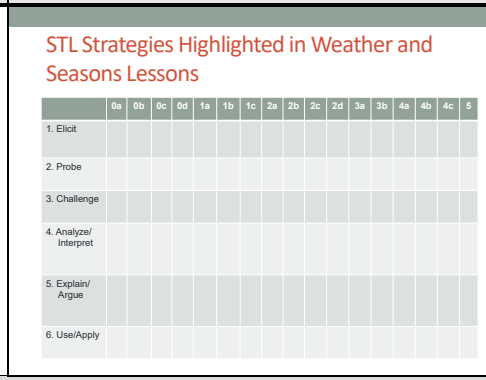
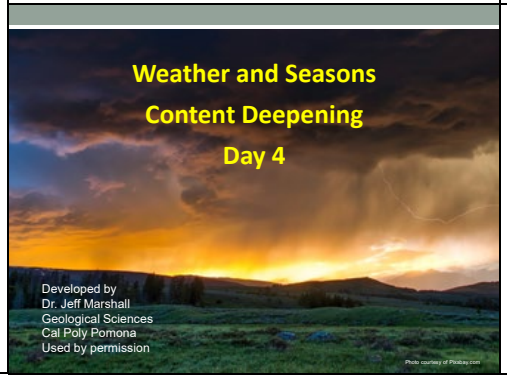
| | |  | **Display Slide 24.** STL Strategies Highlighted in Weather and Seasons Lessons<br><br>a. Use this slide in conjunction with the previous slide. |
| 12:00–12:45<br>45 min | **LUNCH** | | |
| 12:45–3:15<br><br>150 min (Includes 10-min break)<br><br>**Science and Math Content Deepening: Weather and Seasons**<br><br>Slides 25–73 | **Purpose**<br>• Understand why weather is different in different places and at various times of the year.<br>• Understand the importance of representing data in clear, accurate, and concrete ways and consider the problem of deceptive statistics.<br><br>**Content**<br>• There are many factors that explain why weather is different in different places at different times of the year. These factors include the angle of sunlight striking Earth's curved surface, the tilt of Earth in relation to Earth's orbit around the Sun, elevation, and proximity to large bodies of water or mountains.<br>• Content representations, such as graphs, are useful for identifying |  | **Display Slide 25.** Science and Math Content Deepening: Weather and Seasons (Less than 1 min)<br><br>a. "Let's dig into our content deepening work for today."<br><br>**Note:** Refer to the content background document and Common Student Ideas about Weather and Seasons as needed throughout this phase. |
| | |  | **Display Slide 26.** Content Deepening: Day 4 (Less than 1 min)<br><br>a. "Today we'll synthesize our understandings of why weather isn't the same everywhere. We'll also investigate the use of graphs for identifying patterns in data and the importance of presenting data as clearly and accurately as possible." |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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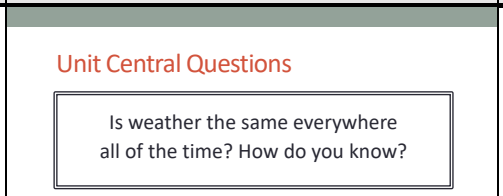
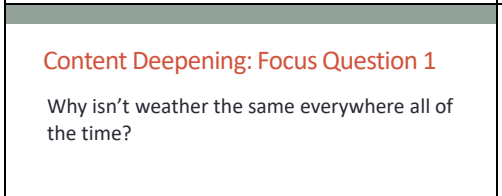
| | and analyzing patterns in data. They also help clarify science ideas and make them more real or concrete for students.<br>• Presenting data as clearly and accurately as possible is essential for preventing misleading or deceptive statistics and data displays.<br><br>**What Participants Do**<br>• Investigate how elevation affects temperature by reading a story about a mountain-climbing expedition to Mount Everest.<br>• Compare weather patterns in Hiroshima, Japan; Casablanca, Morocco; and Pomona, California.<br>• Identify misleading or deceptive data presentations in a variety of scenarios.<br>• Discuss different types of graphs and the information they present.<br>• Explore an online graph-making resource for students.<br>• Engage in a use-and-apply activity in which they collect data on reaction time and discuss how to present it.<br><br>**Handouts in Lesson Plans Binder**<br>• 3.7 Uneven Heating (from day 3)<br>• 4.7 Climb to Cold<br>• 4.8 Space Shuttle *Challenger* |  <br>  | **Display Slide 27.** Unit Central Questions (Less than 1 min)<br><br>a. Review the unit central questions on the side.<br>b. Remind participants that these questions guide student learning throughout the Weather and Seasons lesson series.<br><br>**Display Slide 28.** Content Deepening: Focus Question 1 (1 min)<br><br>a. "Based on the evidence we've gathered in our content deepening sessions, we know that weather isn't the same everywhere all of the time. But why? What causes differences in weather patterns from place to place?"<br>b. "Even though we won't explore this in depth with our kindergartners, it's important that we understand why weather is different in different places and at various times of the year."<br>c. "We already have some ideas about what causes these differences, but let's spend a few minutes reviewing what we know that can help us answer this focus question."<br>d. Have participants copy the focus question into their science notebooks and leave space to write a response. |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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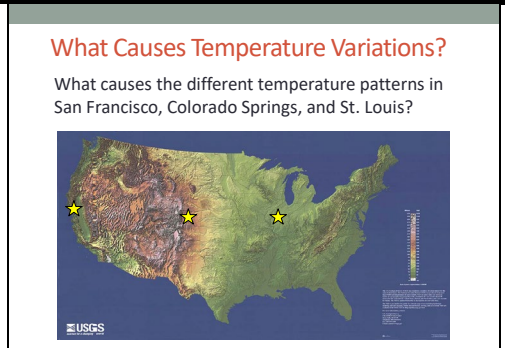
| | Historical Launch Data: Temperatures and O-ring Condition<br><br>**Supplies**<br>• Science notebooks<br>• Chart paper and markers<br>• Globe or world map that shows Hiroshima, Japan; Casablanca, Morocco; and Pomona, California<br>• NCES Create a Graph (online tutorial)<br>• 30-cm rulers (1 per pair)<br><br>**PD Resources**<br>• RESPeCT lesson plans binder<br><br>**Resources in Lesson Plans Binder**<br>*Resources section:*<br>• Content background document<br>• Common Student Ideas |  | **Display Slide 29.** What Causes Temperature Variations? (6 min)<br><br>a. "In our previous content deepening session, we investigated possible causes of temperature variations among three cities: San Francisco, Colorado Springs, and St. Louis. What did we find out that helped us explain the different temperature patterns in these cities?"<br><br>b. **Pairs:** Have participants discuss this question with an elbow partner. Allow them to use available resources (notes, handouts, charts) to help them develop a list of causes.<br><br>c. **Whole group:** Invite pairs to share their ideas with the group. List the causes of temperature variations on chart paper and encourage participants to agree, disagree, ask questions, or add on during this discussion. Make sure participants include evidence to support the causes they list. |
| | |  | **Display Slide 30.** Investigation: Climb to Cold! (Less than 1 min)<br><br>a. "Next, we'll engage in one final investigation to help us synthesize our ideas about why weather isn't the same everywhere. For this investigation, we'll read a story titled "Climb to Cold" about a hiking expedition to Mount Everest. The inset images on this slide are from the story."<br><br>b. Note that this activity comes from a 6th-grade lesson on the Sun's effect on climate. |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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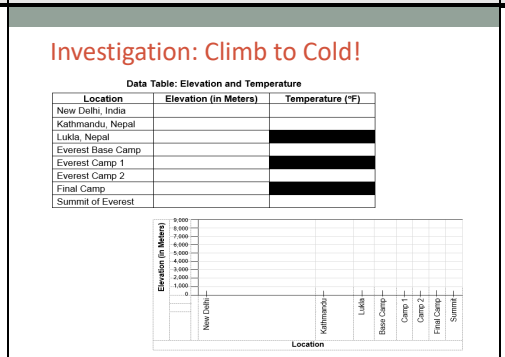
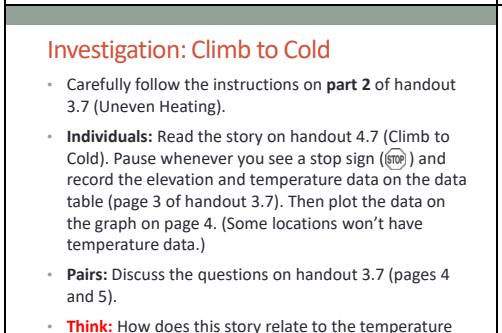
| | |  | **Display Slide 31.** Investigation: Climb to Cold! (1 min)<br><br>a. "Throughout the story, you'll find elevation and temperature data that you'll record on a data table like the one at the top of this slide. Then you'll plot the data on a graph and analyze the results."<br><br>b. Direct participants to pair up with an elbow partner for the investigation and have them locate handout 3.7 (Uneven Heating) from the previous session and handout 4.7 (Climb to Cold) in their PD program binders. |
| | |  | **Display Slide 32.** Investigation: Climb to Cold (15 min)<br><br>a. Read the instructions and the question on the slide. Then walk participants through the instructions in part 2 of handout 3.7.<br><br>b. Ask participants if they have any questions before they begin reading the Climb to Cold story.<br><br>c. Emphasize that pairs should develop concise answers to the questions on handout 3.7 and be prepared to share their ideas with the group.<br><br>d. **Whole group:** Following the investigation, invite participants to share their responses to the questions on the handout. Challenge them to use evidence from the data table and graph to support their answers. |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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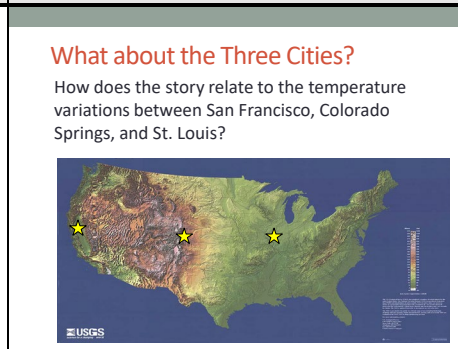
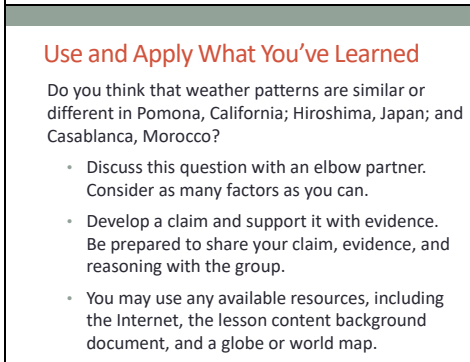
| | |  | **Display Slide 33.** What about the Three Cities? (5 min)<br><br>a. "How does the story relate to the temperature variations between San Francisco, Colorado Springs, and St. Louis?"<br>b. Elicit a variety of ideas and ask probe and challenge questions to clarify participants' thinking.<br>c. Review the list of causes you recorded earlier for temperature variations among the three cities and ask participants if they have any causes to add to the list.<br>d. Emphasize that the story illustrates how elevation affects temperatures in different locations. As elevation increases, temperatures generally decrease. Elevation is one key factor that causes temperature variations between cities like San Francisco, Colorado Springs, and St. Louis, even though these cities are located at approximately the same latitude. |
| | |  | **Display Slide 34.** Use and Apply What You've Learned (12 min)<br><br>a. "Do you think that weather patterns are similar or different in Pomona, California; Hiroshima, Japan; and Casablanca, Morocco?"<br>b. **Pairs:** "Discuss this question with an elbow partner. Consider as many factors as possible that might explain similarities or differences between the weather patterns in these cities. Then work together to make a claim that answers the question using what you've learned about weather patterns. You can also use any available resources to find evidence that supports your claims. Be prepared to share your claims, |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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| | | | evidence, and reasoning with the group."<br>c. Some of the resources participants might use are listed on the slide (e.g., the Internet, the content background document in their lesson plans binders, a globe or world map), but allow them to use any other resources at their disposal.<br>d. **Whole-group discussion:** Invite participants to share their claims, evidence, and reasoning with the group. Record key ideas on chart paper and ask probe and challenge questions to clarify participants' reasoning.<br>**Key ideas:**<br>• Latitude, the angle of sunlight striking Earth's curved surface, Earth's tilt and orbit, elevation, and proximity to water and mountains are all factors that influence weather patterns in different locations at various times of the year. |
| | | Reflect: Content Deepening Focus Question 1<br>Why isn't weather the same everywhere all of the time? | **Display Slide 35.** Reflect: Content Deepening Focus Question 1 (4 min)<br>a. Review the focus question on the slide.<br>b. **Individuals:** Have participants answer the question in their science notebooks, using evidence from the investigations to support their ideas.<br>c. **Whole group:** Invite participants to share their ideas and evidence with the group. Record key ideas on chart paper and ask probe and challenge questions to clarify participants' thinking. |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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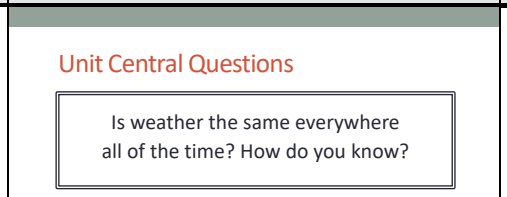
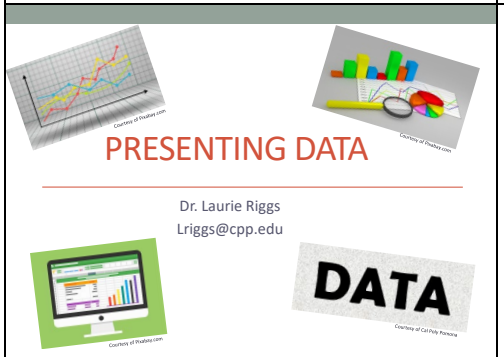
| | |  | **Display Slide 36.** Unit Central Questions (7 min)<br>a. "Let's revisit our unit central questions."<br>b. Read the questions on the slide.<br>c. **Pairs:** Have participants pair up with an elbow partner and work together to develop a few concise statements that answer the questions. Remind them to support their answers with evidence from the weather investigations they conducted this week.<br>d. **Whole group:** Invite pairs to share their answers and evidence with the group. Record key ideas and evidence on chart paper. Elicit a variety of responses and ask probe and challenge questions to clarify participants' reasoning.<br>e. Encourage participants to listen carefully to the ideas others share and be prepared to agree or disagree, ask questions, and add ideas or evidence from the investigations. |
| | |  | **Display Slide 37.** Presenting Data (Less than 1 min)<br>a. "Next, we'll focus on math content deepening and explore ideas about data presentation." |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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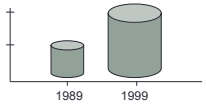
| | | Content Deepening: Focus Question 2<br>Why do we use graphs? | **Display Slide 38.** Content Deepening: Focus Question 2 (1 min)<br>a. Introduce the focus question on the slide.<br>b. Have participants write the question in their science notebooks. |
| | | What Do You Know about Graphs?<br>• What do you already know about graphs and why we use them?<br>• Is it important to know which type of graph to use and how to read and/or interpret it? | **Display Slide 39.** What Do You Know about Graphs? (2 min)<br>a. Discuss the questions on the slide and record participants' ideas on chart paper.<br>b. **Emphasize:** "We want our students to be graph literate and comfortable using graphs." |
| | | What Does This Graph Depict?<br>  <br>**Claim:** Oil consumption in the US doubles. | **Display Slide 40.** What Does This Graph Depict? (2 min)<br>a. "What does the graph on this slide depict? Is it an accurate representation?"<br>**Ideal answer:** The graph falsely depicts that the oil consumption from 1989 to 1999 more than doubled.<br>b. "What do you think is missing from this graph?"<br>**Ideal answer:** It has no legend or units.<br>c. "In this content deepening session, we'll consider the importance of presenting data as clearly and accurately as possible. We'll also look at some |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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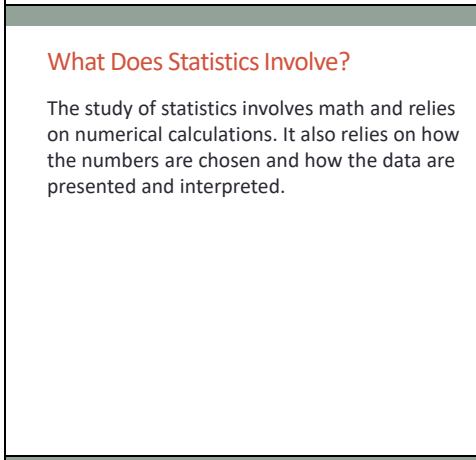
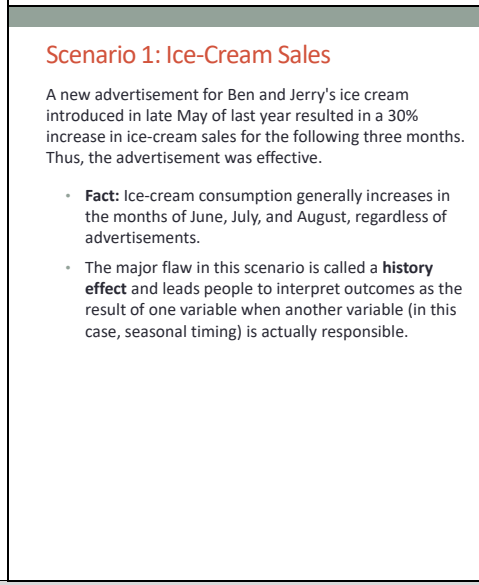
| | | | deceptive statistics and talk about the implications for clarity." |
| | |  | **Display Slide 41.** What Does Statistics Involve? (Less than 1 min)<br>a. "Let's think for a moment about what statistics involves."<br>b. Read the information on the slide.<br>c. "So if statistics relies on how numbers are chosen and how the data are presented and interpreted, can statistics be misleading or even deceptive? Next, we'll consider how statistics were presented and interpreted in different scenarios and see if we can identify a major flaw in each scenario." |
| | |  | **Display Slide 42.** Scenario 1: Ice-Cream Sales (6 min)<br>**Note:** Initially, display only the scenario at the top of the slide.<br>a. Introduce the scenario on the slide.<br>b. "What is the major flaw in how the statistics in this scenario were presented and interpreted?"<br>c. **Think-Pair-Share:** Ask participants to think about this question for a moment and then share their ideas with an elbow partner.<br>d. **Whole group:** Reveal the rest of the information on the slide and briefly discuss the major flaw in how the statistics were presented and interpreted. |
| | **10-MINUTE BREAK** | | |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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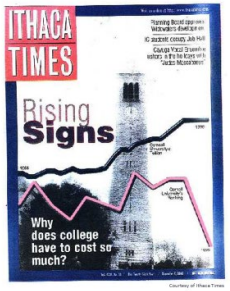
| | | Scenario 2: Churches and Crime<br>When there are more churches in a city, there is more crime. Thus, churches lead to crime.<br>• **Fact:** Bigger cities with larger populations have more churches and more crime. Larger populations explain why there are more churches and higher crime rates.<br>• **Major flaw:** People erroneously believe that there is a **causal relationship** between two primary variables rather than recognizing that a third variable may be responsible. | **Display Slide 43.** Scenario 2: Churches and Crime (6 min)<br>**Note:** This slide may be skipped if time is running short.<br>a. Display only the scenario at the top of the slide.<br>b. Ask participants, "What is the major flaw in how the data in this scenario were presented and interpreted?"<br>c. **Think-Pair-Share:** Ask participants to think about this question for a moment and then share their ideas with an elbow partner.<br>d. **Whole group:** Reveal the rest of the information on the slide and briefly discuss the major flaw in how the statistics were presented and interpreted. |
| | | Deceptive Displays<br>  | **Display Slide 44.** Deceptive Displays (Less than 1 min)<br>a. "Next, we'll consider deceptive displays of data."<br>b. "This cover of the December 7, 2000, issue of the *Ithaca Times* shows what may be the most misleading graphs ever published. I have never seen so many graphical sins in a single image!" |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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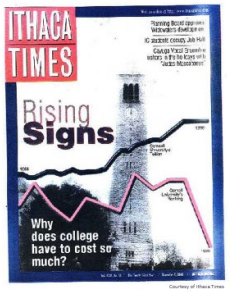
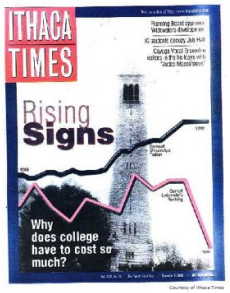
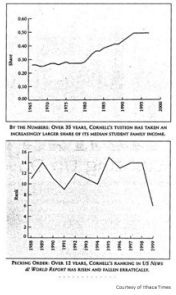
| | | Deceptive Displays<br>  <br> | **Display Slide 45.** Deceptive Displays (3 min)<br>a. "On the cover of the magazine is the question, 'Why does college have to cost so much?' Superimposed on an image of Cornell University are two lines showing the university's tuition rate and ranking from the 1960s to 1999."<br>b. Ask participants, "What message does this graphic convey? How should we interpret it?" |
| | | Deceptive Displays<br>  <br> | **Display Slide 46.** Deceptive Displays (Less than 1 min)<br>a. "Let's take a closer look at the graphic on the magazine cover. The top black line shows Cornell's tuition rising steadily between 1965 and 1999, and the bottom red line shows the university's ranking rising and falling repeatedly before plummeting to an all-time low in 1999."<br>b. "The clear impression is that students are paying more for a college education at Cornell but are receiving far less in terms of quality." |
| | | Deceptive Displays<br>  | **Display Slide 47.** Deceptive Displays (3 min)<br>a. "Now look at each graph in context."<br>b. "What do you notice? What is each graph saying?" |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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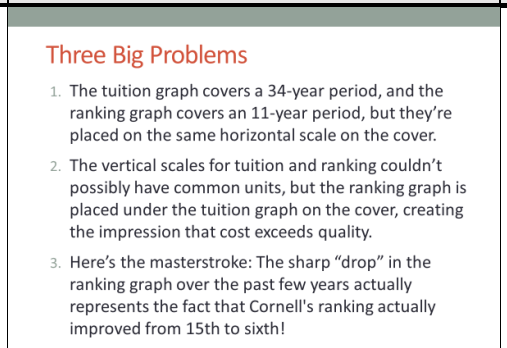
| | |  | **Display Slide 48.** Three Big Problems (4 min)<br><br>a. "Here are three big problems with the tuition and ranking graphs:<br>1. "The tuition graph covers a 34-year period, and the ranking graph covers an 11-year period, but they're placed on the same horizontal scale.<br>2. "The vertical scales for tuition and ranking couldn't possibly have common units, but placing the ranking graph under the tuition graph on the cover creates the impression that cost exceeds quality.<br>3. "Here's the masterstroke: The sharp "drop" in ranking on the graph actually represents the fact that Cornell's ranking *improved* from 15th to sixth!"<br><br>b. "What are the implications of failing to examine data presentations with a critical eye? What are the implications for our students?" |
| | |  | **Display Slide 49.** The *Challenger* Disaster (Less than 1 min)<br><br>a. "The way data is presented can not only be misleading or deceiving; it can also cost lives! Do you remember the *Challenger* disaster in 1986?"<br><br>b. "In 1997, Edward R. Tufte, one of the world's leading experts in the visual presentation of information, demonstrated how poor data presentation contributed to the explosion of the space shuttle, which led to the deaths of seven astronauts." |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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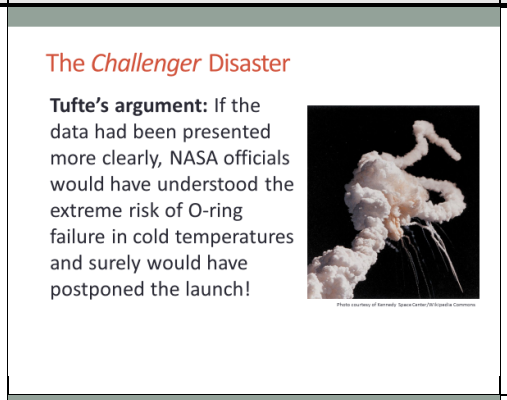
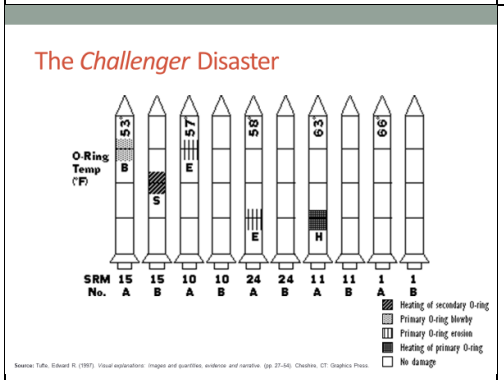
| | |  | **Display Slide 50.** The *Challenger* Disaster (Less than 1 min)<br><br>a. "Tufte's argument was compelling: Had the data been presented more clearly, NASA officials would have understood the extreme risk of O-ring failure in cold temperatures and surely would have postponed the launch. The data was available well before the launch, but it was never presented in a way that highlighted the problem or made it apparent." |
| | |  | **Display Slide 51.** The *Challenger* Disaster (2 min)<br><br>a. "After analyzing the thirteen charts submitted to NASA, Tufte concluded that the chart makers had failed to demonstrate a clear causal link between cold temperature and O-ring damage. They had accurately assessed the problem, but the way they presented the data failed to communicate the severity of the risk to NASA officials."<br><br>b. "Graphics were another major flaw in the presentation. The first chart, like the one shown on this slide, included a legend with symbols of various types of damage to the O-rings, but the legend didn't appear on subsequent charts that showed serious O-ring damage. Had the legend appeared on every chart, NASA officials would have been able to quickly and accurately assess the damage." |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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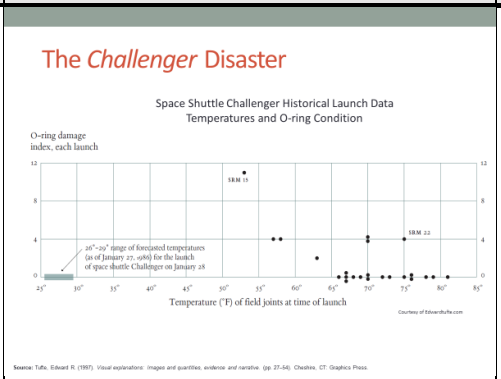
| | |  | **Display Slide 52.** The *Challenger* Disaster (6 min)<br><br>a. "Let's examine a different presentation of the O-ring data."<br><br>b. Distribute handout 4.8 (Space Shuttle *Challenger* Historical Launch Data: Temperatures and O-ring Condition).<br><br>c. "This graph shows historical temperature data and O-ring condition for the *Challenger*. It also tells us that the forecast temperatures for the *Challenger* launch were between 26 and 29 degrees Fahrenheit. The O-ring damage is plotted along the vertical axis on the graph, and the temperature data is plotted along the horizontal axis."<br><br>d. "What does the graph tell us? At which temperature did the most damage occur?"<br><br>e. "Based on this scatter-plot data for the 24 previous *Challenger* launches, would you predict a problem for the upcoming launch? Why or why not?"<br><br>**Key observations:**<br>• Over the years, *Challenger*'s O-rings had persistent problems at cooler temperatures. Every launch below 66 degrees resulted in O-ring damage.<br>• At or above 66 degrees, only three launches experienced some O-ring erosion.<br>• A launch forecast of 29 degrees is *5.7 standard deviations* from the average temperature for previous launches!<br>• The graph data clearly shows that there were serious risks of O-ring damage for a launch at 29 degrees. |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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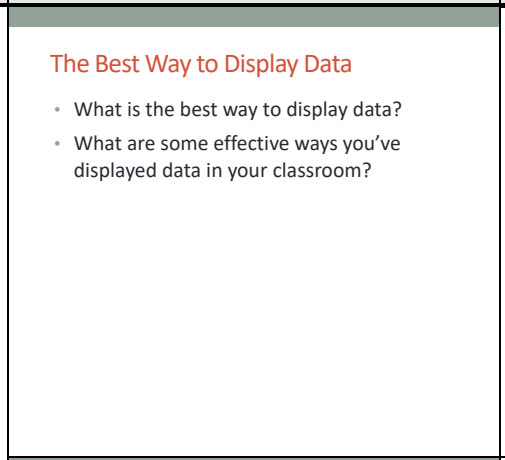
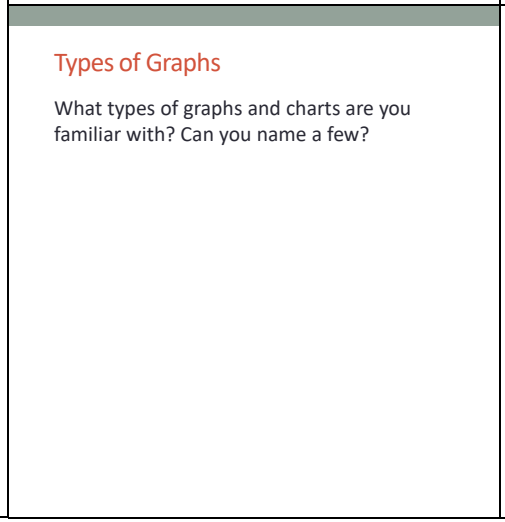
| | |  | **Display Slide 53.** The Best Way to Display Data (3 min)<br><br>a. "What is the best way to display data? What are some effective ways you've displayed data in your classrooms?"<br>b. Elicit ideas from participants and record them on chart paper.<br>c. **Emphasize:** "The best way to display data can depend on the type of data you collect and what you need to learn from the data. Different types of graphs tell us different things." |
| | |  | **Display Slide 54.** Types of Graphs (2 min)<br><br>a. "What types of graphs and charts are you familiar with? Can you name a few?"<br>b. As participant's share their ideas, record them on chart paper.<br>**Possible responses:**<br>• Histogram<br>• Bar graph<br>• Line graph or chart<br>• Scatter-plot or scatter graph<br>• Pie chart<br>• Stem-and-leaf plot or diagram<br>• Box-and-whisker plot or box plot |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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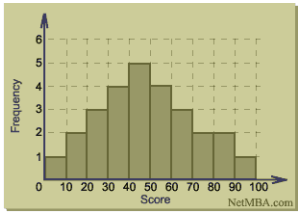
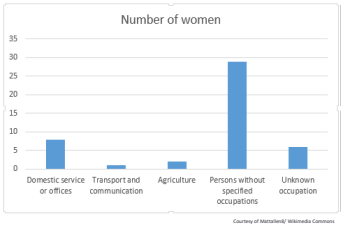
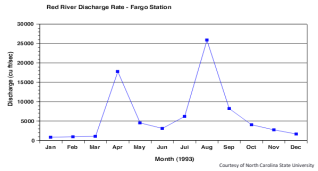
| | | Histograms<br>Histograms show interval data.<br>  <br> | **Display Slide 55.** Histograms (Less than 1 min)<br>a. "Let's look at some different types of graphs and charts."<br>b. "A histogram is similar to a bar graph, but it's used for interval data and relates to only one variable. Who can tell me what interval data are?"<br>**Answer:** Interval data are a type of data measured along a scale, and each data point is equidistant from another data point. |
| | | Bar Graphs<br>How are bar graphs different from histograms?<br>  <br> | **Display Slide 56.** Bar Graphs (1 min)<br>a. "How are bar graphs different from histograms?"<br>b. Point out that bar graphs show categorical data and typically have space between the bars. Categorical data are simply data that can be categorized. Color, grade, and size (small, medium, and large) are some examples of categories. |
| | | Line Graphs<br>  <br><br>Line graphs help us see more clearly the rate of change (slope) between individual data points. This data could have also been presented as a bar graph. | **Display Slide 57.** Line Graphs (1 min)<br>a. Read the information on the slide.<br>b. Ask participants, "How are line graphs similar to bar graphs?" |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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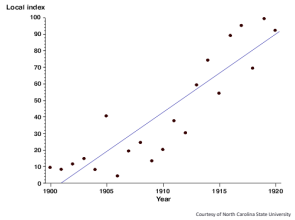
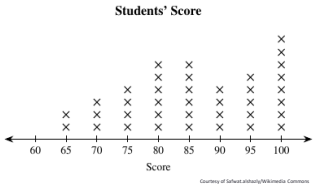
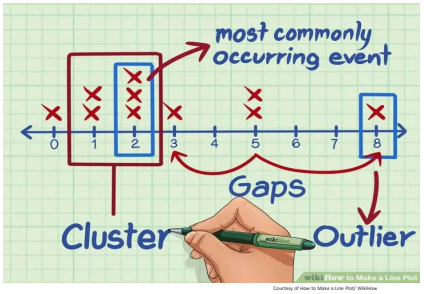
| | | Scatter Plots<br>  <br> | **Display Slide 58.** Scatter Plots (2 min)<br>a. "What does a scatter plot help us see?"<br>b. Point out that a scatter plot or diagram plots two variables along two axes and shows the pattern of relationships among the data points. The line on the graph is called a *trend line* or *line of best fit* and shows the general pattern of the data. |
| | | Line Plots<br>A line plot is a graph that shows data frequency along a number line.<br>  <br> | **Display Slide 59.** Line Plots (2 min)<br>a. "A line plot is a graph that shows data frequency along a number line. Students can learn to make this kind of graph at an early age."<br>b. "What challenges might students encounter when making a graph like this?"<br>c. Note that students often don't pay attention to scale, so graph paper can help. |
| | | What Do Line Plots Help Us See?<br>  <br> | **Display Slide 60.** What Do Line Plots Help Us See? (Less than 1 min)<br>a. "In addition to showing data frequency, line plots also show gaps in data, clusters of data, and outliers." |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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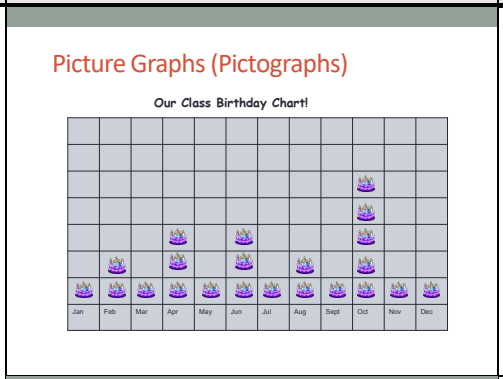
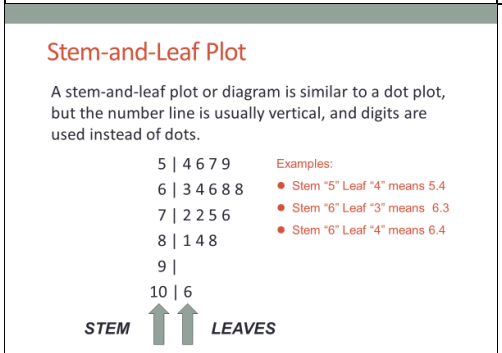
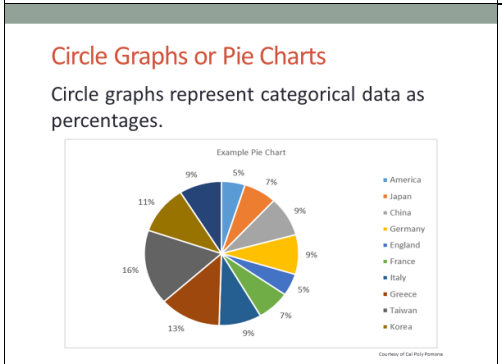
| | |  | **Display Slide 61.** Picture Graphs (Pictographs) (1 min)<br><br>a. "Kindergarten students most often use picture graphs, or pictographs, to display data, as we saw in the lessons on weather."<br>b. "How does this graph relate to other graphs we've discussed?" |
| | |  | **Display Slide 62.** Stem-and-Leaf Plot (Less than 1 min)<br><br>a. Read the information on the slide.<br>b. "This type of graph is also similar to a histogram placed on its side, but it can display more information. You also see the exact data points rather than just the intervals." |
| | |  | **Display Slide 63.** Circle Graphs or Pie Charts (1 min)<br><br>a. "Circle graphs or pie charts represent categorical data as percentages. Students can use pie charts to compare data in terms of percentages or fractions of the whole."<br>b. "How is a circle graph similar to a bar graph?"<br>c. Highlight some of the categories and percentages of the circle graph on the slide. |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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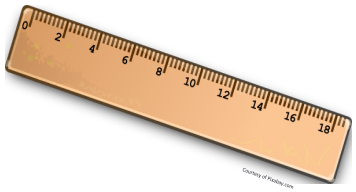
| | |  <br>Link to web site: https://nces.ed.gov/nceskids/createagraph/ | **Display Slide 64.** Graphing Tutorial (5 min)<br><br>a. "The National Center for Education Statistics has some very nice resources for students on its website. Let's look at some of the graphs they can create and the graphing tutorial they can use."<br><br>b. Quickly tour the NCES Kids' Zone Create a Graph web site and show participants how to use the Create a Graph Tutorial (https://nces.ed.gov/nceskids/help/user_guide/graph/index.asp). |
| | | Let's Learn by Doing!<br>• Is it OK to text on a cell phone while you're driving?<br>• What if we wanted to see how distraction affects reaction time? | **Display Slide 65.** Let's Learn by Doing! (Less than 1 min)<br><br>**Note:** If time is running short, skip this activity and advance to slide 73 (reflect on the content deepening focus question).<br><br>a. "Is it OK to text on a cell phone while you're driving? What if we wanted to see how distraction affects reaction time?"<br><br>b. "Next, we'll apply what we've been learning about graphs and collect some data on reaction time that we can display." |
| | | Investigation: Catch a Falling Ruler<br>In this experiment, you and a partner will test reaction time by catching a falling ruler with and without a distraction.<br>  | **Display Slide 66.** Investigation: Catch a Falling Ruler (2 min)<br><br>a. "This experiment is simple. You and a partner will test reaction time for catching a ruler with and without a distraction. One partner will drop a ruler 10 times, and the other partner will try to catch it. You'll record the measurements you collect and then switch roles. First, you'll perform the experiment without any distractions, and then you'll perform it again with a distraction." |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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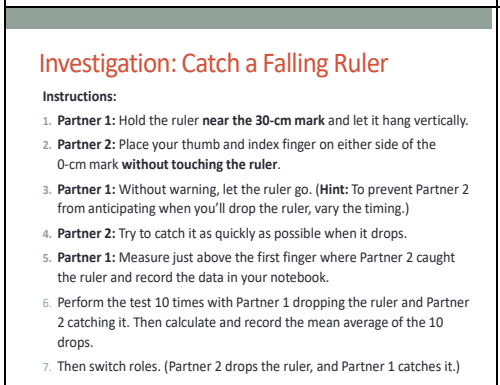
| | | | b. Have participants pair up with an elbow partner. Then give each pair a 30-cm ruler. |
| | |  | **Display Slide 67.** Investigation: Catch a Falling Ruler (15 min)<br><br>a. Walk participants through the instructions on the slide. Then pair up with a volunteer and model for participants how to drop the ruler and collect the data.<br><br>b. Have pairs practice at least one drop per person before they begin the investigation.<br><br>c. As pairs practice, circulate around the room and make sure everyone is following the instructions correctly.<br><br>**Note:** If the ruler drops to the ground without being caught, have pairs record a score of 30, since 0 would be perfect score.<br><br>d. After pairs have completed all of the trials and recorded their results, have them repeat the same investigation. But this time, direct the partner dropping the ruler to distract the other partner by asking questions that will make him or her think (e.g., "What did you have for dinner last night?" or "What is 12 + 3 − 7?"). Each partner should perform 10 drops and record the measurement for each drop and the mean average of the results. |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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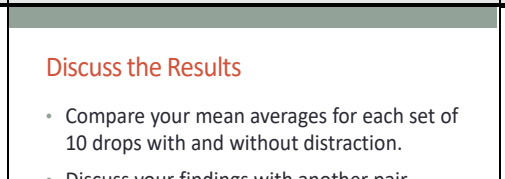
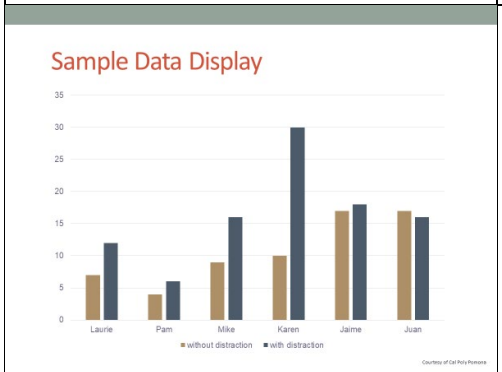
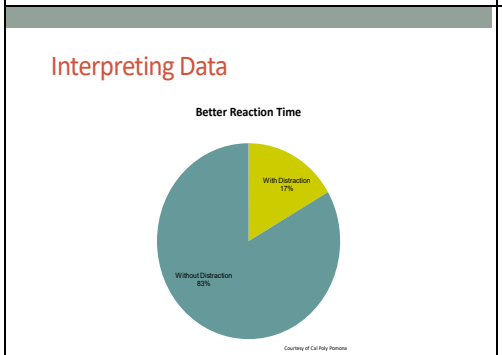
| | |  | **Display Slide 68.** Discuss the Results (3 min)<br><br>a. After the investigation, have pairs compare their mean averages for each set of 10 drops with and without distraction.<br>b. Then have pairs briefly discuss their findings with another pair of participants.<br>c. Next, discuss as a group what type of graph or chart they would use to display their data. |
| | |  | **Display Slide 69.** Sample Data Display (1 min)<br><br>a. "The sample bar graph on this slide is one way we could display our data."<br>b. "What does the graph tell us? Is reaction time better with or without a distraction? How do you know?"<br><br>**Ideal response:** The graph shows that in all but one instance (Juan), reaction time is better without a distraction. |
| | |  | **Display Slide 70.** Interpreting Data (1 min)<br><br>a. "What does this circle graph or pie chart tell us? What does it help us see?"<br><br>**Ideal response:** The graph helps us see that a larger percentage (83%) of test subjects had better reaction times without distraction than with distraction. So we can conclude that reaction time is better without distraction. |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
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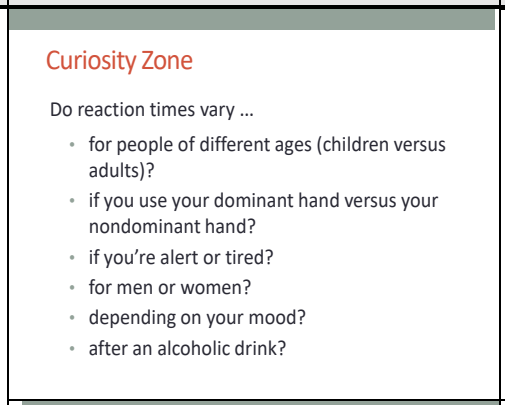
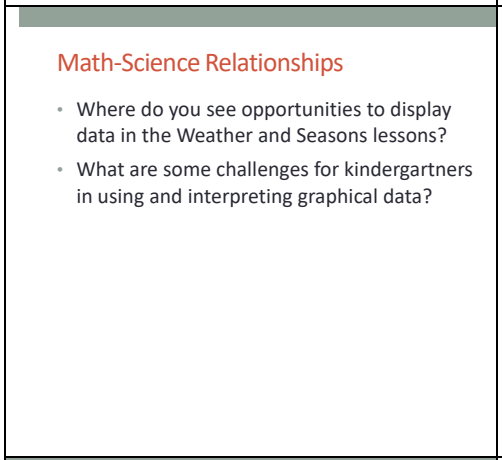
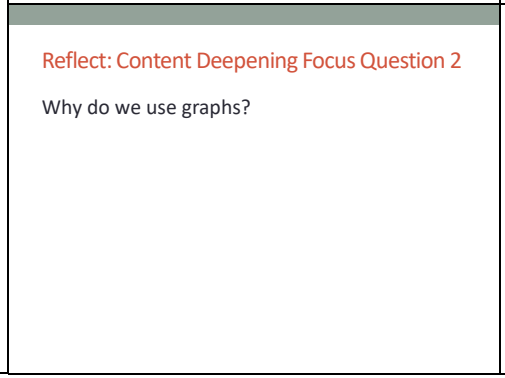
| | |  | **Display Slide 71.** Curiosity Zone (2 min)<br><br>a. Briefly discuss other factors that might influence reaction time. |
| | |  | **Display Slide 72.** Math-Science Relationships (5 min)<br><br>a. Briefly discuss the questions on the slide.<br>b. Ask participants to consider how they might teach their students to use and interpret graphical data. What challenges might they encounter with scale when using pictographs?<br>c. Note that attending to precision (a common core standard of mathematical practice) can be a challenge for students when placing stickers on picture graphs. |
| | |  | **Display Slide 73.** Reflect: Content Deepening Focus Question 2 (6 min)<br><br>a. Review the focus question on the slide.<br>b. **Individuals:** "Answer this question in your science notebooks and support your ideas with evidence from today's investigations."<br>c. **Whole group:** Invite a few participants to share their ideas and evidence with the group. |

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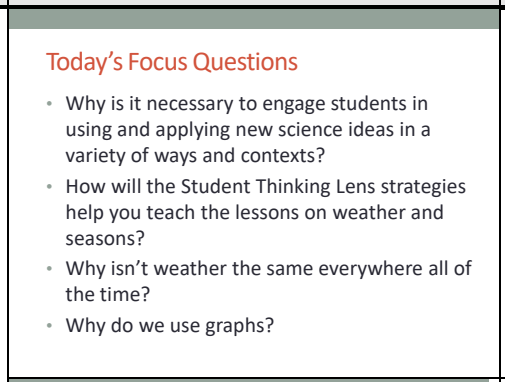
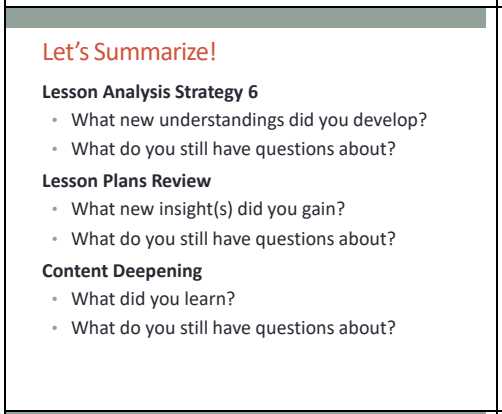
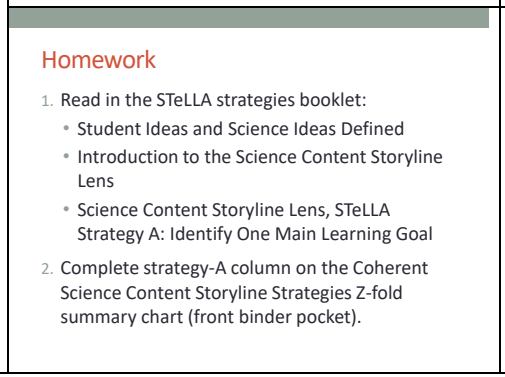
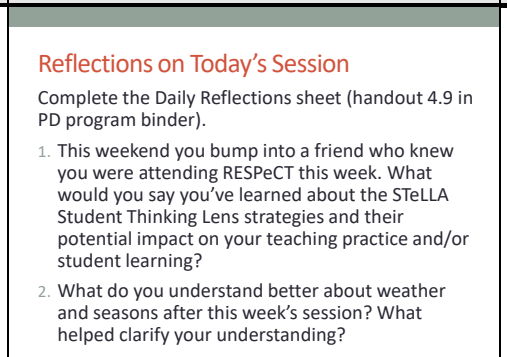
| 3:15–3:30<br><br>15 min<br><br>**Wrap-Up: Summary, Homework, and Reflections**<br><br>Slides 74–77 | **Purpose**<br>• Summarize and reflect on key ideas from today's learning and preview the transition to the Science Content Storyline Lens (SCSL) strategies.<br><br>**What Participants Do**<br>• Review today's focus questions.<br>• Share key ideas from the lesson analysis (strategy 6), lesson plan review, and content deepening work.<br>• Copy down the homework assignment.<br>• Write their reflections on today's learning.<br><br>**Handouts in PD Binder**<br>• 4.9 Daily Reflections—Day 4<br><br>**Supplies**<br>• Science notebooks |  <br>  <br>  | **Display Slide 74.** Today's Focus Questions (2 min)<br><br>a. Review today's focus questions.<br>b. **Individual think time (1 min):** Ask participants to reflect on these questions and think about how they might revise their answers.<br><br>**Display Slide 75.** Let's Summarize! (5 min)<br><br>a. **Individual think time (1 min):** Give participants a minute to think about the questions on the slide and consider questions they still have. Challenge them to formulate a statement summarizing what they learned in each area.<br>b. **Whole-group share-out:** Have participants share at least two different statements about each of the areas on the slide. Elicit more if time allows.<br><br>**Display Slide 76.** Homework (3 min)<br><br>a. "Next week we'll focus on the Science Content Storyline Lens strategies and explore a new content area: plants and animals. To prepare, complete the homework tasks on the slide."<br>b. Make sure participants copy the assignment into their science notebooks. |

| PD Model: Time/Phase | Purpose, Content, and What Participants Do | Slides | Process |
|---|---|---|---|
| | |  | **Display Slide 77.** Reflections on Today's Session (5 min)<br><br>a. Give participants time to reflect on today's session and write their responses to the questions on the Daily Reflections sheet (handout 4.9 in PD program binder). |