

## RESPeCT Summer Institute Professional Development Leader Guide (PDLG)

<b>Grade Level</b>	1	<b>Day</b>	8	<b>STeLLA Strategy</b>	SCSL Strategy F: Link Science Ideas and Activities SCSL Strategy G: Link Science Ideas to Other Science Ideas SCSL Strategy H: Highlight Science Ideas and Focus Question	<b>Subject Matter Focus</b>	Variations in Plants and Animals (VPA)
<b>Focus Questions</b>	<ul style="list-style-type: none"> <li>• How can science content storyline coherence be enhanced by explicitly implementing STeLLA strategy F (Make explicit links between science ideas and activities), strategy G (Link science ideas to other science ideas), and strategy H (Highlight key science ideas and focus question throughout)?</li> <li>• How will the Student Thinking Lens and Science Content Storyline Lens strategies help you teach the VPA lessons in the fall?</li> <li>• How would biologists explain how a trait changes within a population over time?</li> <li>• Why do we use graphs?</li> </ul>						
<b>Main Learning Goals</b>	<p>Participants will understand the following:</p> <ul style="list-style-type: none"> <li>• Strategies F, G, and H are all useful in constructing a coherent science content storyline. Strategy F ensures that students are thinking about science ideas before, during, and after each activity; strategy G focuses on making connections among key science ideas that are developed within and across lessons; and strategy H makes sure that key science ideas are highlighted for students throughout a lesson.</li> <li>• All of the SCSL and STL teaching strategies are highlighted in the VPA lesson plans that teachers will use in the fall. These lessons will support teachers in using and deepening their understandings of the STeLLA strategies.</li> <li>• Inherited (genetic) characteristics influence how likely an organism is to survive and reproduce.</li> <li>• Some traits and trait variations in individual plants or animals of the same kind can confer an advantage that enables them to survive long enough to reproduce.</li> <li>• Individual plants or animals of the same kind that are more likely to survive and reproduce are also likely to pass on their genetic (inherited) characteristics to their offspring.</li> <li>• Trait variations in plants or animals of the same kind can affect their ability to survive and pass on these traits to future generations.</li> <li>• Different environmental conditions can favor different traits, even in individuals of the same species. Organisms with certain trait variations become more common in different environmental situations.</li> <li>• Natural selection is a non-random evolutionary process resulting from trait variation among individuals in a population, inheritance that produces trait variation among offspring, selection of offspring that are better equipped to compete for limited resources and are thus more likely to survive and reproduce, and adaptation as the frequencies of traits and the genes that code for them change within a population over time.</li> <li>• 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.</li> <li>• Presenting data as clearly and accurately as possible is essential for preventing misleading or deceptive statistics and data displays.</li> </ul>						

Preparation	Materials	Videos
<p><b>Daily Setup Tasks</b></p> <ul style="list-style-type: none"> <li>• Check that video clips are correctly linked to PowerPoint (PPT) slides.</li> <li>• Set up PowerPoint.</li> <li>• Make sure video clips play correctly with good sound.</li> <li>• Arrange furniture and food.</li> <li>• Arrange participant materials.</li> <li>• Put up posters and charts.</li> </ul> <p><b>Planning and Preparation Tasks</b></p> <ul style="list-style-type: none"> <li>• Study the PDLG, PowerPoint slides (PPTs), video clips, and handouts. Make changes to PPTs if needed. Modify text highlighted in <b>light-blue font</b> on slides and/or in PDLG to make it specific for your group</li> <li>• Review the reflections from day 7 and create a summary slide.</li> <li>• Watch the video clips and anticipate participant responses.</li> <li>• Prepare charts for the day’s agenda and focus questions.</li> <li>• Prepare two charts to use during the lesson plan review (see slides 15 and 16). These charts will highlight which STL and SCSL strategies are covered in each lesson.</li> <li>• Insert some possible meeting dates for school-year study-group meetings on PPT slide 19.</li> <li>• Decide how you want to celebrate the end of the Summer Institute and insert those plans on the relevant PPT slide. (See some celebration suggestions in the leader notes for slide 70.)</li> <li>• Content deepening: <ul style="list-style-type: none"> <li>• Register for the free BSCS course Across the Sciences at <a href="http://online.bscs.org">online.bscs.org</a>. (Click on the course link on the navigation bar from the home page.)</li> <li>• After registering for the course and logging</li> </ul> </li> </ul>	<p><b>Posters and Charts</b></p> <ul style="list-style-type: none"> <li>• STeLLA Framework and Strategies poster</li> <li>• Day-8 Agenda (chart)</li> <li>• Day-8 Focus Questions (chart)</li> <li>• Norms for Working Together (chart)</li> <li>• Effective Science Teaching chart (from day 1)</li> <li>• Strategy charts from days 1–7 (STL strategies 1–7 and SCSL strategies A, B, C, D, I)</li> <li>• Chart of STL strategies highlighted in lesson plans (see PPT 15 for model)</li> <li>• Chart of SCSL strategies highlighted in lesson plans (see PPT 16 for model)</li> <li>• Parking Lot poster</li> </ul> <p><b>Handouts in RESPeCT PD Binder Front Pocket</b></p> <ul style="list-style-type: none"> <li>• Z-fold summary chart: Science Content Storyline Lens Strategies</li> </ul> <p><b>Handouts in RESPeCT PD Binder, Day 8</b></p> <ul style="list-style-type: none"> <li>• 7.7 Natural-Selection Explanation Table (from day 7)</li> <li>• 8.1 Analysis Guide F: Making Explicit Links between Science Ideas and Activities</li> <li>• 8.2 Transcript for Video Clip 8.1</li> <li>• 8.3 Transcript for Video Clip 8.2</li> <li>• 8.4 Transcript for Video Clip 8.3</li> <li>• 8.5 Overview of School-Year RESPeCT Study Groups</li> <li>• 8.6 Transcript for <i>The Making of the Fittest: Natural Selection and Adaptation</i></li> <li>• 8.7 Space Shuttle <i>Challenger</i> Historical Launch Data: Temperatures and O-ring Condition</li> </ul> <p><b>Supplies</b></p> <ul style="list-style-type: none"> <li>• Science notebooks</li> <li>• Chart paper and markers</li> <li>• For content deepening: <ul style="list-style-type: none"> <li>• 30-cm rulers (1 per pair)</li> </ul> </li> </ul>	<p>Video clips from one VPA lesson:</p> <ul style="list-style-type: none"> <li>• <a href="#">Video Clip 8.1</a>: Griffin classroom (strategies F, G, H; before the activity); 8.1_mspcp_gr.1.tav_griffin_L7_c1</li> <li>• <a href="#">Video Clip 8.2</a>: Griffin classroom (strategies F, G, H; during the activity); 8.2_mspcp_gr.1.tav_griffin_L7_c2</li> <li>• <a href="#">Video Clip 8.3</a>: Griffin classroom (strategies F, G, and H; after the activity); 8.3_mspcp_gr.1.tav_griffin_L7_c3</li> </ul> <p>For content deepening:</p> <ul style="list-style-type: none"> <li>• <i>The Making of the Fittest: Natural Selection and Adaptation</i> short film (10:25); <a href="http://www.hhmi.org/biointeractive/making-fittest-natural-selection-and-adaptation">http://www.hhmi.org/biointeractive/making-fittest-natural-selection-and-adaptation</a></li> </ul>

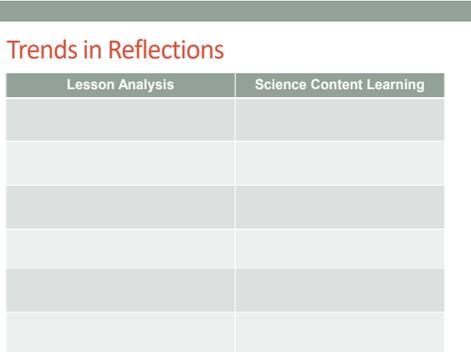
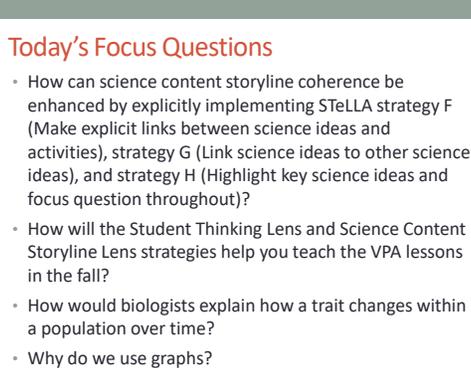
Preparation	Materials	Videos
<p>in, access the mouse simulation by clicking on Evolution; then Explore Evolution; then Predator and Prey. Once on the web page, find the link that says “Click here to view the ‘Predator and Prey’ Interactive.” Click on the link to open a new window and begin the simulation.</p> <ul style="list-style-type: none"> <li>• Run through the simulations you’ll be conducting during the content deepening phase to make sure the setup is working properly.</li> <li>• Before you begin the content deepening session, log into the course so it’s ready to go.</li> <li>• Preview the Kids’ Zone Create a Graph Tutorial on the National Center for Education Statistics (NCES) and check the link (<a href="https://nces.ed.gov/nceskids/help/user_guide/graph/howto.asp">https://nces.ed.gov/nceskids/help/user_guide/graph/howto.asp</a>).</li> </ul>	<ul style="list-style-type: none"> <li>• NCES Create a Graph (online tutorial)</li> </ul> <p><b>PD Resources</b></p> <ul style="list-style-type: none"> <li>• STeLLA strategies booklet</li> <li>• RESPeCT PD program binder</li> <li>• RESPeCT lesson plans binder</li> </ul> <p><b>Resources in Lesson Plans Binder</b></p> <p><i>Resources section:</i></p> <ul style="list-style-type: none"> <li>• Variations in Plants and Animals and Variation in Traits Content Background Document</li> <li>• Common Student Ideas about Variations in Plants and Animals</li> </ul>	

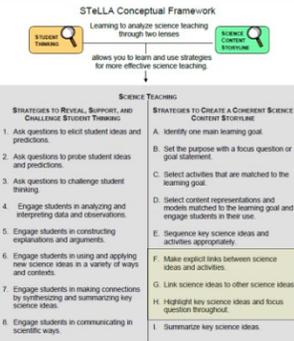
## DAY 8 SESSION OUTLINE

Time	Activities	Purpose
8:00–8:15 15 min	<b>Getting Started: Housekeeping, Agenda, Day-7 Reflections, Norms, Focus Questions</b>	<ul style="list-style-type: none"> <li>• Build community by sharing participants' reflections from day 7.</li> <li>• Set the stage for a day of learning.</li> </ul>
8:15–8:55 40 min	<b>Introducing SCSL Strategies F, G, and H</b>	<ul style="list-style-type: none"> <li>• Deepen participants' knowledge of the purposes and key features of SCSL strategies F, G, and H.</li> <li>• Develop participants' understandings of the similarities and differences among strategies F, G, and H.</li> </ul>
8:55–10:30 95 min (Includes 10-min break)	<b>Lesson Analysis: SCSL Strategies F, G, and H</b>	<ul style="list-style-type: none"> <li>• Develop participants' ability to identify and analyze strategies F, G, and H in the VPA lesson video clips.</li> <li>• Deepen participants' science-content knowledge of variations in plants and animals through lesson analysis.</li> </ul>
10:30–12:00 90 min	<b>Variations in Plants and Animals Lesson Plan Review and Fall Overview/Logistics</b>	<ul style="list-style-type: none"> <li>• Deepen participants' understandings of the VPA lesson plans and the opportunities they provide to practice using STeLLA STL and SCSL strategies.</li> <li>• Help participants understand and feel comfortable with the fall activities and logistics.</li> </ul>
12:00–12:45 45 min	<b>LUNCH</b>	
12:45–3:00 135 min (Includes 10-min break)	<b>Content Deepening: Variations in Plants and Animals</b>	<ul style="list-style-type: none"> <li>• Continue to explore the evidence biologists collect to support the argument that traits evolve because of natural selection.</li> <li>• Understand the importance of representing data in clear, accurate, and concrete ways and consider the problem of deceptive statistics.</li> </ul>
3:00–3:30 30 min	<b>Wrap-Up and Celebration</b>	<ul style="list-style-type: none"> <li>• Help participants understand the relationships among the Science Content Storyline Lens strategies and when each strategy occurs in the lesson flow.</li> <li>• Facilitate understanding which SCSL strategies must be addressed in the planning process and which need to be anticipated in planning but occur responsively during the actual teaching of the lesson.</li> <li>• Recognize and celebrate participants' learning so far and anticipate further growth in the coming year.</li> </ul>

**DAY 8**

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
<p>8:00–8:15 15 min</p> <p><b>Getting Started</b></p> <p>Slides 1–5</p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>• Build community by sharing participants’ reflections from day 7.</li> <li>• Set the stage for a day of learning.</li> </ul> <p><b>Posters and Charts</b></p> <ul style="list-style-type: none"> <li>• STeLLA Framework and Strategies poster</li> <li>• Day-8 Agenda (chart)</li> <li>• Day-8 Focus Questions (chart)</li> </ul>	<div data-bbox="789 305 1310 331" style="background-color: #808080; height: 16px; margin-bottom: 10px;"></div> <div data-bbox="835 396 1171 428" style="text-align: center;"> <p><b>RESPeCT PD PROGRAM</b></p> </div> <div data-bbox="999 454 1058 480" style="text-align: center;"> <p>Day 8</p> </div> <hr style="border: 0.5px solid #808080; margin: 10px 0;"/> <div data-bbox="1062 513 1222 529" style="text-align: center; font-size: small;"> <p>RESPeCT Summer Institute</p> </div> <div data-bbox="856 574 1213 623" style="text-align: center; display: flex; justify-content: space-around;">  </div> <div data-bbox="789 792 1310 818" style="background-color: #808080; height: 16px; margin-top: 10px;"></div> <div data-bbox="831 831 1020 863" style="text-align: center;"> <p><b>Agenda for Day 8</b></p> </div> <ul style="list-style-type: none"> <li>• Day-7 reflections</li> <li>• Focus questions</li> <li>• Introducing SCSL strategies F, G, and H</li> <li>• Lesson analysis: SCSL strategies F, G, and H</li> <li>• VPA Lesson plan review</li> <li>• Fall overview and study-group scheduling</li> <li>• Lunch</li> <li>• Content deepening: variations in plants and animals</li> <li>• Wrap-up and celebration!</li> </ul>	<p><b>Display Slide 1.</b> RESPeCT PD Program (5 min)</p> <p>a. Take care of any housekeeping issues.</p> <hr style="border: 0.5px solid #808080; margin: 10px 0;"/> <p><b>Display Slide 2.</b> Agenda for Day 8 (2 min)</p> <p>a. Talk through today’s agenda.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p><b>Display Slide 3.</b> Trends in Reflections (5 min)</p> <p>a. Give participants time to review your feedback on their reflections from day 7 and offer reactions, comments, or follow-up questions.</p>
			<p><b>Display Slide 4.</b> Today's Focus Questions (2 min)</p> <p>a. Introduce the focus questions that will guide today's work.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		 <p>The diagram illustrates the STeLLA Conceptual Framework. At the top, it states 'Learning to analyze science teaching through two lenses: Student Thinking and Science Content Structure'. Below this, it says 'allows you to learn and use strategies for more effective science teaching'. The framework is divided into two columns of strategies:</p> <ul style="list-style-type: none"> <li><b>STRATEGIES TO REVEAL, SUPPORT, AND CHALLENGE STUDENT THINKING:</b> <ol style="list-style-type: none"> <li>1. Ask questions to elicit student ideas and predictions.</li> <li>2. Ask questions to probe student ideas and predictions.</li> <li>3. Ask questions to challenge student thinking.</li> <li>4. Engage students in analyzing and interpreting data and observations.</li> <li>5. Engage students in constructing explanations and arguments.</li> <li>6. Engage students in using and applying new science ideas in a variety of ways and contexts.</li> <li>7. Engage students in making connections by differentiating and summarizing key science ideas.</li> <li>8. Engage students in communicating in scientific ways.</li> </ol> </li> <li><b>STRATEGIES TO CREATE A COHERENT SCIENCE CONTENT STRUCTURE:</b> <ol style="list-style-type: none"> <li>A. Identify one main learning goal.</li> <li>B. Set the purpose with a focus question or goal statement.</li> <li>C. Select activities that are matched to the learning goal.</li> <li>D. Select content representations and models matched to the learning goal and engage students in their use.</li> <li>E. Sequence key science ideas and activities appropriately.</li> <li>F. Make explicit links between science ideas and activities.</li> <li>G. Link science ideas to other science ideas.</li> <li>H. Highlight key science ideas and focus question throughout.</li> <li>I. Summarize key science ideas.</li> </ol> </li> </ul>	<p><b>Display Slide 5.</b> STeLLA Conceptual Framework (1 min)</p> <p>a. “Today we’ll focus on three Science Content Storyline Lens strategies, all of which make explicit links to science ideas:</p> <ul style="list-style-type: none"> <li>• Strategy F explicitly links science ideas to activities that students are doing.</li> <li>• Strategy G explicitly links science ideas to other science ideas.</li> <li>• Strategy H explicitly highlights key science ideas and links them back to the focus question.”</li> </ul> <p>b. “We won’t address strategy E about sequencing science ideas and activities until the school year, since you’ll learn a lot about sequencing from teaching the RESPeCT lesson plans.”</p>
<p>8:15–8:55 40 min</p> <p><b>Introducing SCSL Strategies F, G, and H</b></p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>• Deepen participants’ knowledge of the purposes and key features of SCSL strategies F, G, and H.</li> <li>• Develop participants’ understandings of the similarities and differences among strategies F, G, and H.</li> </ul> <p><b>Content</b></p> <ul style="list-style-type: none"> <li>• While strategies F, G, and H help students construct meaning from</li> </ul>	<p><b>Lesson Analysis: Focus Question 1</b></p> <p>How can science content storyline coherence be enhanced by explicitly implementing STeLLA strategy F (Make explicit links between science ideas and activities), strategy G (Link science ideas to other science ideas), and strategy H (Highlight key science ideas and focus question throughout)?</p>	<p><b>Display Slide 6.</b> Lesson Analysis: Focus Question 1 (Less than 1 min)</p> <p>a. Read the focus question on the slide.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
Slides 6–8	<p>the science content storyline, each strategy has its own specific purpose.</p> <ul style="list-style-type: none"> <li>In strategy F, activities that students carry out should be explicitly linked to the science content storyline so the science ideas are made visible to students before, during, and after an activity.</li> <li>In strategy G, science ideas introduced in a lesson should be clearly and explicitly linked to the main learning goal(s) within and across lessons.</li> <li>In strategy H, the science content storyline is easier for students to construct if the main learning goal, supporting science ideas, and flow of events are highlighted at key points during the lesson.</li> </ul> <p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>Make, share, and discuss charts summarizing the purposes and key features of strategies F, G, and H.</li> </ul> <p><b>PD Resources</b></p> <ul style="list-style-type: none"> <li>STeLLA strategies booklet</li> <li>SCSL Z-fold summary chart (front pocket of PD binder)</li> </ul>	<p><b>SCSL Strategies F, G, and H: Purposes and Key Features</b></p> <p><b>Group 1:</b></p> <ul style="list-style-type: none"> <li>What are the purposes and key features of strategy F?</li> <li>Why is this strategy important for science content storyline coherence?</li> </ul> <p><b>Group 2:</b></p> <ul style="list-style-type: none"> <li>What are the purposes and key features of strategy G?</li> <li>Why is this strategy important for science content storyline coherence?</li> </ul> <p><b>Group 3:</b></p> <ul style="list-style-type: none"> <li>What are the purpose and key features of strategy H?</li> <li>Why is this strategy important for science content storyline coherence?</li> </ul>	<p><b>Display Slide 7.</b> SCSL Strategies F, G, and H: Purposes and Key Features (30 min)</p> <p>a. <b>Small groups:</b> Divide participants into three groups to make charts that capture the purposes and key features of strategies F, G, and H. Direct groups to refer to their Z-fold summary charts and the STeLLA strategies booklet.</p> <p>b. <b>Whole group:</b> Have small groups share their charts with the entire group.</p> <p>c. Challenge participants to imagine themselves in their Teacher Leader roles. Ask them, “How would you explain these strategies to the teachers you’re leading?”</p>
		<p><b>SCSL Strategies F, G, and H: Discussion Question</b></p> <p>What’s similar and different about these three strategies?</p>	<p><b>Display Slide 8.</b> SCSL Strategies F, G, and H: Discussion Question (10 min)</p> <p><b>Note:</b> This slide may be skipped if similarities and differences were addressed in the previous discussion.</p> <p>a. <b>Individuals (3 min):</b> “Look at your three strategy charts, your Z-fold summary charts, and the strategies booklet as you think about the question on the slide.”</p> <p>b. <b>Whole group:</b> Have participants share their ideas about the three strategies.</p> <p><b>Key ideas about strategies F, G, and H:</b></p> <p>1. Similarities:</p> <p>a. These strategies are all focused on linking complete sentence-length science ideas: Strategy F links science ideas to activities, strategy G links science ideas to other science</p>

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			<p>ideas, and strategy H highlights key science ideas and links them to the focus question throughout the lesson.</p> <p>b. All of these strategies emphasize making the links <b>explicit</b>, not just assuming that students will see the intended links.</p> <p>c. All of these strategies can and should occur throughout the lesson.</p> <p>2. Differences:</p> <p>a. Strategy F explicitly links science ideas to student activities.</p> <p>b. Strategy G explicitly links science ideas to other science ideas.</p> <p>c. Strategy H explicitly highlights key science ideas and links them back to the focus question.</p>
<p>8:55–10:20 95 min (Includes 10-min break)</p> <p><b>Lesson Analysis: SCSL Strategies F, G, and H</b></p> <p>Slides 9–12</p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>Develop participants’ ability to identify and analyze strategies F, G, and H in the VPA lesson video clips.</li> <li>Deepen participants’ science-content knowledge of variations in plants and animals through lesson analysis.</li> </ul> <p><b>Content</b></p> <ul style="list-style-type: none"> <li>In strategy F, activities that students carry out should be explicitly linked to the science content storyline so the science ideas are made visible to students before, during, and after an activity.</li> </ul>	<p style="background-color: #cccccc; padding: 5px;"><b>Preparing for Video-based Lesson Analysis</b></p> <p>Read Analysis Guide F, part 1.</p> <ol style="list-style-type: none"> <li>What is the difference between the main learning goal and supporting science ideas?</li> <li>What is similar about the main learning goal and supporting science ideas?</li> </ol>	<p><b>Display Slide 9.</b> Preparing for Video-based Lesson Analysis (5 min)</p> <p>a. “Next we’re going to watch a series of three classroom video clips from one lesson on variations in plants and animals. The first clip takes place before students start working on the mouse activity. The second clip shows students while they’re working on the activity, and the third clip shows the teacher following up with students after the activity. Our focus for this analysis will be strategy F.”</p> <p>b. Have participants locate Analysis Guide F (handout 8.1) in their PD program binders.</p> <p>c. Tell participants that part 1 of the guide provides the context for the video clips.</p> <p>d. <b>Individuals:</b> “Read part 1 of the analysis guide and be prepared to discuss the two questions on the</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	<ul style="list-style-type: none"> <li>In strategy G, science ideas introduced in a lesson should be clearly and explicitly linked to the main learning goal(s) within and across lessons.</li> <li>In strategy H, the content storyline is easier for students to construct if the main learning goal, supporting science ideas, and flow of events are highlighted at key points during the lesson.</li> </ul> <p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>Identify and analyze the use of strategy F in three classroom video clips.</li> <li>Identify and analyze the use of strategies F, G, and H in transcripts from the same three video clips.</li> </ul> <p><b>Videos</b></p> <ul style="list-style-type: none"> <li>Video Clip 8.1, Griffin classroom (before the activity)</li> <li>Video Clip 8.2, Griffin classroom (during the activity)</li> <li>Video Clip 8.3, Griffin classroom (after the activity)</li> </ul> <p><b>Handouts in PD Binder</b></p> <ul style="list-style-type: none"> <li>8.1 Analysis Guide F</li> <li>8.2 Transcript for Video Clip 8.1</li> <li>8.3 Transcript for Video Clip 8.2</li> <li>8.4 Transcript for Video Clip 8.3</li> </ul> <p><b>PD Resources</b></p> <ul style="list-style-type: none"> <li>STeLLA strategies booklet</li> </ul>	<p style="text-align: center;"><b>Lesson Analysis: Strategy F</b></p> <ol style="list-style-type: none"> <li>For each of the video clips, read the context at the top of the transcript and then watch the clip: <ul style="list-style-type: none"> <li>Video clip 1: setup for the activity</li> <li>Video clip 2: during the activity</li> <li>Video clip 3: follow-up to the activity</li> </ul> </li> <li>For each clip, use the criteria in part 2 of Analysis Guide F to analyze how well science ideas were linked to the activity.</li> </ol> <p style="font-size: small; text-align: center;">Links to video clips: <a href="#">8.1_mspcp_gr.1.tav_griffin_L7_c1</a>, <a href="#">8.2_mspcp_gr.1.tav_griffin_L7_c2</a>, <a href="#">8.3_mspcp_gr.1.tav_griffin_L7_c3</a></p>	<p>slide.”</p> <p><b>e. Whole group:</b></p> <ul style="list-style-type: none"> <li>Discuss the questions on the slide.</li> <li>Ask whether participants have any questions about the activity they’ll be observing in the video clips.</li> </ul> <p><b>Key ideas:</b></p> <ul style="list-style-type: none"> <li><i>Difference between the main learning goal and supporting science ideas:</i> The main learning goal is the big idea that is the focus of the lesson. Supporting science ideas are smaller, connected ideas that build upon each other to support the main learning goal.</li> <li><i>Similarity between the main learning goal and supporting science ideas:</i> The main learning goal and supporting science ideas are all expressed as complete-sentence science ideas (not as topics, phrases, or activities).</li> </ul> <p><b>Display Slide 10.</b> Lesson Analysis: Strategy F (60 min—15 min/clip)</p> <p><b>Note:</b> These video clips are from an earlier version of the lesson plan.</p> <p>a. Have participants review part 2 of Analysis Guide F. After they watch each video clip, ask them to study the corresponding transcript, answer the questions in part 2 of the analysis guide, and then analyze the links between science ideas and activities that were (or were not) made before, during, or after the activity.</p> <p>b. Have participants read the context for video clip 1 at the top of the transcript (handout 8.2 in PD program binder).</p>

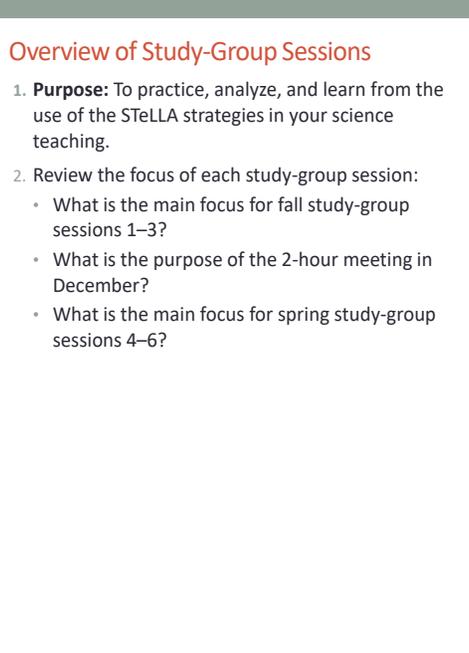
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>c. Show video clip 1 and then guide participants through these tasks:</p> <ul style="list-style-type: none"> <li>• <b>Individuals:</b> “Study the video transcript and then complete part 2, section 1 of the analysis guide, Setup for the Activity.”</li> <li>• <b>Whole group:</b> Ask participants to share their analyses of the video clip.</li> </ul> <p>d. Have participants read the context for video clip 2 at the top of the transcript (handout 8.3 in PD binder).</p> <p>e. Show video clip 2 and then guide participants through these tasks:</p> <ul style="list-style-type: none"> <li>• <b>Individuals:</b> “Study the video transcript and then complete part 2, section 2 of the analysis guide, During the Activity.”</li> <li>• <b>Whole group:</b> Ask participants to share their analyses of the video clip.</li> </ul> <p>f. Have participants read the context for video clip 3 at the top of the transcript (handout 8.4 in PD binder).</p> <p>g. Show video clip 3 and then guide participants through these tasks:</p> <ul style="list-style-type: none"> <li>• <b>Individuals:</b> “Study the video transcript and complete part 2, section 3 of the analysis guide, Follow-up to the Activity.”</li> <li>• <b>Whole group:</b> Ask participants to share their analyses of the video clip.</li> </ul> <p><b>Sample analysis for video clip 1:</b></p> <ul style="list-style-type: none"> <li>• Certain variations in fur color will help some mice survive better in their environment than others.</li> </ul> <p><b>Sample analysis for video clip 2:</b></p> <ul style="list-style-type: none"> <li>• Certain variations in fur color will help some mice survive better in their environment than others.</li> </ul>



PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p data-bbox="789 781 1289 813" style="background-color: #cccccc; margin: 0; padding: 2px;"><b>Summary: Strategies F, G, and H</b></p> <ul data-bbox="825 873 1262 1166" style="list-style-type: none"> <li>• Use linking strategies to make the science ideas explicit to the whole class (strategies F and G).</li> <li>• Engage <b>students</b> in linking science ideas to activities before, during, and after an activity (strategy F).</li> <li>• Engage <b>students</b> in linking science ideas to other science ideas (strategy G).</li> <li>• Highlight key science ideas throughout the lesson (strategy H).</li> <li>• Keep returning to the focus question throughout and at the end of the lesson (strategy H).</li> </ul>	<p data-bbox="1331 261 1514 289"><b>Observations:</b></p> <p data-bbox="1331 310 1961 396"><b>Strategy F:</b> During both the activity setup and follow-up, the teacher refers to the focus questions to help build a coherent science content storyline.</p> <p data-bbox="1331 417 1944 503"><b>Strategy G:</b> The teacher strengthens links by referring to the focus question in all three clips (e.g., at the beginning of each clip).</p> <p data-bbox="1331 524 1961 672"><b>Strategy H:</b> The teacher does a great job referring to the focus questions in the clips. However, her use of strategy H could be strengthened if she wrote key science ideas on chart paper as students bring them up.</p> <p data-bbox="1331 802 1961 859"><b>Display Slide 12.</b> Summary: Strategies F, G, and H (Less than 1 min)</p> <ol data-bbox="1331 911 1976 1045" style="list-style-type: none"> <li>a. Read the summary statements on the slide or give participants time to read them silently.</li> <li>b. Ask participants whether they have a brief comment or question about the summary.</li> </ol>
10:20–10:30 10 min	<b>BREAK</b>		

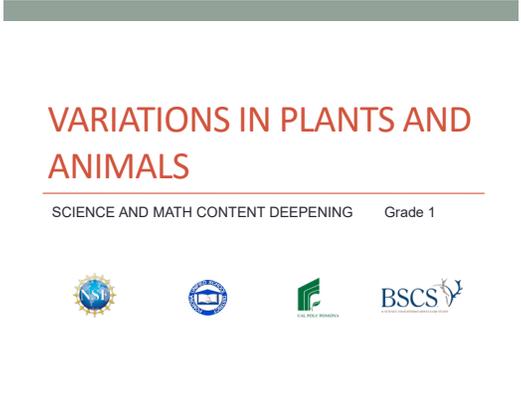
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
<p>10:30–12:00 90 min</p> <p><b>Variations in Plants and Animals Lesson Plan Review and Fall Overview/ Logistics</b></p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>• Deepen participants’ understandings of the VPA lesson plans and the opportunities they provide to practice using STeLLA STL and SCSL strategies.</li> <li>• Help participants understand and feel comfortable with the fall activities and logistics.</li> </ul> <p><b>Content</b></p> <ul style="list-style-type: none"> <li>• The VPA lesson plans highlight STeLLA strategies and support teachers in using these strategies.</li> </ul>	<p><b>Lesson Analysis: Focus Question 2</b></p> <p>How will the Student Thinking Lens and Science Content Storyline Lens strategies help you teach the VPA lessons in the fall?</p>	<p><b>Display Slide 13.</b> Lesson Analysis: Focus Question 2 (Less than 1 min)</p> <p>a. Read the focus question on the slide.</p>
<p>Slides 13–19</p>	<p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>• Share key aspects of an assigned VPA lesson plan.</li> <li>• Chart which STeLLA strategies are highlighted in each lesson.</li> <li>• Decide on academic-year study-group meeting dates after the PD leader describes what will happen in the fall.</li> </ul> <p><b>Handouts in PD Binder</b></p> <ul style="list-style-type: none"> <li>• 8.5 Overview of School-Year RESPeCT Study Groups</li> </ul> <p><b>PD Resources</b></p> <ul style="list-style-type: none"> <li>• STeLLA strategies booklet</li> <li>• RESPeCT lesson plans binder</li> </ul>	<p><b>VPA Lesson Plan Conversation</b></p> <ol style="list-style-type: none"> <li>1. <b>The science content storyline across lessons</b> <ul style="list-style-type: none"> <li>• Review the main learning goal for each lesson sequentially.</li> </ul> </li> <li>2. <b>The science content storyline within lessons</b> (5–7 min for each two-part lesson) <ul style="list-style-type: none"> <li>• How does this lesson fit into the arc of all the lessons?</li> <li>• What are the main learning goal and focus question?</li> <li>• Describe the main activity (or activities).</li> <li>• How will the activity help students better understand the learning goal for the day?</li> <li>• What STeLLA strategy/strategies are highlighted in this activity?</li> <li>• What concerns or suggestions do you have about this activity?</li> </ul> </li> <li>3. <b>Practical issues and questions</b></li> </ol>	<p><b>Display Slide 14.</b> VPA Lesson Plan Conversation (60 min in conjunction with the next two slides)</p> <p><b>Note:</b> Create charts like the samples on the next two slides so that participants can view both as they report out.</p> <p><b>Timing note:</b> Make sure you limit the time for each lesson conversation so you can get through them all. Aim for 5–7 minutes for each lesson.</p> <p>a. Give a brief overview of the science content storyline across lessons and then begin the lesson conversation.</p> <p>b. For step 1 on the slide, review the main learning goal for each lesson sequentially and how it connects to the lesson before and after it. (5 min)</p> <p>c. For steps 2 and 3, ask each participant to report on her/his two-part lesson, which was assigned on day 5.</p> <p><b>Note:</b> Encourage participants to present the <b>big picture</b> using the questions in step 2 on the slide, <b>not to walk through every step in their lesson</b></p>

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			<p><b>plans.</b> They should bring up details only when they have some concern, question, or suggestion about a modification.</p> <p>d. As participants give their reports, fill in the charts you've created, checking off the main strategies highlighted in each lesson. (See the chart format on the next two slides.)</p> <p><b>Note:</b> Encourage participants to pick just one or two Student Thinking Lens strategies and one or two Science Content Storyline Lens strategies that are actually highlighted in the lesson. (Each lesson uses several strategies.)</p> <p><b>Ideal pattern to highlight for the Student Thinking Lens strategies:</b></p> <ul style="list-style-type: none"> <li>Elicit, probe, and challenge strategies are found throughout the lessons, whereas strategies 4–6 are found predominantly in later lessons.</li> </ul> <p><b>Ideal pattern to highlight for the Science Content Storyline Lens strategies:</b></p> <ul style="list-style-type: none"> <li>Strategy A is very important, since other SCSL strategies are linked to it.</li> </ul>																																																																																																																														
		<p style="text-align: center;"><b>STL Strategies Highlighted in the VPA Lessons</b></p> <table border="1" data-bbox="816 1089 1283 1377"> <thead> <tr> <th>Lesson</th> <th>1</th> <th>1</th> <th>1</th> <th>2</th> <th>2</th> <th>3</th> <th>3</th> <th>4</th> <th>4</th> <th>5</th> <th>5</th> <th>Math</th> <th>Math</th> </tr> <tr> <th></th> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>a</th> <th>b</th> <th>a</th> <th>b</th> <th>a</th> <th>b</th> <th>c</th> <th>1</th> <th>2</th> </tr> </thead> <tbody> <tr> <td>1. Elicit</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>2. Probe</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>3. Challenge</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>4. Analyze/ Interpret</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>5. Explain/ Argue</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>6. Use/Apply</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>7. Synthesize/ Summarize</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table>	Lesson	1	1	1	2	2	3	3	4	4	5	5	Math	Math		a	b	c	d	a	b	a	b	a	b	c	1	2	1. Elicit														2. Probe														3. Challenge														4. Analyze/ Interpret														5. Explain/ Argue														6. Use/Apply														7. Synthesize/ Summarize														<p><b>Display Slide 15.</b> STL Strategies Highlighted in the VPA Lessons</p> <p>a. As participants report out, complete the chart, indicating with check marks the STL strategies highlighted in the VPA lessons.</p> <p>b. Discuss the reasons certain strategies appear at specific times in the lesson sequence. (See ideal patterns on slide 14 and refer to the summary charts in the STeLLA strategies booklet as needed.)</p>
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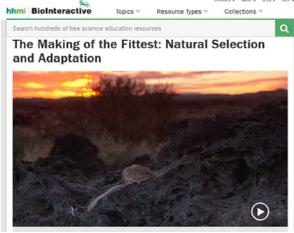
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		 <p><b>Overview of Study-Group Sessions</b></p> <ol style="list-style-type: none"> <li><b>Purpose:</b> To practice, analyze, and learn from the use of the STeLLA strategies in your science teaching.</li> <li>Review the focus of each study-group session: <ul style="list-style-type: none"> <li>What is the main focus for fall study-group sessions 1–3?</li> <li>What is the purpose of the 2-hour meeting in December?</li> <li>What is the main focus for spring study-group sessions 4–6?</li> </ul> </li> </ol>	<p><b>Display Slide 17.</b> Overview of Study-Group Sessions (5 min)</p> <p>a. Have participants locate handout 8.5—Overview of School-Year RESPeCT Study Groups—in their PD program binders.</p> <p>b. <b>Emphasize:</b> “The purpose of the study-group sessions is to practice, analyze, and learn from using the STeLLA strategies in your teaching of the VPA lessons in the fall and the Sound lessons in the spring.”</p> <p>c. Talk participants through Study Groups 1–3 on the handout.</p> <p>d. Pause for questions and a summary task. Ask participants, “What is the main focus for fall study-group sessions 1–3?”</p> <p>e. Talk participants through the 2-hour meeting in December/January and Study Groups 4–6 on the handout.</p>																																																																																																																																																									

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			<p>f. Pause for questions and a summary task. Ask participants, “What is the purpose of the 2-hour meeting in December/January?” and “What is the main focus for spring study-group sessions 4–6?”</p>
		<p><b>Teaching the VPA Lessons</b></p> <ol style="list-style-type: none"> <li>1. Before teaching lesson 1, give your students the classroom pretest.</li> <li>2. Teach all the lessons and have one lesson video recorded.</li> <li>3. Give your students the classroom posttest.</li> <li>4. <b>Hold on to your students’ pre-post tests!</b> You’ll analyze them in preparation for Study Group 3.</li> </ol>	<p><b>Display Slide 18.</b> Teaching the VPA Lessons (10 min)</p> <ol style="list-style-type: none"> <li>a. Before going over this slide, have participants locate the VPA classroom pre-post test in their lesson plans binders (pretabs section). <ul style="list-style-type: none"> <li>• <b>The classroom pre-post test:</b> “This test is in your lesson plans binder. After you administer the pre- and posttest to your students, you’ll need to save all of them, since you’ll be analyzing them as part of our study-group work in the fall.”</li> </ul> </li> <li>b. Review the steps on the slide.</li> <li>c. <b>Emphasize:</b> “It’s very important to follow these steps in order and <b>save all of your classroom pre-post tests</b>. Don’t return them to students until after Study Group 3.”</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>Scheduling School-Year Study Groups</b></p> <p><b>Proposed meeting day/time:</b> Wednesdays 2:00–6:00 p.m.  <b>Meeting place:</b> In our classrooms, rotating from school to school</p> <p><b>Possible dates for our study-group sessions:</b></p> <ul style="list-style-type: none"> <li>• Study Group 1: [insert possible date]</li> <li>• Study Group 2: [insert possible date]</li> <li>• Study Group 3: [insert possible date]</li> <li>• 2-hour meeting to review Sound lessons: [insert possible date]</li> <li>• Study Group 4: [insert possible date]</li> <li>• Study Group 5: [insert possible date]</li> <li>• Study Group 6: [insert possible date]</li> </ul>	<p><b>Display Slide 19.</b> Scheduling School-Year Study Groups (15 min)</p> <p><b>Note:</b> Include on this slide some possible dates for six 4-hour study-group meetings and the 2-hour meeting that occurs between Study Groups 3 and 4.</p> <p>a. Suggest possible dates for the study-group sessions, starting with the Wednesday afternoon slot from 2:00 to 6:00 p.m.</p> <p><b>Note:</b> As you schedule the meetings, keep in mind that you'll need some time between the end of the school day and the beginning of the meeting to get to the location and set up everything.</p> <ul style="list-style-type: none"> <li>• <b>Study Group 1:</b> Early October. Round-1 teachers should have their classroom video recordings completed at least three weeks before this session. You will need three weeks to watch the classroom video(s), select the ones you'll use during the study groups, and prepare the video-clip selections and transcripts.</li> <li>• <b>Study Group 2:</b> Mid-November. Round-2 teachers should have their classroom video recordings completed at least three weeks before this session. You will need three weeks to watch the classroom video(s), select the ones you'll use during the study groups, and prepare the video-clip selections and transcripts.</li> <li>• <b>Study Group 3:</b> Early December. This session can occur anytime after Study Group 2 and before the holiday break.</li> <li>• <b>2-hour meeting:</b> December/January. The purpose of this meeting is to review the Sound</li> </ul>

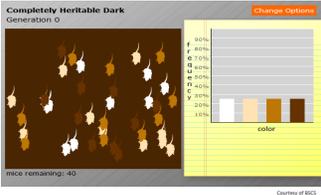
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>lesson plans in preparation for teaching them.</p> <ul style="list-style-type: none"> <li>• <b>Study Group 4:</b> Early February. Round-1 teachers should have their classroom video recordings completed at least three weeks before this session. You will need three weeks to watch the classroom video(s), select the ones you'll use during the study groups, and prepare the video-clip selections and transcripts.</li> <li>• <b>Study Group 5:</b> March. Round-2 teachers should have their classroom video recordings completed at least three weeks before this session. You will need three weeks to watch the classroom video(s), select the ones you'll use during the study groups, and prepare the video-clip selections and transcripts.</li> <li>• <b>Study Group 6.</b> April. This session can occur anytime after, but preferably within a month of, Study Group 5.</li> </ul>
12:00–12:45 45 min	<b>LUNCH</b>		
12:45–3:00 135 min (Includes 10-min break)  <b>Science and Math Content Deepening: Variations in Plants and</b>	<b>Purpose</b> <ul style="list-style-type: none"> <li>• Continue to explore the evidence biologists collect to support the argument that traits evolve because of natural selection.</li> <li>• Understand the importance of representing data in clear, accurate, and concrete ways and consider the problem of deceptive statistics.</li> </ul> <b>Content</b> <ul style="list-style-type: none"> <li>• Inherited (genetic) characteristics</li> </ul>		<b>Display Slide 20.</b> Science and Math Content Deepening: Variations in Plants and Animals (Less than 1 min)  a. “Now let’s continue our content deepening work on variations in plants and animals.”  <b>Note:</b> Throughout this content deepening phase, refer as needed to the content background document and Common Student Ideas about Variations in Plants and Animals.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
<p><b>Animals</b></p> <p>Slides 20–67</p>	<p>influence how likely an organism is to survive and reproduce.</p> <ul style="list-style-type: none"> <li>Some traits and trait variations in individual plants or animals of the same kind can confer an advantage that enables them to survive long enough to reproduce.</li> <li>Individual plants or animals of the same kind that are more likely to survive and reproduce are also likely to pass on their genetic (inherited) characteristics to their offspring.</li> <li>Trait variations in plants or animals of the same kind can affect their ability to survive and pass on these traits to future generations.</li> <li>Different environmental conditions can favor different traits, even in individuals of the same species. Organisms with certain trait variations become more common in different environmental situations.</li> <li>Natural selection is a non-random evolutionary process resulting from trait variation among individuals in a population, inheritance that produces trait variation among offspring, selection of offspring that are better equipped to compete for limited resources and are thus more likely to survive and</li> </ul>	<div data-bbox="789 269 1310 293" style="background-color: #cccccc; height: 15px; margin-bottom: 10px;"></div> <p><b>Unit Central Question</b></p> <p>How do differences (variations) in plants or animals of the same kind help them survive so they can produce young (babies or seeds)?</p>  <div data-bbox="789 813 1310 837" style="background-color: #cccccc; height: 15px; margin-top: 10px;"></div> <p><b>Content Deepening: Focus Question 1</b></p> <p>How would biologists explain how a trait changes within a population over time?</p>	<p><b>Display Slide 21.</b> Unit Central Question (Less than 1 min)</p> <p>a. Review the unit central question on the slide. Remind participants that this question will guide student thinking throughout the VPA lesson sequence.</p> <p><b>Display Slide 22.</b> Content Deepening: Focus Question 1 (Less than 1 min)</p> <p>a. Review the focus question on the slide.</p> <p>b. “Today, we’ll continue exploring this question from our previous content deepening session.”</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	<p>reproduce, and adaptation as the frequencies of traits and the genes that code for them change within a population over time</p> <ul style="list-style-type: none"> <li>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.</li> </ul> <p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>Watch the rest of a short film on natural selection and adaptation.</li> <li>Record evidence needed to develop a full explanation of how traits change in a population over time.</li> <li>Practice linking evidence to a scientific explanation based on natural selection.</li> <li>Use a simulation to collect additional data that supports an explanation of trait changes in populations over time.</li> <li>Identify misleading or deceptive data presentations in a variety of scenarios.</li> <li>Discuss different types of graphs and the information they present.</li> <li>Explore an online graph-making resource for students.</li> <li>Engage in a use-and-apply activity in which they collect data on reaction time and discuss how to present it.</li> </ul> <p><b>Videos</b></p>	<div data-bbox="789 269 1310 675"> <p><b>Explaining Changes over Time</b></p> <p><b>Goal:</b> To develop a full explanation for change in populations over time using evidence and major principles of natural selection</p> </div> <div data-bbox="789 675 1310 1411"> <p><b>Investigation 1: Explaining Changes over Time</b></p>  <p><a href="http://www.hhmi.org/biointeractive/making-fittest-natural-selection-and-adaptation">http://www.hhmi.org/biointeractive/making-fittest-natural-selection-and-adaptation</a></p> </div>	<p><b>Display Slide 23.</b> Explaining Changes over Time (Less than 1 min)</p> <ol style="list-style-type: none"> <li>Review the goal from the previous session.</li> <li>“We started working toward this goal in our last content deepening session, and by the end of today’s session, we’ll have a complete explanation for change within populations over time.”</li> </ol> <p><b>Display Slide 24.</b> Investigation 1: Explaining Changes over Time (10 min)</p> <ol style="list-style-type: none"> <li>“Next, we’ll watch the rest of the short film <i>The Making of the Fittest: Natural Selection and Adaptation</i>.”</li> </ol> <p><b>Note:</b> You may want to start over at the beginning of the video or continue from the 2:37 time mark.</p> <ol style="list-style-type: none"> <li>Have participants locate their Natural-Selection Explanation Table (handout 7.7) from the previous session.</li> <li>“As you watch the video, look for evidence that supports each principle of natural selection on the handout for changes in the fur-color trait in the rock pocket mouse population. Record this evidence on the handout.”</li> <li>Show the video.</li> <li>Following the video, distribute handout 8.6 (Transcript for <i>The Making of the Fittest: Natural Selection and Adaptation</i>).</li> </ol>

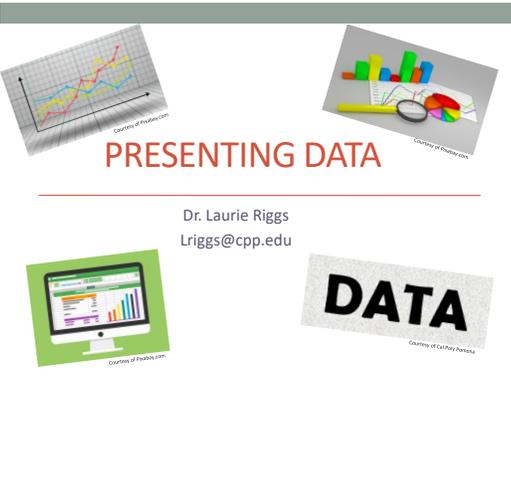
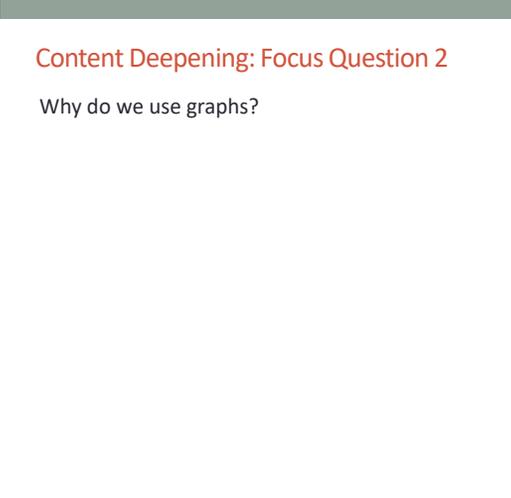
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process																																				
	<ul style="list-style-type: none"> <li><i>The Making of the Fittest: Natural Selection and Adaptation</i></li> </ul> <p><b>Handouts in PD Binder</b></p> <ul style="list-style-type: none"> <li>8.6 Transcript for <i>The Making of the Fittest: Natural Selection and Adaptation</i></li> <li>8.7 Space Shuttle <i>Challenger</i> Historical Data: Temperatures and O-ring Condition</li> </ul> <p><b>Supplies</b></p> <ul style="list-style-type: none"> <li>Science notebooks</li> <li>Chart paper and markers</li> <li>30-cm rulers</li> <li>NCES Create a Graph (online tutorial)</li> </ul> <p><b>Resources in Lesson Plans Binder</b></p> <p><i>Resources section:</i></p> <ul style="list-style-type: none"> <li>Content background document</li> <li>Common Student Ideas</li> </ul>	<div style="background-color: #cccccc; height: 15px; margin-bottom: 5px;"></div> <p style="color: #c00000; text-align: center;">Investigation 1: Explaining Changes over Time</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #ffcc00;"> <th colspan="3">Constructing a Natural-Selection Explanation</th> </tr> <tr style="background-color: #ffcc00;"> <th>Principle</th> <th>Definition</th> <th>Evidence</th> </tr> </thead> <tbody> <tr> <td>Variation</td> <td>(See handout for definitions.)</td> <td></td> </tr> <tr> <td>Inheritance</td> <td></td> <td></td> </tr> <tr> <td>Selection</td> <td></td> <td></td> </tr> <tr> <td>Adaptation</td> <td></td> <td></td> </tr> </tbody> </table> <div style="background-color: #cccccc; height: 15px; margin-bottom: 5px;"></div> <p style="color: #c00000; text-align: center;">Investigation 1: Explaining Changes over Time</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #ffcc00;"> <th colspan="3">Constructing a Natural-Selection Explanation</th> </tr> <tr style="background-color: #ffcc00;"> <th>Principle</th> <th>Definition</th> <th>Evidence</th> </tr> </thead> <tbody> <tr> <td>Variation</td> <td></td> <td>The black rock pocket mice and the tan rock pocket mice in the video are the same species. 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The same phenotype evolved in different groups of mice on different lava flows, and the genetic bases for these changes in phenotype are different.</td> </tr> </tbody> </table>	Constructing a Natural-Selection Explanation			Principle	Definition	Evidence	Variation	(See handout for definitions.)		Inheritance			Selection			Adaptation			Constructing a Natural-Selection Explanation			Principle	Definition	Evidence	Variation		The black rock pocket mice and the tan rock pocket mice in the video are the same species. In this population, one black mouse is born for every 100,000 tan mice.	Inheritance		New mutations cause black fur color (segment 3:24). Many genes control fur color (4:29). Most genes are identical, but dark and light rock pocket mice differ in one gene: MC1R (segment 4:55).	Selection		A survival advantage of 1% for dark rock pocket mice on a dark background would result in 95% of the mice being dark in 1,000 years. 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Review the evidence on the slide.</p> <p>b. <b>Individuals:</b> Ask participants to compare the evidence on the slide with the evidence they recorded on their handouts and identify any information they didn’t consider in their own analyses.</p> <p>c. <b>Whole group:</b> “What evidence do you see on this table that you didn’t consider?”</p>
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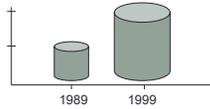
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Investigation 2: Predator-Prey Simulation</b></p> <p>Write the following heading in your science notebook:</p> <p><b>Simulation 1:</b> Dark background; mouse fur color inherited; color variation present</p> 	<p><b>Display Slide 27.</b> Investigation 2: Predator-Prey Simulation (15 min)</p> <p><b>Note:</b> You should already have set up the “Predator and Prey” interactive in advance (see instructions on overview page). If you didn’t log into the simulation earlier, do so now.</p> <ol style="list-style-type: none"> <li>Introduce the predator-and-prey simulation in the BSCS Across the Sciences online course.</li> <li>Ask participants to write the following information in their science notebooks: <p><b>Simulation 1:</b> Dark background; mouse fur color inherited; color variation present.</p> </li> <li>Select Option 1 in the simulation menu (click on the Change Options button) and have participants sketch the initial graph in their notebooks.</li> <li>Run the simulation for one round of hunting. Then direct participants to sketch the resulting graph in their notebooks.</li> <li>Run the simulation again for a second round of hunting and have participants sketch the resulting graph.</li> <li>Following the simulation, ask participants, “What claim can you make based on the data in the graphs? Make sure to include your evidence.”</li> <li>“What do you think will happen if the mouse’s environment changes? Let’s find out!”</li> <li>Ask participants to write the following information in their science notebooks: <p><b>Simulation 2:</b> Light background; mouse fur color inherited; color variation present</p> </li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p data-bbox="827 751 1272 781"><b>Investigation 2: Predator-Prey Simulation</b></p> <p data-bbox="827 800 1278 878">What would happen if the fur-color variation wasn't inherited or there was no variation in this trait at all?</p> 	<p data-bbox="1335 256 1969 545">i. Select Option 2 in the simulation menu (light background) and have participants sketch the initial graph in their notebooks. Complete two rounds of hunting and direct participants to sketch the resulting graphs in their notebooks.</p> <p data-bbox="1335 427 1934 545">j. Then ask participants to make a claim supported with evidence from the graphs that answers the question, “What happens if the environment changes?”</p> <hr/> <p data-bbox="1335 719 1919 776"><b>Display Slide 28.</b> Investigation 2: Predator-Prey Simulation (10 min)</p> <p data-bbox="1335 829 1969 914">a. “What would happen if the fur-color variation wasn't inherited or there was no variation in this trait at all? That's what we'll explore next.”</p> <p data-bbox="1335 935 1969 992">b. Select Option 3 (variation not inherited) and run the simulation again.</p> <p data-bbox="1335 1013 1913 1070">c. Then select Option 4 (no variation) and run the simulation.</p> <p data-bbox="1335 1091 1927 1175">d. Have participants add evidence from these simulations to the Natural-Selection Explanation Table (handout 7.7).</p>

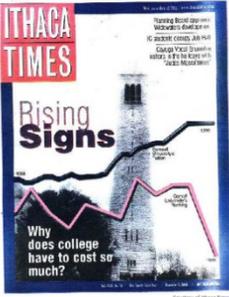
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>Lines of Evidence for Evolution</b></p> <p>How do we know that evolution has occurred?</p> <ol style="list-style-type: none"> <li>1. Fossil record</li> <li>2. Structural similarities among organisms</li> <li>3. Biogeography</li> <li>4. Similarities among embryos different types of embryos</li> <li>5. Similarities among DNA sequences of different organisms</li> <li>6. Observations of evolutionary changes in the laboratory and in the wild</li> </ol>	<p><b>Display Slide 29.</b> Lines of Evidence for Evolution (6 min)</p> <p><b>Note:</b> Initially show only the question at the top of the slide.</p> <p>a. <b>Individuals:</b> “Now take out your content background documents and read the last four paragraphs of section 7, Natural Selection and Evolution. As you read, think about the lines of evidence that support the argument for change over time through natural selection.”</p> <p>b. <b>Whole group:</b> Discuss the lines of evidence for change over time through natural selection presented in the reading and summarized on the slide. During this discussion, record participants’ ideas on chart paper.</p> <p><b>Note:</b> Reveal one line of evidence on the slide at a time as you present it.</p>
		<p><b>Use and Apply Key Science Ideas</b></p> <p><i>Evolution by natural selection depends on context.</i></p> <p>Use the science ideas you’ve learned about to explain what this statement means.</p>	<p><b>Display Slide 30.</b> Use and Apply Key Science Ideas (6 min)</p> <p>a. Read the statement on the slide.</p> <p>b. <b>Individuals:</b> “Use the science ideas you’ve learned about to explain what this statement means. Write your explanations in your notebooks and make sure to include evidence and reasoning.”</p> <p>c. <b>Whole group:</b> Invite participants to share their explanations, evidence, and reasoning with the group. Record participants’ ideas on chart paper.</p> <p><b>Key ideas:</b></p> <ul style="list-style-type: none"> <li>• Natural selection is highly dependent on context.</li> <li>• A trait that works well in one environment may not</li> </ul>

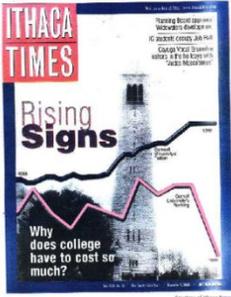
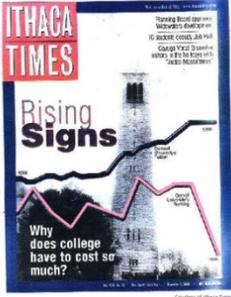
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			work well in a different environment. This argues against evolution being goal directed and moving toward perfection.
		<p><b>Reflect: Content Deepening Focus Question 1</b></p> <p>How would biologists explain how a trait changes within a population over time?</p>	<p><b>Display Slide 31.</b> Reflect: Content Deepening Focus Question 1 (5 min)</p> <p>a. Review the focus question on the slide.</p> <p>b. <b>Individuals:</b> Have participants answer the question in their science notebooks using evidence from today's investigations and the investigations from the previous content deepening session to support their ideas.</p> <p>c. <b>Whole group:</b> Invite a few participants to share their ideas and evidence with the group.</p>
		<p><b>Unit Central Question</b></p> <p>How do differences (variations) in plants or animals of the same kind help them survive so they can produce young (babies or seeds)?</p>  <p><small>Photo courtesy of Pixabay.com</small></p>	<p><b>Display Slide 32.</b> Reflect: Unit Central Question (5 min)</p> <p>a. Review the unit central question.</p> <p>b. <b>Individuals:</b> "Answer this question in your science notebooks using the science ideas and evidence about variations in plants and animals that we've gathered this week."</p> <p>c. <b>Whole group:</b> Invite a few participants to share their answers and evidence with the group.</p>
<b>10-MINUTE BREAK</b>			

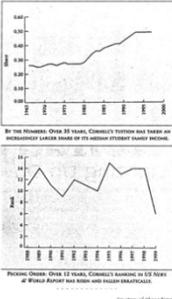
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		 <p style="text-align: center;"><b>PRESENTING DATA</b></p> <p style="text-align: center;">Dr. Laurie Riggs Lriggs@cpp.edu</p>	<p><b>Display Slide 33.</b> Presenting Data (Less than 1 min)</p> <p>a. “Next, we’ll engage in some math content deepening and explore ideas about data presentation.”</p>
		 <p style="text-align: center;"><b>Content Deepening: Focus Question 2</b></p> <p style="text-align: center;">Why do we use graphs?</p>	<p><b>Display Slide 34.</b> Content Deepening: Focus Question 2 (Less than 1 min)</p> <p>a. Introduce the focus question on the slide.</p> <p>b. Have participants write the question in their science notebooks.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>What Do You Know about Graphs?</b></p> <ul style="list-style-type: none"> <li>• What do you already know about graphs and why we use them?</li> <li>• Is it important to know which type of graph to use and how to read and/or interpret it?</li> </ul>	<p><b>Display Slide 35.</b> What Do You Know about Graphs? (1 min)</p> <ol style="list-style-type: none"> <li>Discuss the questions on the slide and record participants' ideas on chart paper.</li> <li><b>Emphasize:</b> "We want our students to be graph literate and comfortable using graphs."</li> </ol>
		<p><b>What Does This Graph Depict?</b></p>  <p><b>Claim:</b> Oil consumption in the US doubles.</p>	<p><b>Display Slide 36.</b> What Does This Graph Depict? (2 min)</p> <ol style="list-style-type: none"> <li>"What does the graph on this slide depict? Is it an accurate representation?" <b>Ideal answer:</b> The graph falsely depicts that the oil consumption from 1989 to 1999 more than doubled.</li> <li>"What do you think is missing from this graph?" <b>Ideal answer:</b> It has no legend or units.</li> <li>"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 deceptive statistics and talk about the implications for clarity."</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>What Does Statistics Involve?</b></p> <p>The study of statistics involves math and relies on numerical calculations. It also relies on how the numbers are chosen and how the data are presented and interpreted.</p>	<p><b>Display Slide 37.</b> Can Statistics Be Deceptive? (Less than 1 min)</p> <ol style="list-style-type: none"> <li>“Let’s think for a moment about what statistics involves.”</li> <li>Read the information on the slide.</li> <li>“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.”</li> </ol>
		<p><b>Scenario 1: Ice-Cream Sales</b></p> <p>A new advertisement for Ben and Jerry’s ice cream introduced in late May of last year resulted in a 30% increase in ice-cream sales for the following three months. Thus, the advertisement was effective.</p> <ul style="list-style-type: none"> <li><b>Fact:</b> Ice-cream consumption generally increases in the months of June, July, and August, regardless of advertisements.</li> <li>The major flaw in this scenario is called a <b>history effect</b> and leads people to interpret outcomes as the result of one variable when another variable (in this case, seasonal timing) is actually responsible.</li> </ul>	<p><b>Display Slide 38.</b> Scenario 1: Ice-Cream Sales (4 min)</p> <p><b>Note:</b> Initially, display only the scenario at the top of the slide.</p> <ol style="list-style-type: none"> <li>Introduce the scenario on the slide.</li> <li>“What is the major flaw in how the statistics in this scenario were presented and interpreted?”</li> <li><b>Think-Pair-Share:</b> Ask participants to think about this question for a moment and then share their ideas with an elbow partner.</li> <li><b>Whole group:</b> Reveal the rest of the information on the slide and briefly discuss the major flaw in how the statistics were presented and interpreted.</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>Scenario 2: Churches and Crime</b></p> <p>When there are more churches in a city, there is more crime. Thus, churches lead to crime.</p> <ul style="list-style-type: none"> <li>• <b>Fact:</b> Bigger cities with larger populations have more churches and more crime. Larger populations explain why there are more churches and higher crime rates.</li> <li>• <b>Major flaw:</b> People erroneously believe that there is a <b>causal relationship</b> between two primary variables rather than recognizing that a third variable may be responsible.</li> </ul>	<p><b>Display Slide 39.</b> Scenario 2: Churches and Crime (3 min)</p> <p><b>Note:</b> This slide may be skipped if time is running short.</p> <ol style="list-style-type: none"> <li>Display only the scenario at the top of the slide.</li> <li>Ask participants, “What is the major flaw in how the data in this scenario were presented and interpreted?”</li> <li><b>Think-Pair-Share:</b> Ask participants to think about this question for a moment and then share their ideas with an elbow partner.</li> <li><b>Whole group:</b> Reveal the rest of the information on the slide and briefly discuss the major flaw in how the statistics were presented and interpreted.</li> </ol>
		<p><b>Deceptive Displays</b></p> 	<p><b>Display Slide 40.</b> Deceptive Displays (Less than 1 min)</p> <ol style="list-style-type: none"> <li>“Next, we’ll consider deceptive displays of data.”</li> <li>“This cover of the December 7, 2000, issue of the <i>Ithaca Times</i> shows what may be the most misleading graphs ever published. I have never seen so many graphical sins in a single image!”</li> </ol>

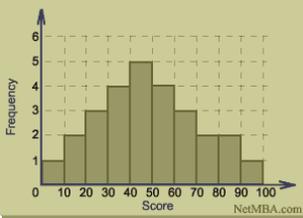
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p data-bbox="835 302 1041 329">Deceptive Displays</p> 	<p data-bbox="1335 272 1885 300"><b>Display Slide 41.</b> Deceptive Displays (1 min)</p> <p data-bbox="1335 350 1976 574">a. “On the cover of the magazine is the question, ‘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.”</p> <p data-bbox="1335 521 1965 574">b. Ask participants, “What message does this graphic convey? How should we interpret it?”</p>
		<p data-bbox="835 829 1041 857">Deceptive Displays</p> 	<p data-bbox="1335 800 1948 860"><b>Display Slide 42.</b> Deceptive Displays (Less than 1 min)</p> <p data-bbox="1335 911 1969 1084">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.”</p> <p data-bbox="1335 1109 1938 1195">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.”</p>

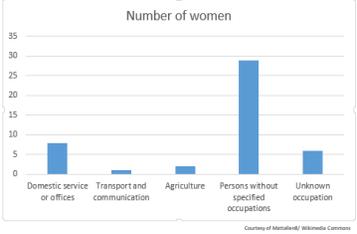
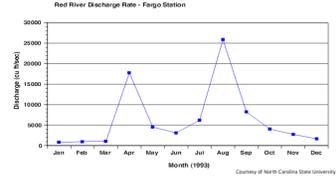
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Deceptive Displays</b></p> 	<p><b>Display Slide 43.</b> Deceptive Displays (2 min)</p> <p>a. “Now look at each graph in context.”</p> <p>b. Ask participants, “What do you notice? What is each graph saying?”</p>
		<p style="text-align: center;"><b>Three Big Problems</b></p> <ol style="list-style-type: none"> <li>1. The tuition graph covers a 34-year period, and the ranking graph covers an 11-year period, but on the magazine cover, they’re placed on the same horizontal scale.</li> <li>2. The vertical scales for tuition and ranking couldn’t possibly have common units, but the ranking graph is placed under the tuition graph on the cover, creating the impression that cost exceeds quality.</li> <li>3. Here’s the masterstroke: The sharp “drop” in ranking on the graph actually represents the fact that Cornell’s ranking <b>improved</b> from 15th to sixth during this 11-year period!</li> </ol>	<p><b>Display Slide 44.</b> Three Big Problems (1 min)</p> <p>a. “Here are three big problems with the tuition and ranking graphs:</p> <ol style="list-style-type: none"> <li>1. “The tuition graph covers a 34-year period, and the ranking graph covers an 11-year period, but on the magazine cover, they’re placed on the same horizontal scale.</li> <li>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.</li> <li>3. “Here’s the masterstroke: The sharp “drop” in ranking on the graph actually represents the fact that Cornell’s ranking <i>improved</i> from 15th to sixth during this 11-year time period!”</li> </ol> <p>b. “What are the implications of failing to examine data presentations with a critical eye? What are the implications for our students?”</p>

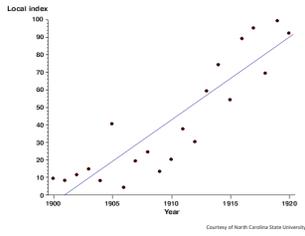
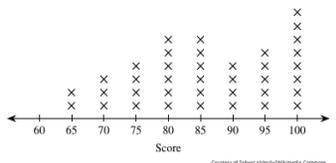
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p data-bbox="829 313 1092 345"><i>The Challenger Disaster</i></p>  <p data-bbox="1192 638 1270 646"><small>Photo courtesy of wikipedia.org</small></p>	<p data-bbox="1333 272 1932 329"><b>Display Slide 45.</b> The <i>Challenger</i> Disaster (Less than 1 min)</p> <ul style="list-style-type: none"> <li data-bbox="1333 386 1942 475">a. “The way data is presented can not only be misleading or deceiving; it can also cost lives! Do you remember the <i>Challenger</i> disaster in 1986?”</li> <li data-bbox="1333 492 1942 670">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.”</li> </ul>
		<p data-bbox="829 889 1092 922"><i>The Challenger Disaster</i></p> <p data-bbox="829 938 1092 1149"><b>Tufte’s argument:</b> If the data had 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!</p>  <p data-bbox="1140 1149 1287 1157"><small>Photo courtesy of Kennedy Space Center/Wikipedia Commons</small></p>	<p data-bbox="1333 849 1932 906"><b>Display Slide 46.</b> The <i>Challenger</i> Disaster (Less than 1 min)</p> <ul style="list-style-type: none"> <li data-bbox="1333 954 1963 1198">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.”</li> </ul>

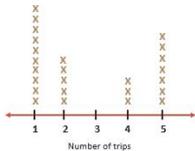
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>The Challenger Disaster</b></p> <p style="text-align: center;"><small>Source: Tufts, Edward R. (1997). Visual explanations: images and quantiles, evidence and narrative. (pp. 27-54). Cheshire, CT: Graphics Press.</small></p>	<p><b>Display Slide 47.</b> The <i>Challenger</i> Disaster (Less than 1 min)</p> <ol style="list-style-type: none"> <li>“After analyzing the thirteen charts submitted to NASA, Tufts 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.”</li> <li>“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.”</li> </ol>
		<p style="text-align: center;"><b>The Challenger Disaster</b></p> <p style="text-align: center;">Space Shuttle Challenger Historical Launch Data Temperatures and O-ring Condition</p> <p style="text-align: center;"><small>Source: Tufts, Edward R. (1997). Visual explanations: images and quantiles, evidence and narrative. (pp. 27-54). Cheshire, CT: Graphics Press.</small></p>	<p><b>Display Slide 48.</b> The <i>Challenger</i> Disaster (4 min)</p> <ol style="list-style-type: none"> <li>“Let’s examine a different presentation of the O-ring data.”</li> <li>Distribute handout 8.7 (Space Shuttle <i>Challenger</i> Historical Launch Data: Temperatures and O-ring Condition).</li> <li>“This graph shows historical temperature data and O-ring condition for the <i>Challenger</i>. It also tells us that the forecast temperatures for the <i>Challenger</i> 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.”</li> <li>“What does the graph tell us? At which temperature</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>did the most damage occur?”</p> <p>e. “Based on this scatter-plot data for the 24 previous <i>Challenger</i> launches, would you predict a problem for the upcoming launch? Why or why not?”</p> <p><b>Key observations:</b></p> <ul style="list-style-type: none"> <li>• Over the years, <i>Challenger</i>’s O-rings had persistent problems at cooler temperatures. Every launch below 66 degrees resulted in O-ring damage.</li> <li>• At or above 66 degrees, only three launches experienced some O-ring erosion.</li> <li>• A launch forecast of 29 degrees is <i>5.7 standard deviations</i> from the average temperature for previous launches!</li> <li>• The graph data clearly shows that there were serious risks of O-ring damage for a launch at 29 degrees.</li> </ul>
		<hr style="border: 2px solid #808080;"/> <p><b>The Best Way to Display Data</b></p> <ul style="list-style-type: none"> <li>• What is the best way to display data?</li> <li>• What are some effective ways you’ve displayed data in your classroom?</li> </ul>	<p><b>Display Slide 49.</b> The Best Way to Display Data (2 min)</p> <p>a. “What is the best way to display data? What are some effective ways you’ve displayed data in your classrooms?”</p> <p>b. Elicit ideas from participants and record them on chart paper.</p> <p>c. <b>Emphasize:</b> “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.”</p>

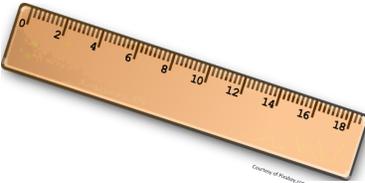
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Types of Graphs</b></p> <p>What types of graphs and charts are you familiar with? Can you name a few?</p>	<p><b>Display Slide 50.</b> Types of graphs (Less than 1 min)</p> <p>a. “What types of graphs and charts are you familiar with? Can you name a few?”</p> <p>b. As participant’s share their ideas, record them on chart paper.</p> <p><b>Possible responses:</b></p> <ul style="list-style-type: none"> <li>• Histogram</li> <li>• Bar graph</li> <li>• Line graph or chart</li> <li>• Scatter-plot or scatter graph</li> <li>• Pie chart</li> <li>• Stem-and-leaf plot or diagram</li> <li>• Box-and-whisker plot or box plot</li> </ul>
		<p style="text-align: center;"><b>Histograms</b></p> <p>Histograms show interval data.</p> 	<p><b>Display Slide 51.</b> Histograms (Less than 1 min)</p> <p>a. “Let’s look at some different types of graphs and charts.”</p> <p>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?”</p> <p><b>Answer:</b> Interval data are a type of data measured along a scale, and each data point is equidistant from another data point.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Bar Graphs</b></p> <p>How are bar graphs different from histograms?</p>  <p style="text-align: right; font-size: small;">Courtesy of Wikimedia Commons</p>	<p><b>Display Slide 52.</b> Bar Graphs (Less than 1 min)</p> <p>a. “How are bar graphs different from histograms?”</p> <p>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.</p>
		<p style="text-align: center;"><b>Line Graphs</b></p>  <p style="text-align: right; font-size: small;">Courtesy of North Carolina State University</p> <p>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.</p>	<p><b>Display Slide 53.</b> Line Graphs (Less than 1 min)</p> <p>a. Read the information on the slide.</p> <p>b. Ask participants, “How are line graphs similar to bar graphs?”</p>

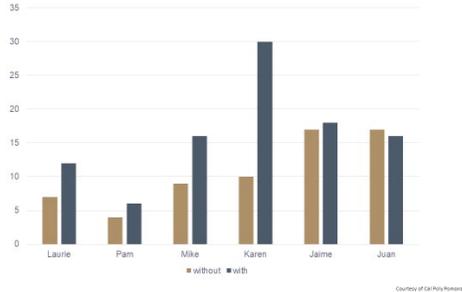
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Scatter Plots</b></p>  <p style="text-align: center;"><small>Courtesy of North Carolina State University</small></p>	<p><b>Display Slide 54.</b> Scatter Plots (Less than 1 min)</p> <p>a. “What does a scatter plot help us see?”</p> <p>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 <i>trend line</i> or <i>line of best fit</i> and shows the general pattern of the data.</p>
		<p style="text-align: center;"><b>Line Plots</b></p> <p>A line plot is a graph that shows data frequency along a number line.</p> <p style="text-align: center;"><b>Students' Score</b></p>  <p style="text-align: center;"><small>Courtesy of Saffers University/Wisconsin Commons</small></p>	<p><b>Display Slide 55.</b> Line Plots (Less than 1 min)</p> <p>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.”</p> <p>b. “What challenges might students encounter when making a graph like this?”</p>

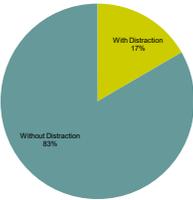
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process												
		<p style="text-align: center;"><b>What Does This Graph Tell Us?</b></p> <p style="text-align: center;">Went to the aquarium last summer</p>  <p style="text-align: center;">How many people are there in all?</p> <p><input type="text"/> people</p> <p style="text-align: center;"><input type="button" value="Submit"/></p> <p style="text-align: right;"><small>Courtesy of Ed-Only-Person</small></p>	<p><b>Display Slide 56.</b> Assessing Data (Less than 1 min)</p> <p>a. “What does this graph tell us?”</p>												
		<p style="text-align: center;"><b>Stem-and-Leaf Plot</b></p> <p>A stem-and-leaf plot or diagram is similar to a dot plot, but the number line is usually vertical, and digits are used instead of dots.</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: right;">5   4 6 7 9</td> <td style="text-align: left;">Examples:</td> </tr> <tr> <td style="text-align: right;">6   3 4 6 8 8</td> <td style="text-align: left;">● Stem “5” Leaf “4” means 5.4</td> </tr> <tr> <td style="text-align: right;">7   2 2 5 6</td> <td style="text-align: left;">● Stem “6” Leaf “3” means 6.3</td> </tr> <tr> <td style="text-align: right;">8   1 4 8</td> <td style="text-align: left;">● Stem “6” Leaf “4” means 6.4</td> </tr> <tr> <td style="text-align: right;">9  </td> <td></td> </tr> <tr> <td style="text-align: right;">10   6</td> <td></td> </tr> </table> <p style="text-align: center;">STEM        LEAVES</p>	5   4 6 7 9	Examples:	6   3 4 6 8 8	● Stem “5” Leaf “4” means 5.4	7   2 2 5 6	● Stem “6” Leaf “3” means 6.3	8   1 4 8	● Stem “6” Leaf “4” means 6.4	9		10   6		<p><b>Display Slide 57.</b> Stem-and-Leaf Plot (Less than 1 min)</p> <p>a. Review the information on the slide.</p> <p>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.”</p>
5   4 6 7 9	Examples:														
6   3 4 6 8 8	● Stem “5” Leaf “4” means 5.4														
7   2 2 5 6	● Stem “6” Leaf “3” means 6.3														
8   1 4 8	● Stem “6” Leaf “4” means 6.4														
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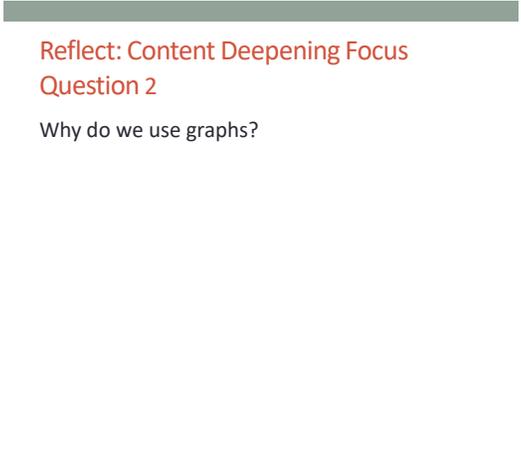
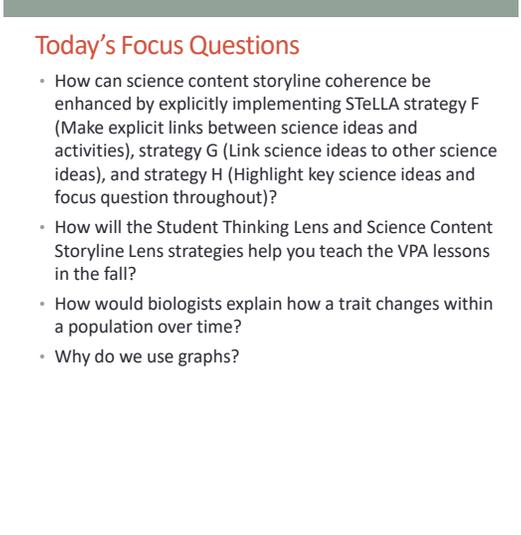
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Circle Graphs or Pie Charts</b></p> <p>Circle graphs represent categorical data as percentages.</p> <p style="text-align: right; font-size: small;">Courtesy of La Hely-Perron</p>	<p><b>Display Slide 58.</b> Circle Graphs or Pie Charts (Less than 1 min)</p> <ol style="list-style-type: none"> <li>“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.”</li> <li>“How is a circle graph similar to a bar graph?”</li> <li>Highlight some of the categories and percentages of the circle graph on the slide.</li> </ol>
		<p style="text-align: center;"><b>GRAPHING TUTORIAL</b></p> <p><b>HOW TO CHOOSE WHICH TYPE OF GRAPH TO USE?</b></p> <p>When to Use . . .</p> <ul style="list-style-type: none"> <li>. . . a Line Graph. Line graphs are used to track changes over short and long periods of time. When smaller changes exist, line graphs are better to use than bar graphs. Line graphs can also be used to compare changes over the same period of time for more than one group.</li> <li>. . . a Pie Chart. Pie charts are best to use when you are trying to compare parts of a whole. They do not show changes over time.</li> <li>. . . a Bar Graph. Bar graphs are used to compare things between different groups or to track changes over time. However, when trying to measure change over time, bar graphs are best when the changes are large.</li> <li>. . . an Area Graph. Area graphs are very similar to line graphs. They can be used to track changes over time for one or more groups. Area graphs are good to use when you are tracking the changes in two or more related groups that make up one whole category (for example public and private groups).</li> <li>. . . an X-Y Plot. X-Y plots are used to determine relationships between the two different things. The x-axis is used to measure one event (or variable) and the y-axis is used to measure the other. If both variables increase at the same time, they have a positive relationship. If one variable decreases while the other increases, they have a negative relationship. Sometimes the variables don't follow any pattern and have no relationship.</li> </ul> <p style="text-align: right; font-size: small;">Close Window</p> <p style="text-align: center;"><a href="https://nces.ed.gov/nceskids/createagraph/">Link to web site: https://nces.ed.gov/nceskids/createagraph/</a></p>	<p><b>Display Slide 59.</b> Graphing Tutorial (2 min)</p> <ol style="list-style-type: none"> <li>“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.”</li> <li>Quickly tour the NCES Kids’ Zone Create a Graph web site and show participants how to use the Create a Graph Tutorial (<a href="https://nces.ed.gov/nceskids/help/user_guide/graph/index.asp">https://nces.ed.gov/nceskids/help/user_guide/graph/index.asp</a>).</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Let's Learn by Doing!</b></p> <ul style="list-style-type: none"> <li>• Is it OK to text on a cell phone while you're driving?</li> <li>• What if we wanted to see how distraction affects reaction time?</li> </ul>	<p><b>Display Slide 60.</b> Let's Learn by Doing! (Less than 1 min)</p> <p><b>Note:</b> If time is running short, skip this activity and advance to slide 67 (reflect on the content deepening focus question).</p> <ol style="list-style-type: none"> <li>“Is it OK to text on a cell phone while you're driving? What if we wanted to see how distraction affects reaction time?”</li> <li>“Next, we'll apply what we've been learning about graphs and collect some data on reaction time that we can display.”</li> </ol>
		<p style="text-align: center;"><b>Investigation: Catch a Falling Ruler</b></p> <p>In this experiment, you and a partner will test reaction time by catching a falling ruler with and without a distraction.</p> 	<p><b>Display Slide 61.</b> Investigation: Catch a Falling Ruler (1 min)</p> <ol style="list-style-type: none"> <li>“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.”</li> <li>Have participants pair up with an elbow partner. Then give each pair a 30-cm ruler.</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Investigation: Catch a Falling Ruler</b></p> <p><b>Instructions:</b></p> <ol style="list-style-type: none"> <li><b>Partner 1:</b> Hold the ruler near the 30-cm mark and let it hang vertically.</li> <li><b>Partner 2:</b> Place your thumb and index finger on either side of the 0-cm mark <b>without touching the ruler</b>.</li> <li><b>Partner 1:</b> Without warning, let the ruler go. (<b>Hint:</b> To prevent Partner 2 from anticipating when you'll drop the ruler, vary the timing.)</li> <li><b>Partner 2:</b> Try to catch it as quickly as possible when it drops.</li> <li><b>Partner 1:</b> Measure just above the first finger where Partner 2 caught the ruler and record the data in your notebook.</li> <li>Perform the test 10 times with Partner 1 dropping the ruler and Partner 2 catching it. Then calculate and record the mean average of the 10 drops.</li> <li>Then switch roles. (Partner 2 drops the ruler, and Partner 1 catches it.)</li> </ol>	<p><b>Display Slide 62.</b> Investigation: Catch a Falling Ruler (15 min)</p> <ol style="list-style-type: none"> <li>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.</li> <li>Have pairs practice at least one drop per person before they begin the investigation.</li> <li>As pairs practice, circulate around the room and make sure everyone is following the instructions correctly. <p><b>Note:</b> If the ruler drops to the ground without being caught, have pairs record a score of 30, since 0 would be perfect score.</p> </li> <li>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 <math>12 + 3 - 7</math>?"). Each partner should perform 10 drops and record the measurement for each drop and the mean average of the results.</li> </ol>

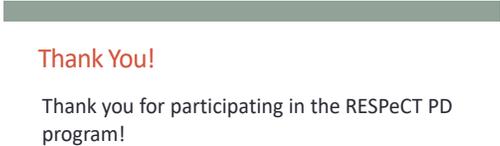
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Discuss the Results</b></p> <ul style="list-style-type: none"> <li>• Compare your mean averages for each set of 10 drops with and without distraction.</li> <li>• Discuss your findings with another pair.</li> <li>• <b>Question:</b> What type of graph or chart would you use to display your data?</li> </ul>	<p><b>Display Slide 63.</b> Discuss the Results (3 min)</p> <ol style="list-style-type: none"> <li>After the investigation, have pairs compare their mean averages for each set of 10 drops with and without distraction.</li> <li>Then have pairs briefly discuss their findings with another pair of participants.</li> <li>Next, discuss as a group what type of graph or chart they would use to display their data.</li> </ol>
		<p style="text-align: center;"><b>Sample Data Display</b></p> 	<p><b>Display Slide 64.</b> Sample Data Display (Less than 1 min)</p> <ol style="list-style-type: none"> <li>“The sample bar graph on this slide is one way we could display our data.”</li> <li>“What does the graph tell us? Is reaction time better with or without a distraction? How do you know?”</li> </ol> <p><b>Ideal response:</b> The graph shows that in all but one instance (Juan), reaction time is better without a distraction.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Interpreting Data</b></p> <p style="text-align: center;">Better Reaction Time</p>  <p style="text-align: center;"><small>Courtesy of CarlPaly Partners</small></p>	<p><b>Display Slide 65.</b> Interpreting Data (Less than 1 min)</p> <p>a. “What does this circle graph or pie chart tell us? What does it help us see?”</p> <p><b>Ideal response:</b> 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.</p>
		<p style="text-align: center;"><b>Curiosity Zone</b></p> <p>Do reaction times vary ...</p> <ul style="list-style-type: none"> <li>• for people of different ages (children versus adults)?</li> <li>• if you use your dominant hand versus your nondominant hand?</li> <li>• if you’re alert or tired?</li> <li>• for men or women?</li> <li>• depending on your mood?</li> <li>• after an alcoholic drink?</li> </ul>	<p><b>Display Slide 66.</b> Curiosity Zone (1 min)</p> <p>a. Briefly discuss other factors that might influence reaction time.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		 <p>Reflect: Content Deepening Focus Question 2</p> <p>Why do we use graphs?</p>	<p><b>Display Slide 67.</b> Reflect: Content Deepening Focus Question 2 (4 min)</p> <p>a. Review the focus question on the slide.</p> <p>b. <b>Individuals:</b> “Answer this question in your science notebooks and support your ideas with evidence from today’s investigations.”</p> <p>c. <b>Whole group:</b> Invite a few participants to share their ideas and evidence with the group.</p>
<p>3:00–3:30 30 min</p> <p><b>Wrap-Up and Celebration</b></p> <p>Slides 68–71</p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>• Help participants understand the relationships among the Science Content Storyline Lens strategies and when each strategy occurs in the lesson flow.</li> <li>• Facilitate understanding which SCSL strategies must be addressed in the planning process and which need to be anticipated in planning but occur responsively during the actual teaching of the lesson.</li> <li>• Recognize and celebrate participants’ learning so far and anticipate further growth in the coming year.</li> </ul>	 <p>Today’s Focus Questions</p> <ul style="list-style-type: none"> <li>• How can science content storyline coherence be enhanced by explicitly implementing STeLLA strategy F (Make explicit links between science ideas and activities), strategy G (Link science ideas to other science ideas), and strategy H (Highlight key science ideas and focus question throughout)?</li> <li>• How will the Student Thinking Lens and Science Content Storyline Lens strategies help you teach the VPA lessons in the fall?</li> <li>• How would biologists explain how a trait changes within a population over time?</li> <li>• Why do we use graphs?</li> </ul>	<p><b>Display Slide 68.</b> Today’s Focus Questions (5 min)</p> <p>a. Give participants a couple of minutes to think about today’s focus questions and then answer them in their notebooks.</p> <p>b. If time allows, have a share-out of ideas.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	<p><b>Content</b></p> <ul style="list-style-type: none"> <li>Many of the SCSL strategies must be completed during the planning stage. Strategies B, F, G, H, and I are moves the teacher makes while teaching. But planning and anticipating how these strategies will help develop the lesson is critical to success.</li> <li>The RESPeCT lesson plans provide examples of how strategies B, F, G, H, and I might be used during the lessons.</li> <li>Strategies F, G, and H should be used throughout the lesson. Strategy B is used at the beginning of a lesson, and strategy I is used at the end.</li> </ul> <p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>Study the SCSL summary chart in the STeLLA strategies booklet to identify key patterns and relationships among the strategies.</li> </ul> <p><b>Posters and Charts</b></p> <ul style="list-style-type: none"> <li>Effective Science Teaching chart</li> </ul> <p><b>Supplies</b></p> <ul style="list-style-type: none"> <li>Science notebooks</li> </ul> <p><b>PD Resources</b></p> <ul style="list-style-type: none"> <li>STeLLA strategies booklet</li> <li><b>Optional:</b> SCSL Z-fold summary chart (front pocket of PD binder)</li> </ul>	<div style="background-color: #c0c0c0; height: 15px; margin-bottom: 10px;"></div> <p><b>Summarizing Science Content Storyline Lens Strategies</b></p> <ul style="list-style-type: none"> <li>What does the organization of the summary chart in the STeLLA strategies booklet highlight about the Science Content Storyline Lens strategies?</li> <li>Do you want to make any revisions or additions to our chart on effective science teaching?</li> </ul>	<p><b>Display Slide 69.</b> Summarizing Science Content Storyline Lens Strategies (10 min)</p> <p><b>Note:</b> Display one question at a time on the slide.</p> <p>a. “This week we focused on the Science Content Storyline Lens and strategies. Let’s synthesize and summarize our learning by looking at the summary chart in your strategies booklet—Summary of the STeLLA Science Content Storyline Lens Strategies.”</p> <p><b>Note:</b> Participants may also refer to their SCSL Z-fold summary charts for this activity.</p> <p>b. <b>Individuals:</b> “Look at this summary chart and how it’s organized. What do you think the organization highlights? Write your observations in your notebooks.”</p> <p>c. <b>Whole group:</b> “What did you notice about the organization of this chart? What does it highlight about the science content storyline strategies?”</p> <p>d. Reveal the second discussion question on the slide and invite participants to suggest additions or changes to the Effective Science Teaching chart.</p> <p><b>Key ideas:</b></p> <ol style="list-style-type: none"> <li>Many of the SCSL strategies must be completed during the lesson planning stage. For example, the main learning goal and activities that match them must be selected ahead of time.</li> <li>Strategies B, F, G, H, and I are moves the teacher makes while teaching the lesson, but planning and anticipating how these strategies will help develop the lesson is critical to success.</li> <li>The RESPeCT lesson plans provide examples of how strategies B, F, G, H, and I might be used</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>during the lessons.</p> <p>4. Strategies F, G, and H should be applied throughout the lesson. Strategy B is used at the beginning of a lesson, and strategy I is used at the end.</p> <p>5. Each strategy has its own distinct purpose(s), but all of them contribute to creating a coherent science content storyline.</p>
		<p><b>Let's Celebrate!</b></p> <p>Design your own end-of-program celebration and insert any comments or instructions here.</p>	<p><b>Display Slide 70.</b> Let's Celebrate! (15 min)</p> <p>a. <b>Decide how you'll celebrate the end of the RESPeCT PD program, and modify the slide accordingly.</b> Here are a few ideas:</p> <ul style="list-style-type: none"> <li>• Have refreshments and toast the group's success with a bubbly, nonalcoholic drink.</li> <li>• Have everyone write on an index card a "golden nugget" that represents something they're taking away from the Summer Institute experience. Pass around a bowl filled with chocolates wrapped in gold paper, and have participants take a piece of chocolate when they drop their cards in the bowl. After the bowl is passed around, share the golden nuggets with the group.</li> <li>• Take a group photo.</li> </ul>

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		 <p><b>Thank You!</b></p> <p>Thank you for participating in the RESPeCT PD program!</p>	<p><b>Display Slide 71.</b> Thank You! (Less than 1 min)</p> <p>a. Before dismissing participants, thank them for participating in the RESPeCT PD program.</p>