

# RESPeCT Summer Institute Professional Development Leader Guide (PDLG)

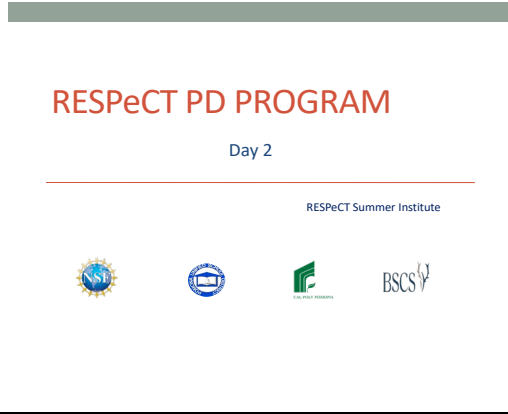
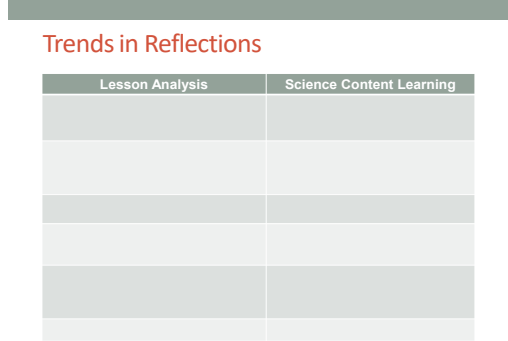
Grade Level	1	Day	2	STeLLA Strategy	STL Strategies 1, 2, 3: Elicit, Probe, and Challenge Questions	Subject Matter Focus	Sound
<b>Focus Questions</b>	<ul style="list-style-type: none"> <li>• How can lesson analysis help us better understand how elicit, probe, and challenge questions can reveal and challenge student thinking?</li> <li>• Why are some sounds loud, while other sounds are soft (quiet)?</li> <li>• Why does a sound get softer (quieter) as you walk away from the source?</li> </ul>						
<b>Main Learning Goals</b>	<p>Participants will understand the following:</p> <ul style="list-style-type: none"> <li>• Student thinking can be made more visible in science classrooms when the teacher asks questions that elicit and probe student ideas and predictions and challenge student thinking.</li> <li>• Lesson analysis allows us to slow down teaching so we can clarify our understandings of the distinct purposes of elicit, probe, and challenge questions and how they can be used effectively in science lessons.</li> <li>• Large vibrations in the air generate the loud sounds we hear, and smaller vibrations generate softer, quieter sounds.</li> <li>• When you're far away from the source of a sound, your ears receive a smaller portion of the sound energy than when you're close to the source. The vibrations of atoms are smaller (the sound is quieter) when you're farther away from the source.</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 the PPTs, if needed.</li> <li>• Review the reflections from day 1 and create a summary slide.</li> <li>• Cut apart the elicit-question cards from the PD leader master to pass out for practice interviews.</li> <li>• Watch video clips and anticipate</li> </ul>		<p><b>Posters and Charts</b></p> <ul style="list-style-type: none"> <li>• STeLLA Framework and Strategies poster</li> <li>• Day-2 Agenda (chart)</li> <li>• Day-2 Focus Questions (chart)</li> <li>• Norms for Working Together (chart)</li> <li>• Effective Science Teaching chart (from day 1)</li> <li>• Strategy charts from day 1 (STL strategies 1–3)</li> <li>• Common Student Ideas chart</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: Student Thinking Lens Strategies</li> </ul> <p><b>Handouts in RESPeCT PD Binder, Day 2</b></p> <ul style="list-style-type: none"> <li>• 2.1 Transcript for Video Clip 2.1</li> <li>• 2.2 Transcript for Video Clip 2.2</li> <li>• 2.3 Transcript for Video Clip 2.3</li> <li>• 2.4 Bird Sounds</li> <li>• 2.5 Which Way Will the Sound Move? (from Sound lesson 5a)</li> <li>• 2.6 Daily Reflections—Day 2</li> </ul>			<ul style="list-style-type: none"> <li>• <u>Video Clip 2.1</u>: Hayden preinterview, Derosé classroom (elicit and probe questions); 2.1_mspcp_gr1_sound_derosé_pre.hayden_c1</li> <li>• <u>Video Clip 2.2</u>: Derosé classroom (probe and challenge questions); 2.2_mspcp_gr1_sound_derosé_L1_c2</li> <li>• <u>Video Clip 2.3</u>: Doody classroom (probe and challenge questions); 2.3_mspcp_gr1_sound_doody_L6_c3</li> </ul> <p>Content deepening:</p> <ul style="list-style-type: none"> <li>• Kahn Academy video <i>Why Do Sounds Get Softer?</i> (4:51); <a href="https://www.khanacademy.org/science/physics/mechanical-waves-and-sound/sound-topic/v/why-do-sounds-get-softer">https://www.khanacademy.org/science/physics/mechanical-waves-and-sound/sound-topic/v/why-do-sounds-get-softer</a></li> <li>• Kahn Academy video <i>Sound Properties: Amplitude, Period, Frequency, Wavelength</i> (3:38); <a href="https://www.khanacademy.org/science/physics">https://www.khanacademy.org/science/physics</a></li> </ul>		

<p>participant responses.</p> <ul style="list-style-type: none"> <li>• Prepare charts for the day’s agenda and focus questions.</li> <li>• On chart paper, create a Common Student Ideas chart (see resources section in lesson plans binder) and post it at the front of the class. Make sure to leave space in the left-hand margin to apply sticker dots. This chart will be used during lesson analysis (slide 19).</li> <li>• For content deepening: <ul style="list-style-type: none"> <li>• Review the Kahn Academy video clips <i>Why Do Sounds Get Softer?</i> and <i>Sound Properties: Amplitude, Period, Frequency, Wavelength</i>. Make sure the links are working correctly.</li> </ul> </li> </ul>	<p><b>PD Leader Masters, Days 1–4</b></p> <ul style="list-style-type: none"> <li>• PD Leader Master: Elicit Question Cards—Sound (for practice interviews)</li> </ul> <p><b>Supplies</b></p> <ul style="list-style-type: none"> <li>• Science notebooks</li> <li>• Chart paper and markers</li> <li>• Red and blue sticker dots (or pencils)</li> <li>• Sticky notes (for Parking Lot poster)</li> <li>• For content deepening: <ul style="list-style-type: none"> <li>• A small soundmaker you can move around with your hand (such as a cell phone, a bell, car keys)</li> </ul> </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>• Sound Content Background Document</li> <li>• Common Student Ideas about Sound</li> </ul> <p><i>Pretabs section:</i></p> <ul style="list-style-type: none"> <li>• Sound: Learning Goals for Students and Teachers</li> </ul>	<p>/mechanical-waves-and-sound/sound-topic/v/sound-properties-amplitude-period-frequency-wavelength</p>
--	--	---

## DAY 2 SESSION OUTLINE

Time	Activities	Purpose
8:00–8:30 30 min	<b>Getting Started: Housekeeping, Day-1 Reflections, Norms, Agenda, Focus Questions, Review STL Strategies</b>	<ul style="list-style-type: none"> <li>• Build community by sharing participants' reflections from day 1 and reviewing/revising the norms.</li> <li>• Set the stage for a day of learning by introducing the focus questions for day 2 and reviewing the purposes and key features of elicit, probe and challenge questions. (These strategies will be the focus of today's lesson analysis work.)</li> </ul>
8:30–9:20 50 min	<b>STL Lesson Analysis: Elicit and Probe Questions</b>	<ul style="list-style-type: none"> <li>• Begin to develop an understanding of the RESPeCT lesson analysis process.</li> <li>• Deepen understandings of elicit and probe questions (STL strategies 1 and 2) and how they reveal student thinking.</li> <li>• Deepen science-content knowledge of sound through lesson analysis.</li> </ul>
9:20–11:30 130 min (Includes 10-min break)	<b>STL Lesson Analysis: Probe and Challenge Questions</b>	<ul style="list-style-type: none"> <li>• Develop a deeper understanding of the RESPeCT lesson analysis process.</li> <li>• Deepen understandings of probe and challenge questions (STL strategies 2 and 3), how they reveal student thinking, and how they move student thinking forward.</li> <li>• Deepen science-content knowledge of sound through lesson analysis.</li> <li>• Understand that science-content knowledge is essential for using probe and challenge questions effectively in the classroom.</li> </ul>
11:30–12:00 30 min	<b>Practice Using Elicit and Probe Questions: Interviews</b>	<ul style="list-style-type: none"> <li>• Deepen understandings of elicit and probe questions.</li> <li>• Begin to develop the ability to ask elicit and probe questions effectively.</li> <li>• Appreciate that science-content knowledge is essential for using elicit and probe questions effectively in the classroom.</li> </ul>
12:00–12:45 45 min	<b>LUNCH</b>	
12:45–3:15 150 min (Includes 10-min break)	<b>Content Deepening: Sound</b>	<ul style="list-style-type: none"> <li>• Deepen participants' understandings of sound, sound waves, and the intensity of sound.</li> </ul>
3:15–3:30 15 min	<b>Wrap-Up: Summary, Homework, and Reflections</b>	<ul style="list-style-type: none"> <li>• Summarize and reflect on the day's learning, including progress made in understanding sound and the relationship between lesson analysis and asking effective elicit, probe, and challenge questions.</li> </ul>

**DAY 2**

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
<p>8:00–8:30 30 min</p> <p><b>Getting Started</b></p> <p>Slides 1–8</p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>• Build community by sharing participants’ reflections from day 1 and reviewing/revising the norms.</li> <li>• Set the stage for a day of learning by introducing the focus questions for day 2 and reviewing the purposes and key features of elicit, probe, and challenge questions. (These strategies will be the focus of today’s lesson analysis work.)</li> </ul> <p><b>Content</b></p> <ul style="list-style-type: none"> <li>• Norms enable the group to build trust and productivity.</li> <li>• Probe questions seek to understand what students are saying/writing and encourage them to explain their ideas more clearly or fully (<b>not</b> to change their thinking).</li> <li>• Challenge questions seek to engage students in ways that will challenge them to think, reconsider their ideas, change</li> </ul>	 	<p><b>Display Slide 1.</b> RESPeCT PD Program (3 min)</p> <p>a. Take care of any housekeeping issues.</p> <p><b>Display Slide 2.</b> Trends in Reflections (5 min)</p> <p>a. Give participants time to review your summary of their reflections from day 1 and offer reactions and comments or ask follow-up questions.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	<p>their initial ideas, and move toward more-scientific understandings.</p> <p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>• Discuss the reflections from day 1 and how the group is doing with the norms.</li> <li>• Study a short transcript example from the STeLLA strategies booklet to identify probe and challenge questions.</li> <li>• Review and contrast the purposes and key features of probe and challenge questions.</li> </ul> <p><b>Posters and Charts</b></p> <ul style="list-style-type: none"> <li>• STeLLA Framework and Strategies poster</li> <li>• Norms for Working Together (chart)</li> <li>• Day-2 agenda (chart)</li> <li>• Day-2 focus questions (chart)</li> </ul> <p><b>PD Resources</b></p> <ul style="list-style-type: none"> <li>• STeLLA strategies booklet</li> <li>• Half-page sheet of norms (pasted into science notebooks)</li> </ul>	<p><b>Norms for Working Together: The Basics</b></p> <p><b>Purpose:</b> Build trust and develop a productive study group for all participants.</p> <p><b>The Basics</b></p> <ul style="list-style-type: none"> <li>• Arrive prepared and on time; stay for the duration; return from breaks on time.</li> <li>• Remain attentive, thoughtful, and respectful; engage and be present.</li> <li>• Eliminate interruptions (turn off cell phones, email, and other electronic devices; avoid sidebar conversations).</li> <li>• Make room for everyone to participate (monitor your floor time).</li> </ul>	<p><b>Display Slide 3.</b> Norms for Working Together: The Basics (5 min)</p> <p>a. <b>Provide context:</b> “Since we’ll be working together throughout the Summer Institute and the academic year, we need norms that will enable us to build trust and productivity as a group. Today we’ll start our analysis of other teachers’ classroom videos. In the fall, we’ll analyze videos from each other’s classrooms. For this work to be meaningful, we’ll need to push and challenge each other. This will require mutual respect and a common understanding of our goals.”</p> <p>b. “Do you want to clarify or revise any of these norms?”</p> <p><b>Note:</b> Have participants locate the half-page sheet of norms they pasted into their science notebooks on day 1. Remind them to leave space for revising the norms.</p> <p>c. Encourage participants to ask clarifying questions regarding the meaning of any of the norms and jot notes in their science notebooks.</p> <p>d. Ask participants if they’re willing to live with these norms today, and let them know they’ll have an opportunity to revise them tomorrow. Remind them of this at the end of the session.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>Norms for Working Together: The Heart</b></p> <p><b>Purpose:</b> Build trust and develop a productive study group for all participants.</p> <p><b>The Heart of RESPeCT Lesson Analysis and Content Deepening</b></p> <ul style="list-style-type: none"> <li>• Keep the goal in mind: analysis of teaching to improve student learning.</li> <li>• Share your ideas, uncertainties, confusion, disagreements, questions, and good humor. All points of view are welcome.</li> <li>• Expect and ask questions to deepen everyone’s learning; be constructively challenging.</li> <li>• Listen carefully; seek to understand other participants’ points of view.</li> </ul>	<p><b>Display Slide 4.</b> Norms for Working Together: The Heart (5 min)</p> <ol style="list-style-type: none"> <li>a. “Now let’s review the norms at the heart of the RESPeCT PD program.”</li> <li>b. “Do you want to clarify or revise any of these norms?”</li> <li>c. “Do you want to add any norms to this list?”</li> <li>d. Ask participants if they’re willing to live with these norms today, and announce that they’ll have an opportunity to revise them tomorrow.</li> </ol>
		<p><b>Agenda for Day 2</b></p> <ul style="list-style-type: none"> <li>• Day-1 reflections</li> <li>• Focus questions</li> <li>• Review of STL strategies 1–3</li> <li>• STL lesson analysis: elicit and probe questions</li> <li>• STL lesson analysis: probe and challenge questions</li> <li>• Practice using elicit and probe questions</li> <li>• Lunch</li> <li>• Content deepening: sound</li> <li>• Summary, homework, and reflections</li> </ul>	<p><b>Display Slide 5.</b> Agenda for Day 2 (Less than 1 min)</p> <ol style="list-style-type: none"> <li>a. Talk through the agenda for the day.</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Today's Focus Questions</b></p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><b>Lesson Analysis</b></p> <ul style="list-style-type: none"> <li>How can lesson analysis help us better understand how elicit, probe, and challenge questions can reveal and challenge student thinking?</li> </ul> </div> <div style="width: 45%;"> <p><b>Content Deepening</b></p> <ul style="list-style-type: none"> <li>Why are some sounds loud, while other sounds are soft (quiet)?</li> <li>Why does a sound get softer (quieter) as you walk away from the source?</li> </ul> </div> </div>	<p><b>Display Slide 6.</b> Today's Focus Questions (1 min)</p> <ol style="list-style-type: none"> <li>Introduce the focus questions that will guide today's session.</li> <li>"Each day we're going to have at least one lesson analysis focus question and one content deepening focus question."</li> <li>"Here are our focus questions for today's session."</li> </ol>
		<p style="text-align: center;"><b>STeLLA Conceptual Framework</b></p> <p style="text-align: center;">Learning to analyze science teaching through two lenses</p> <p style="text-align: center;">allows you to learn and use strategies for more effective science teaching.</p> <div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p><b>STRATEGIES TO REVEAL, SUPPORT, AND CHALLENGE STUDENT THINKING</b></p> <ol style="list-style-type: none"> <li>Ask questions to elicit student ideas and predictions.</li> <li>Ask questions to probe student ideas and predictions.</li> <li>Ask questions to challenge student thinking.</li> <li>Engage students in analyzing and interpreting data and observations.</li> <li>Engage students in constructing explanations and arguments.</li> <li>Engage students in using and applying new science ideas in a variety of ways and contexts.</li> <li>Engage students in making connections by synthesizing and summarizing key science ideas.</li> <li>Engage students in communicating in scientific ways.</li> </ol> </div> <div style="width: 45%;"> <p><b>STRATEGIES TO CREATE A COHERENT SCIENCE CONTENT STORYLINE</b></p> <ol style="list-style-type: none"> <li>Identify one main learning goal.</li> <li>Set the purpose with a focus question or goal statement.</li> <li>Select activities that are matched to the learning goal.</li> <li>Select content representations and models related to the learning goal and engage students in their use.</li> <li>Sequence key science ideas and activities appropriately.</li> <li>Make explicit links between science ideas and activities.</li> <li>Link science ideas to other science ideas.</li> <li>Highlight key science ideas and focus question throughout.</li> <li>Summarize key science ideas.</li> </ol> </div> </div>	<p><b>Display Slide 7.</b> The STeLLA Conceptual Framework (1 min)</p> <ol style="list-style-type: none"> <li>Point out the strategies highlighted on the slide.</li> <li>"During today's session, we'll focus again on the first three Student Thinking Lens strategies: elicit, probe, and challenge questions."</li> </ol>
		<p style="text-align: center;"><b>Probe versus Challenge Questions</b></p> <ul style="list-style-type: none"> <li>Read one of the dialogue examples for STL strategy 3 in the STeLLA strategies booklet.</li> <li>With an elbow partner, try to justify why each question is labeled probe or challenge.</li> <li>For help, refer to the STL Z-fold summary chart and the explanations, examples, and general questions for strategy 3 in the strategies booklet.</li> <li>Be ready to share your ideas.</li> </ul>	<p><b>Display Slide 8.</b> Probe versus Challenge Questions (10 min)</p> <ol style="list-style-type: none"> <li>Have participants look in the STeLLA strategies booklet at a dialogue example for STL strategy 3 that highlights probe and challenge questions.</li> <li>The purposes of this activity are as follows: <ol style="list-style-type: none"> <li>To get participants' heads back into the questioning strategies discussed on day 1.</li> <li>To make sure participants understand the</li> </ol> </li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>distinct purposes of probe and challenge questions:</p> <ul style="list-style-type: none"> <li>• <b>Probe questions</b> seek to understand what students are saying/writing and encourage them to explain their ideas more clearly or fully (not to change their thinking).</li> <li>• <b>Challenge questions</b> seek to engage students in ways that will challenge them to think, reconsider their ideas, change their initial ideas, and move toward more-scientific understandings.</li> </ul>
<p>8:30–9:20 50 min</p> <p><b>STL Lesson Analysis: Elicit and Probe Questions</b></p> <p>Slides 9–15</p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>• Begin to develop an understanding of the RESPeCT lesson analysis process.</li> <li>• Deepen understandings of elicit and probe questions (STL strategies 1 and 2) and how they reveal student thinking.</li> <li>• Deepen science-content knowledge of sound through lesson analysis.</li> </ul> <p><b>Content</b></p> <ul style="list-style-type: none"> <li>• Elicit questions are designed to reveal a variety of ideas, misconceptions, and experiences that students bring with them when learning new science content.</li> <li>• Probe questions follow up on student statements to find out more about what students are trying to say.</li> <li>• Lesson analysis involves a three-step protocol: (1) Identify</li> </ul>	<p><b>Lesson Analysis Focus Question</b></p> <p>How can lesson analysis help us better understand how elicit, probe, and challenge questions can reveal and challenge student thinking?</p> <hr/> <p><b>RESPeCT Lesson Analysis Protocol</b></p> <ol style="list-style-type: none"> <li>1. <b>Identify the strategy</b> <ul style="list-style-type: none"> <li>• What STeLLA lens and strategy was the teacher using in the video clip?</li> </ul> </li> <li>2. <b>Analyze the video</b> <ul style="list-style-type: none"> <li>• What student thinking was made visible (or not)?</li> <li>• How did the use of the STeLLA strategy impact student thinking?</li> </ul> </li> <li>3. <b>Reflect and apply</b> <ul style="list-style-type: none"> <li>• What did you learn from identifying and analyzing the strategy in the video?</li> </ul> </li> </ol>	<p><b>Display Slide 9.</b> Lesson Analysis Focus Question (Less than 1 min)</p> <p>a. “Today we’ll explore this focus question: How can lesson analysis help us better understand how elicit, probe, and challenge questions can reveal and challenge student thinking?”</p> <p>b. “But first let’s discuss what lesson analysis involves.”</p> <hr/> <p><b>Display Slide 10.</b> RESPeCT Lesson Analysis Protocol (3 min)</p> <p>a. “This is the three-step protocol that will guide our video-based lesson analysis work. Although we’ll follow the protocol a bit more loosely during the Summer Institute, we’ll rely heavily on this explicit three-step format as we move into the fall study groups.”</p> <p>b. Review the steps on the slide; then tell participants, “Framing our analysis in this way and</p>



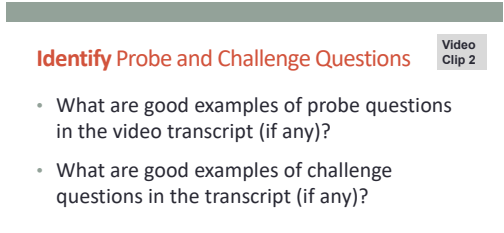
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	<p>the strategy, (2) analyze the use of the strategy in classroom videos, and (3) reflect on learning from the lesson analysis.</p> <ul style="list-style-type: none"> <li>The lesson analysis protocol follows a five-step process: (1) Review the lesson content, (2) identify and discuss the STeLLA strategy in focus, (3) watch the video clip, (4) analyze the clip using the three-step protocol, and (5) reflect on the lesson analysis experience.</li> <li>The analysis phase of lesson analysis involves making claims related to the STeLLA framework and providing evidence and reasoning to support the claims.</li> </ul> <p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>Review the lesson analysis video viewing basics.</li> <li>Use the five-step lesson analysis process to identify and analyze the use of elicit and probe questions in a student interview (video clip 1).</li> </ul> <p><b>Videos</b></p> <ul style="list-style-type: none"> <li>Video Clip 2.1, Hayden interview</li> </ul> <p><b>Handouts in PD Binder</b></p> <ul style="list-style-type: none"> <li>2.1 Transcript for Video Clip 2.1</li> </ul> <p><b>Supplies</b></p> <ul style="list-style-type: none"> <li>Science notebooks</li> </ul> <p><b>PD Resources</b></p>		<p>following specific steps will help us focus more holistically on the teaching and the impact of the STeLLA strategies on student thinking and learning and the storyline students are constructing (i.e., the Student Thinking Lens and the Science Content Storyline Lens).”</p>
		<p><b>Lesson Analysis Process</b></p> <ol style="list-style-type: none"> <li><b>Review</b> the lesson context: <ul style="list-style-type: none"> <li>What is the ideal student response to the focus question?</li> <li>How is the clip situated in the content storyline?</li> </ul> </li> <li><b>Identify</b> and discuss the strategy that is the focus of analysis for each clip.</li> <li><b>Watch</b> video clip(s).</li> <li><b>Analyze</b> the lesson using the lesson analysis protocol.</li> <li><b>Reflect</b> on the lesson analysis experience: <ul style="list-style-type: none"> <li>As a reviewer</li> <li>As a teacher in the clip</li> </ul> </li> </ol>	<p><b>Display Slide 11.</b> Lesson Analysis Process (3 min)</p> <ol style="list-style-type: none"> <li>“The lesson analysis protocol includes this five-step process.”</li> <li>Review the steps on the slide and note that in the study groups, these steps will be followed more explicitly than they will be during the Summer Institute.</li> </ol>
		<p><b>Lesson Analysis: Viewing Basics</b></p> <ul style="list-style-type: none"> <li><b>Viewing basic 1:</b> Look past the trivial, or little things, that bug you.</li> <li><b>Viewing basic 2:</b> Avoid the “This doesn’t look like my classroom!” trap.</li> <li><b>Viewing basic 3:</b> Avoid making snap judgments about the teaching or learning in the classroom you’re viewing.</li> </ul> <p><b>Note:</b> Find out more about the viewing basics on page 1 of in the STeLLA strategies booklet.</p>	<p><b>Display Slide 12.</b> Lesson Analysis: Viewing Basics (2 min)</p> <ol style="list-style-type: none"> <li><b>Ask:</b> “Why is each of these viewing basics important? Which will be hardest for you?”</li> <li>Tell participants they can find further details on the viewing basics in the STeLLA strategies booklet and refer to this information later.</li> <li><b>Highlight:</b> “The videos we’ll be viewing throughout the program aren’t necessarily exemplary, but rather they provide real-world examples of teachers implementing the STeLLA strategies. Examples like these deepen our thinking because we can see the sometimes unintended results of teacher decisions and consider missed opportunities.”</li> <li><b>Honor the videocase teachers!</b> All of these</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	<ul style="list-style-type: none"> <li>STeLLA strategies booklet</li> <li>STL Z-fold summary chart</li> </ul>	<div data-bbox="793 412 1293 841"> <p><b>Our First Video Clip</b> <span style="float: right;">Video Clip 1</span></p> <p><b>Context:</b> An interview with one student before the teacher begins instruction on sound.</p> </div> <div data-bbox="793 857 1293 1432"> <p><b>Identify Elicit and Probe Questions</b> <span style="float: right;">Video Clip 1</span></p> <ul style="list-style-type: none"> <li>Watch the video clip for examples of the interviewer or teacher asking the student elicit and probe questions.</li> <li>Identify the questions on your transcript and mark them E (elicit) and P (probe).</li> <li>Share your evidence with the group.</li> </ul> <p><b>Remember:</b></p> <ol style="list-style-type: none"> <li>Not all questions will fall into the E and P categories.</li> <li>Elicit questions start a conversation and ask for student ideas without expecting right answers.</li> <li>Probe questions try to figure out what a student means.</li> <li>Probe questions can paraphrase a student's idea.</li> </ol> <p><small><a href="#">Link to video clip 1: 2.1_mspcp_gr1_sound_derose_pre.hayden_c1</a></small></p> </div>	<p>courageous teachers are not only working hard to improve their own teaching practice but are also willing to make their practice public so that others can learn from it. None of them would claim to be exemplary science teachers.</p> <p><b>Display Slide 13.</b> Our First Video Clip (2 min)</p> <ol style="list-style-type: none"> <li>Describe the context of the first video clip participants will watch. (See the top of the transcript—handout 2.1 in the PD program binder.)</li> <li>“This student interview showcases the use of elicit and probe questions. Even though this clip doesn’t take place in the context of an actual classroom, the idea is to look at the quality and form of the questions. Our second video clip will feature probe and challenge questions in a classroom context.”</li> </ol> <p><b>Display Slide 14.</b> <b>Identify</b> Elicit and Probe Questions, Video Clip 1 (20 min)</p> <ol style="list-style-type: none"> <li>Provide instructions for watching video clip 1 and using the transcript to identify questions that elicit (E) and probe (P) student ideas and predictions.</li> <li>Remind participants that the purpose of watching the video clip is to deepen their shared understandings of these strategies and to build their individual and collective lesson analysis skills.</li> <li><b>Individuals:</b> Allow time for participants to review the video transcript and mark E and P questions.</li> <li><b>Whole group:</b> Discuss what participants found in the transcript. Encourage them to use evidence from the transcript and reasons from their Z-fold summary charts or the STeLLA strategies booklet to support their ideas. Participants should work to</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>differentiate elicit and probe questions and distinguish them from other types of teacher questions or statements.</p> <p><b>Examples of elicit questions:</b></p> <ul style="list-style-type: none"> <li>• <b>Video segment 00:07:</b> “What do you see happening?”</li> <li>• <b>Segment 00:18:</b> “Do you think that there might be something about going up and down that has to do with sound?”</li> <li>• <b>Segment 02:24:</b> “Do you have any idea why?”</li> <li>• <b>Segment 04:00:</b> “What happens in my ears that let me hear? Do you know? Have any idea?”</li> </ul> <p><b>Examples of probe questions:</b></p> <ul style="list-style-type: none"> <li>• <b>Video segment 00:27:</b> “Tell me about that.”</li> <li>• <b>Segment 01:14:</b> “Can you tell me about that? What sound might not have something to do with going up and down?” The purpose here is to find out more about what Hayden is thinking, not to push her toward the correct answer.</li> <li>• <b>Segment 01:22:</b> “Tell me about that.”</li> <li>• <b>Segments 00:45–01:21:</b> In this sequence, the interviewer is trying to find out what Hayden thinks is causing the sounds he hears. The probe questions the interviewer asks in this sequence aren’t as obvious.</li> </ul>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>Analyze Student Thinking</b> <span style="float: right; font-size: small;">Video Clip 1</span></p> <p>Review the interview transcript.</p> <ul style="list-style-type: none"> <li>• What student thinking was revealed through the interviewer’s elicit and probe questions?</li> <li>• What ideas did Hayden have about how sound?</li> <li>• Were there places you wished the interviewer had probed the student’s thinking more? Why?</li> </ul>	<p><b>Display Slide 15. Analyze Student Thinking, Video Clip 1 (20 min)</b></p> <ol style="list-style-type: none"> <li>a. Give participants time to review the video transcript and develop an answer to one of the analysis questions on this slide. Encourage them to write down their answers in their science notebooks.</li> <li>b. For this first video analysis, do a round-robin and have each participant share. Ask probe and challenge questions to support participants in communicating their ideas clearly and completely: <ul style="list-style-type: none"> <li>• <b>Probe question:</b> “Can you say more about what you mean by ...?”</li> <li>• <b>Challenge question:</b> “Can you point to a specific place in the transcript that supports your idea?”</li> </ul> </li> <li>c. As participants share, encourage others to respond by asking questions like these: <ul style="list-style-type: none"> <li>• Do others have additional evidence to support (or challenge) this idea?</li> <li>• Do others have a different interpretation?</li> </ul> </li> </ol> <p><b>Examples of student thinking in the clip:</b></p> <ul style="list-style-type: none"> <li>• Hayden seems to think that the up-and-down motion of the object is producing sound (video segments 00:42; 01:00). He also thinks that simply touching (picking up) an object produces sound (01:33).</li> <li>• Hayden thinks that he can hear a sound if he’s “close by” the soundmaker but “can’t really hear it far away” (segments 02:00; 02:14; 03:40).</li> <li>• Hayden seems to think that human action releases sound, such as picking up an object (segments 01:24–01:33). (<b>Note:</b> Asking probe and challenge questions about different objects and comparing them to hearing a person’s voice could help make</li> </ul>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			Hayden’s thinking more visible.)
<p>9:20–11:30 130 min (Includes 10-min break)</p> <p><b>STL Lesson Analysis: Probe and Challenge Questions</b></p> <p>Slides 16–26</p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>• Develop a deeper understanding of the RESPeCT lesson analysis process.</li> <li>• Deepen understandings of probe and challenge questions (STL strategies 2 and 3), how they reveal student thinking, and how they move student thinking forward.</li> <li>• Deepen science-content knowledge of sound through lesson analysis.</li> <li>• Understand that science-content knowledge is essential for using elicit, probe, and challenge questions effectively in the classroom.</li> </ul> <p><b>Content</b></p> <ul style="list-style-type: none"> <li>• Probe questions follow up on student statements to find out more about what students are</li> </ul>	<p><b>Identify Probe and Challenge Questions</b> <small>Video Clip 2</small></p> <ul style="list-style-type: none"> <li>• Now we’ll look at a classroom video and focus on identifying probe and challenge questions.</li> <li>• Read the context at the top of the video transcript (handout 2.2).</li> <li>• Identify probe (P) and challenge (C) questions and mark them on your transcript.</li> <li>• Mark “missed opportunity” (MO) next to places you would like to know more about student thinking.</li> </ul> <p><b>Remember:</b></p> <ol style="list-style-type: none"> <li>1. Not all questions will fall into these categories.</li> <li>2. <b>Probe questions</b> try to figure out what a student means or is thinking. <b>Challenge questions</b> try to move student thinking toward a more scientifically accurate idea.</li> </ol> <p><a href="#">Link to video clip 2: 2.2_mspcp_gr1_sound_derose_l1_c2</a></p>	<p><b>Display Slide 16. Identify</b> Probe and Challenge Questions, Video Clip 2 (20 min)</p> <ol style="list-style-type: none"> <li>a. Provide instructions for watching video clip 2 and using the transcript (handout 2.2) to identify questions that probe student ideas and predictions and challenge student thinking.</li> <li>b. Encourage participants to refer to the strategy charts from day 1 (STL strategies 1–3), their Z-fold summary charts, and the STeLLA strategies booklet for help differentiating probe and challenge questions. Remind them that other types of questions (such as elicit questions) may appear in this video clip.</li> <li>c. <b>Set the context:</b> Read the context for video clip 2 (at the top of the transcript).</li> <li>d. Emphasize that the students in this class haven’t yet studied anything about sound.</li> <li>e. Show the video clip and allow time for participants to study the transcript before advancing to the next slide.</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	<p>trying to say.</p> <ul style="list-style-type: none"> <li>Challenge questions are designed to push students to think hard, make new connections, change their ideas, and move toward more-scientific understandings.</li> <li>The lesson analysis process involves making claims related to the STeLLA framework and providing evidence and reasoning to support those claims.</li> <li>Viewing basics and analysis basics guide the lesson analysis process.</li> </ul> <p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>Identify probe and challenge questions in a classroom video (video clip 2).</li> <li>Review common student ideas about sound.</li> <li>Analyze the use of probe and challenge questions in a classroom video (video clip 2).</li> <li>Identify and analyze the use of probe and challenge questions in another classroom video (video clip 3).</li> <li>Discuss the importance of science-content knowledge in using probe and challenge questions effectively in the classroom.</li> </ul> <p><b>Posters and Charts</b></p> <ul style="list-style-type: none"> <li>Strategy charts from day 1 (STL strategies 1–3)</li> </ul>	 <p><b>Identify Probe and Challenge Questions</b> <small>Video Clip 2</small></p> <ul style="list-style-type: none"> <li>What are good examples of probe questions in the video transcript (if any)?</li> <li>What are good examples of challenge questions in the transcript (if any)?</li> </ul>	<p><b>Display Slide 17. Identify</b> Probe and Challenge Questions, Video Clip 2 (5 min)</p> <p>a. After each suggested probe or challenge question, ask participants the following:</p> <ul style="list-style-type: none"> <li>“What makes this a probe/challenge question?”</li> <li>“Did others mark this as a probe/challenge question?”</li> <li>“Can you point to any of our resources (the Z-fold summary chart, our strategy charts from day 1, or the STeLLA strategies booklet) to support your answer?”</li> </ul> <p>b. Don’t worry about debate and lack of agreement on some questions. <b>The important thing</b> is that participants clearly understand the difference between the purposes of probe and challenge questions. Sometimes it’s hard to tell whether the teacher in the video intended to find out what a student meant (probe) or move student thinking toward more-scientific understandings (challenge). The teacher may also be asking elicit questions to reveal student ideas and misconceptions.</p> <p><b>Examples of probe questions:</b></p> <ul style="list-style-type: none"> <li><b>Video segments 00:54, 05:16, and 05:21:</b> “Can you tell me more about that?”; “Tell me more.”</li> </ul> <p><b>Possible example of a challenge question:</b></p> <ul style="list-style-type: none"> <li><b>Video segment 05:53:</b> “How do you actually know that I’m making sound?” You could argue that the teacher is challenging students to make a connection between the sounds they hear and vibrations. Alternatively, you could argue that she is trying to determine what students think, which would make this a probe question.</li> </ul>


PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	<ul style="list-style-type: none"> <li>• Common Student Ideas chart</li> <li>• Parking Lot poster</li> </ul> <p><b>Videos</b></p> <ul style="list-style-type: none"> <li>• Video Clip 2.2, Derose classroom</li> <li>• Video Clip 2.3, Doody classroom</li> </ul> <p><b>Handouts in PD Binder</b></p> <ul style="list-style-type: none"> <li>• 2.2 Transcript for Video Clip 2.2</li> <li>• 2.3 Transcript for Video Clip 2.3</li> </ul> <p><b>Supplies</b></p> <ul style="list-style-type: none"> <li>• Red and blue sticker dots (or pencils)</li> <li>• Sticky notes</li> </ul> <p><b>PD Resources</b></p> <ul style="list-style-type: none"> <li>• STeLLA strategies booklet</li> <li>• STL Z-fold summary chart</li> </ul> <p><b>Resources in Lesson Plans Binder</b></p> <p><i>Resources section:</i></p> <ul style="list-style-type: none"> <li>• Common Student Ideas</li> </ul>	<div style="border: 1px solid gray; padding: 5px; margin-bottom: 10px;"> <p style="color: red; margin: 0;"><b>Identify Missed Opportunities to Probe Student Thinking</b></p> <p style="font-size: small; margin: 0;">Video Clip 2</p> </div> <p><b>Individuals:</b> Locate one missed opportunity in the video where the teacher could have asked a probe question. Suggest a probe question to better understand student thinking.</p> <p><b>Turn and Talk:</b> Turn to a partner and share your possible probe question. Provide each other with feedback. Ask, “Is this a probe question? Why or why not?”</p> <p><b>Whole group:</b> Do you need any clarification?</p>	<p><b>Display Slide 18. Identify Missed Opportunities to Probe Student Thinking, Video Clip 2 (10 min)</b></p> <ol style="list-style-type: none"> <li>a. <b>Individuals:</b> “Identify a missed opportunity for a probe question in the video transcript.”</li> <li>b. <b>Turn and Talk:</b> Have participants pair up and discuss their suggested probe questions. Listen to their conversations to assess whether they truly comprehend that a probe question is designed to help them understand what students are thinking.</li> <li>c. <b>Whole-group share-out:</b> Participants may need guidance about when to ask probe questions. Remind them that probe questions are appropriate when students make vague or abbreviated statements, or when they simply use a vocabulary term without saying what it means. Do they really understand the term or concept, or do they have misconceptions? Ask a probe question to find out!</li> <li>d. <b>Remind participants:</b> “Don’t probe everything a student says. Just probe responses that seem relevant to the lesson’s main learning goal and might reveal interesting student thinking.”</li> </ol> <p><b>Examples of missed opportunities:</b></p> <ul style="list-style-type: none"> <li>• <b>Video segment 05:44:</b> In addition to asking “How do you know I’m making sound?” the teacher could have asked, “What is your evidence that I’m making a sound? Tell me how you’re thinking about that.”</li> <li>• <b>Segment 06:44:</b> After the student says, “You can hear the vibration that comes toward you,” the teacher could have asked, “Can you say more about what <i>vibration</i> means?”</li> </ul>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
<b>10-MINUTE BREAK</b>			
		<div style="border: 1px solid black; padding: 5px;"> <p style="margin: 0;"><b>Common Student Ideas</b> <span style="float: right; font-size: small;">Video Clip 2</span></p> <ol style="list-style-type: none"> <li>1. Locate Common Student Ideas about Sound (in lesson plans binder).</li> <li>2. Read through the <b>left-hand column</b>. <ul style="list-style-type: none"> <li>• Have you observed any of these common ideas among your students? (Mark these ideas with a <b>red</b> dot.)</li> <li>• Have you ever held any of these ideas yourself? (Mark these ideas with a <b>blue</b> dot.)</li> <li>• Can you think of other misconceptions you've held or observed in students?</li> </ul> </li> <li>3. <b>Pairs:</b> Share your observations with a partner.</li> <li>4. <b>Whole group:</b> What patterns do you notice in the red and blue dots? What did this analysis make you think about?</li> </ol> </div>	<p><b>Display Slide 19.</b> Common Student Ideas, Video Clip 2 (15 min)</p> <ol style="list-style-type: none"> <li>a. "Now let's consider some commonly held student ideas or misconceptions about sound. Then we can analyze whether any of these ideas appear in our video clips."</li> <li>b. Have participants locate the Common Student Ideas chart in the resources section of their lesson plans binders.</li> <li>c. "This Common Student Ideas chart shows some commonly held student ideas that are interesting but aren't scientifically accurate."</li> <li>d. <b>Individuals:</b> Have participants mark with a red sticker dot any ideas they've observed among their students, and mark with a blue sticker dot any ideas they've had themselves.</li> <li>e. <b>Pairs:</b> Have participants discuss their observations with a partner.</li> <li>f. <b>Whole group:</b> Ask participants to share which ideas they've observed in their students and themselves. During this share-out, apply sticker dots to the Common Student Ideas chart at the front of the room as participants to highlight patterns in the results. Then discuss the following questions: <ul style="list-style-type: none"> <li>• "What conceptual patterns do you notice in the red and blue dots?"</li> <li>• "What reactions do you have to this analysis? What did it make you think about?"</li> </ul> </li> </ol> <p><b>Note:</b> If time is short, skip this pattern analysis and</p>



PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>discussion.</p> <p>g. “We’ve recognized these common ideas in students or held them ourselves. It’s important to be aware of them when we’re analyzing student thinking in the video clips or planning and teaching lessons in the future.”</p> <p>h. “Now let’s look for evidence of these common student ideas in a video clip.”</p>
		<p><b>Common Student Ideas</b> <span style="float: right; font-size: small;">Video Clip 2</span></p> <p><b>Individuals:</b> Read the scientific explanations for your assigned idea on the Common Student Ideas chart.</p> <p><b>Pairs:</b> Discuss these explanations briefly with a partner. What was new to you? Write on sticky notes any content questions you have and place them on the Parking Lot poster.</p>	<p><b>Display Slide 20.</b> Common Student Ideas, Video Clip 2 (10 min)</p> <p>a. Have participants count off in ones and twos (1, 2, 1, 2). “Ones” will focus on the odd-numbered ideas 1 on the Common Student Ideas chart, and “twos” will focus on the even-numbered ideas.</p> <p>b. <b>Individuals:</b> “Read the scientific explanations for your assigned idea on the Common Student Ideas chart.”</p> <p>c. <b>Pairs:</b> “Discuss these explanations briefly with a partner. What was new to you? Write on sticky notes any content questions you have and place the notes on the Parking Lot poster.”</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>Lesson Analysis Basics</b></p> <ul style="list-style-type: none"> <li>• <b>Analysis basic 1:</b> Focus on student thinking and the science content storyline.</li> <li>• <b>Analysis basic 2:</b> Look for evidence to support any claims.</li> <li>• <b>Analysis basic 3:</b> Look more than once (in the video and transcript).</li> <li>• <b>Analysis basic 4:</b> Consider alternative explanations and teaching strategies.</li> </ul> <p><b>Note:</b> Find out more about the analysis basics on page 2 of the STeLLA strategies booklet.</p>	<p><b>Display Slide 21.</b> Lesson Analysis Basics (5 min)</p> <ol style="list-style-type: none"> <li>“Before we analyze the video clip, let’s think about our lesson analysis process.”</li> <li>Review the analysis basics on the slide. <ul style="list-style-type: none"> <li><b>Note:</b> Direct participants to page 2 in the strategies booklet if they have specific questions that require more information.</li> </ul> </li> <li><b>Why the analysis basics are important:</b> “The analysis basics will help us dig deeper and learn more from our videocase analyses while keeping us focused on the ultimate goal of improved student learning.” <ul style="list-style-type: none"> <li><b>Note:</b> This lesson analysis process is <b>not</b> about critiquing teachers but about improving student learning.</li> </ul> </li> <li>“We’ll use a more structured lesson analysis protocol when we begin reviewing each other’s videos in the fall study-group sessions.”</li> </ol>
		<p><b>Analyze Questions That Probe and Challenge Student Thinking</b> <span style="float: right; font-size: small;">Video Clip 2</span></p> <p><b>Analysis question:</b> What student thinking is made visible (or not) through the use of probe or challenge questions? Be specific. Consider whether you observed any of the common student ideas or correct scientific explanations in the video.</p> <p><b>Individuals:</b> Make notes or highlight questions/responses on the video transcript. Develop a claim to answer the question. Support the claim with</p> <ul style="list-style-type: none"> <li>• evidence from the transcript,</li> <li>• ideas from the Common Student Ideas chart, and/or</li> <li>• ideas from the STeLLA strategies booklet.</li> </ul> <p><b>Whole group:</b> Share claims and evidence.</p>	<p><b>Display Slide 22.</b> <i>Analyze</i> Questions That Probe and Challenge Student Thinking, Video Clip 2 (15 min)</p> <ol style="list-style-type: none"> <li>Remind participants of the purposes of video analysis: to deepen understandings of STeLLA strategies; to develop their ability to analyze student thinking; and, ultimately, to improve student learning.</li> <li><b>Tell participants:</b> “Remember to refer to your Common Student Ideas chart as you analyze the video clip.”</li> <li><b>Individuals:</b> Review the slide instructions before participants begin working independently on the</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>tasks.</p> <p><b>d. Whole group:</b></p> <ul style="list-style-type: none"> <li>• Have several participants share their claims and evidence.</li> <li>• <b>Ask:</b> “Did you recognize any of the common student ideas in the students’ responses?”</li> <li>• <b>Ask:</b> “What probe or challenge questions might you ask to better understand student thinking?”</li> </ul> <p><b>Note:</b> Remember to use probe and challenge questions as you interact with participants.</p>
		<p><b>Identify Probe, Challenge, and Leading Questions</b> </p> <p>Now we’ll look at another classroom video. Read the context in the video transcript (top of handout 2.3).</p> <p><b>Individuals:</b> Mark the transcript to identify probe (P), challenge (C), or leading (L) questions. Then mark any missed opportunities (MO).</p> <p><b>Remember:</b></p> <ol style="list-style-type: none"> <li>1. Not all questions (or statements) will fall into these four categories: P, C, or L.</li> <li>2. Review the viewing basics and analysis basics.</li> </ol> <p><b>Whole-group share-out:</b> Give reasons for marking the questions the way you did.</p> <p><a href="#">Link to video clip 3: 2.3_mscpcp_gr1_sound_doodly_L6_c3</a></p>	<p><b>Display Slide 23. Identify</b> Probe, Challenge, and Leading Questions, Video Clip 3 (20 min)</p> <p>a. Read the context for this video clip at the top of the transcript (handout 2.3).</p> <p>b. Provide instructions for watching video clip 3 and using the transcript to identify questions that probe student ideas and predictions and challenge student thinking. <b>Participants should also be on the lookout for leading questions and missed opportunities.</b> (<b>Note:</b> Leading questions provide hints or make it easy for students to give the “right” answer.) Remind participants that other types of questions (such as elicit questions) may appear in this video clip.</p> <p>c. Show the video clip.</p> <p><b>d. Individuals:</b> Review the slide instructions before</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>participants begin working independently on the tasks.</p> <p><b>e. Whole group:</b></p> <ul style="list-style-type: none"> <li>• Challenge participants to clearly state their reasons for identifying a question as probe, challenge, or leading.</li> <li>• Encourage participants to provide evidence from the STeLLA strategies booklet to support their claims.</li> </ul> <p><b>Examples of probe questions:</b></p> <ul style="list-style-type: none"> <li>• <b>Video segment 00:21:</b> “What does that mean if it’s moving?”</li> <li>• <b>Segment 01:12:</b> “What vibrated?”</li> <li>• <b>Segment 01:17:</b> “What vibrated?”</li> <li>• <b>Segment 01:29:</b> “Did the rice vibrate on its own?”</li> <li>• <b>Segment 02:34:</b> “Is the rice just vibrating because of the sound?”</li> </ul> <p><b>Example of a challenge question:</b></p> <ul style="list-style-type: none"> <li>• <b>Video segment 01:21:</b> “What made the rice vibrate?” [<i>Justification:</i> The teacher is asking the question to get students thinking and moving toward more-scientific understandings.]</li> </ul> <p><b>Possible leading questions:</b></p> <ul style="list-style-type: none"> <li>• <b>Video segment 01:36:</b> “What do you think ... about the eardrum?”</li> <li>• <b>Segment 01:41:</b> “Do you think that the wax paper was vibrating?” [<i>Justification:</i> The teacher is leading students to the idea that the wax paper is vibrating and compares it to an eardrum from the video they watched.]</li> <li>• <b>Segment 02:42:</b> “Is the sound also vibrating something else that’s causing the rice to vibrate?”</li> </ul> <p><b>Missed opportunities for probe and challenge</b></p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p data-bbox="825 776 1071 800"><b>Analyze Student Thinking</b></p> <p data-bbox="1220 773 1268 800">Video Clip 3</p> <p data-bbox="825 816 1272 883"><b>Analysis question:</b> What student thinking is made visible (or not) through the use of probe or challenge questions? Be specific.</p> <p data-bbox="825 894 1257 938"><b>Individuals:</b> Develop a claim to answer the analysis question. Support the claim with</p> <ul data-bbox="835 943 1230 1040" style="list-style-type: none"> <li>- evidence from the video transcript,</li> <li>- ideas from the Common Student Ideas chart, and/or</li> <li>- ideas from the STeLLA strategies booklet.</li> </ul> <p data-bbox="825 1049 1178 1070"><b>Whole group:</b> Share claims and evidence.</p>	<p data-bbox="1314 245 1455 269"><b>questions:</b></p> <ul data-bbox="1314 285 1934 708" style="list-style-type: none"> <li>• <b>Video segment 01:12:</b> Instead of asking, “What vibrated?” the teacher could have said, “Show me the parts of the model that vibrated.” Then she could have demonstrated the model again. If the teacher had used this strategy at segment 02:34, she could have avoided the leading question at segment 02:42.</li> <li>• <b>Segment 01:34:</b> When the student says the rice didn’t vibrate on its own, the teacher could have asked, “Tell me how you’re thinking about that.”</li> <li>• <b>Segment 02:08:</b> When the student said, “The noise came to our ear,” the teacher could have said, “Tell us more about how the noise came to our ear.”</li> </ul> <p data-bbox="1314 743 1934 802"><b>Display Slide 24.</b> Analyze Student Thinking, Video Clip 3 (10 min)</p> <p data-bbox="1314 854 1934 912">a. <b>Emphasize:</b> “Remember to refer to your Common Student Ideas chart as you analyze the video.”</p> <p data-bbox="1314 932 1923 1045">b. <b>Individuals:</b> Review the slide instructions before participants begin working independently on developing a claim to answer the analysis question.</p> <p data-bbox="1314 1068 1520 1092">c. <b>Whole group:</b></p> <ul data-bbox="1362 1117 1919 1325" style="list-style-type: none"> <li>• Have several participants share their claims and evidence.</li> <li>• <b>Ask:</b> “Did you recognize any of the common student ideas in the students’ responses?”</li> <li>• <b>Ask:</b> “What probe or challenge questions might you ask to better understand student thinking?”</li> </ul> <p data-bbox="1314 1360 1856 1419"><b>Note:</b> Remember to use probe and challenge questions as you interact with participants.</p> <p data-bbox="1314 1438 1887 1463"><b>Visible misconception:</b> The student thinks that</p>

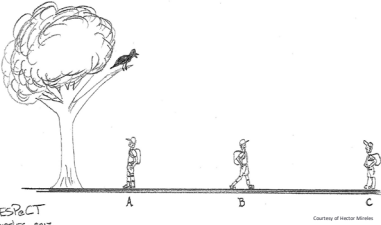
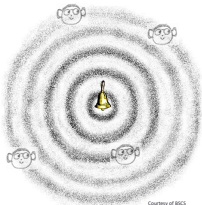
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>matter moves along with the sound waves (video segments 01:17–01:28).</p> <p><b>Possible claim:</b> Several students think that sound (or sound waves) caused the rice to move.</p> <p><b>Evidence:</b> video segments 01:29–01:34, 01:36–01:56, and 03:02–03:36.</p> <p><b>Reasoning:</b> Students see the rice move but don't see the wax paper move.</p> <p><b>Alternative:</b> The teacher could put the rice directly on the table under the document camera and make a sound with the soundmaker. Then the teacher could ask students what they observed (e.g., “Did the rice move?”) and compare these results with the model.</p>
		<p><b>Summarize: Elicit, Probe, and Challenge Questions</b></p> <ol style="list-style-type: none"> <li>1. What makes a good elicit question? A good probe question? A good challenge question?</li> <li>2. What do you need to know to ask good elicit, probe, and challenge questions?</li> </ol> <p>To ask good questions that make student thinking visible, you need a clear understanding of</p> <ol style="list-style-type: none"> <li>a. the science concepts you are teaching, and</li> <li>b. alternative ideas that students may hold.</li> </ol>	<p><b>Display Slide 25.</b> Summarize: Elicit, Probe, and Challenge Questions (5 min)</p> <ol style="list-style-type: none"> <li>a. Pose the first question on the slide. If participants need support, point them to the descriptions of strategies 1, 2, and 3 in the STeLLA strategies booklet (especially the Summary of STeLLA Student Thinking Lens Strategies).</li> <li>b. Pose the second question. Do participants come up with the idea that science-content knowledge is essential for asking good elicit, probe, and challenge questions?</li> <li>c. Use the rest of the time to highlight the importance of knowing science content and being aware of common student ideas.</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Reflect on Your Learning</b></p> <p>Respond to these questions in a quick write:</p> <ol style="list-style-type: none"> <li>1. What did you learn about student thinking from analyzing these videos?</li> <li>2. How did the analysis process help you better understand the questioning strategies?</li> </ol> <p>Be prepared to share your ideas.</p>	<p><b>Display Slide 26.</b> Reflect on Your Learning (5 min)</p> <p>a. Ideally, participants will first respond to the questions in a quick write and then share their ideas with the group. But if time is running short, you can have them simply think for a minute and then share their ideas. But be sure to give them time to think before opening up the discussion.</p>
<p>11:30–12:00 30 min</p> <p style="text-align: center;"><b>Practice Using Elicit and Probe Questions: Interviews</b></p> <p>Slides 27–29</p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>• Deepen understandings of elicit and probe questions.</li> <li>• Begin to develop the ability to ask elicit and probe questions effectively.</li> <li>• Appreciate that science-content knowledge is essential for using elicit and probe questions effectively in the classroom.</li> </ul> <p><b>Content</b></p> <ul style="list-style-type: none"> <li>• Understanding the purposes and key features of elicit and probe questions is essential for implementing the STeLLA questioning strategies effectively</li> </ul>	<p style="text-align: center;"><b>Practice Elicit and Probe Questions: Interview Planning</b></p> <ul style="list-style-type: none"> <li>• <b>The challenge:</b> Pair up and practice using elicit and probe questions. First ask your partner an elicit question and then ask <b>only</b> probe questions to find out what your partner thinks.</li> <li>• <b>To prepare:</b> <ol style="list-style-type: none"> <li>a. Read your elicit question.</li> <li>b. Read the common student ideas and scientific explanations that relate to your question.</li> <li>c. Plan probe questions to clarify ideas you think might emerge.</li> </ol> </li> </ul>	<p><b>Display Slide 27.</b> Practice Elicit and Probe Questions: Interview Planning (12 min)</p> <p>a. <b>Describe the challenge:</b> “Next, you and a partner will practice using elicit and probe questions by interviewing each other. The challenge is to ask your partner an elicit question and then follow up by asking <b>only</b> probe questions.”</p> <p>b. Give each participant a different elicit question (from the PD leader master cards).</p> <p>c. Direct participants to prepare for the interviews by following the slide instructions.</p> <p><b>Note:</b> Participants may refer to the Common Student Ideas chart as a resource for this activity.</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	<p>in the classroom.</p> <p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>Consider possible responses an elicit question (related to sound) might produce, and plan probe questions to follow up on these responses.</li> <li>Work in pairs, taking turns being the interviewer and asking each other an elicit question and then following up with only probe questions.</li> <li>Participate in a group discussion afterward that focuses on the difficult aspects of the pairs work and the interesting thinking it revealed.</li> </ul> <p><b>Posters and Charts</b></p> <ul style="list-style-type: none"> <li>Common Student Ideas chart</li> </ul> <p><b>PD Leader Masters</b></p> <ul style="list-style-type: none"> <li>PD Leader Master: Elicit Question Cards (cut apart)</li> </ul> <p><b>Resources in Lesson Plans Binder</b></p> <p><i>Resources section:</i></p> <ul style="list-style-type: none"> <li>Common Student Ideas</li> </ul>	<p><b>Practice Elicit and Probe Questions: Interview Process</b></p> <ol style="list-style-type: none"> <li>Ask your partner the elicit question.</li> <li>Probe your partner’s thinking without providing any new information. (Keep going for at least 2 minutes!)</li> <li>Debrief with your partner: <ul style="list-style-type: none"> <li>What probe questions did you ask?</li> <li>Did you ask questions that weren’t probe questions?</li> <li>What did your probe questions reveal about your partner’s understanding of the concept?</li> </ul> </li> <li>Switch roles and repeat the interview process, with the other partner asking the questions.</li> </ol> <p><b>Group Discussion</b></p> <ol style="list-style-type: none"> <li>How did the interviews go? What did you find difficult as an interviewer? As a responder?</li> <li>Which probe questions revealed some interesting clarifications or elaborations?</li> <li>Did any of your questions end up challenging your partner’s thinking? (Did your questions move your partner’s thinking toward a more scientifically accurate response?)</li> </ol>	<p><b>Display Slide 28.</b> Practice Elicit and Probe Questions: Interview Process (12 min)</p> <ol style="list-style-type: none"> <li>Review the instructions on the slide.</li> <li>“Each interviewer will have 5 minutes to ask questions. Try to keep going with your probe questions for at least 2 minutes.”</li> <li><b>Interviewees:</b> “Don’t pretend to be an elementary student; be yourself. Help your partner by pushing yourself to explain things in more depth than you actually understand. Try to come up with possible explanations that go beyond the surface vocabulary. Don’t worry about being wrong; this will actually make the task more like what you might encounter in the classroom.”</li> </ol> <p><b>Display Slide 29.</b> Group Discussion (6 min)</p> <ol style="list-style-type: none"> <li><b>Whole group:</b> Discuss the questions on the slide.</li> <li>If there’s time, ask participants, “How might it help your teaching to do more of this type of practice (with a partner or small group)?”</li> </ol>
12:00–12:45 45 min	<b>LUNCH</b>		




PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
<p>12:45–3:15 150 min (Includes 10-min break)</p> <p><b>Content Deepening: Sound</b></p> <p>Slides 30–54</p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>• Deepen participants’ understandings of sound, sound waves, and the intensity of sound.</li> </ul> <p><b>Content</b></p> <ul style="list-style-type: none"> <li>• Large vibrations in the air create the loud sounds we hear, and small vibrations create softer sounds.</li> <li>• When you’re far away from the source of a sound, your ears receive a smaller portion of the sound energy than when you’re closer to the source. The vibrations of atoms are smaller (the sound is quieter) when you’re farther away from the source.</li> </ul> <p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>• Conduct investigations to find out why some sounds are loud and others are quiet.</li> <li>• Conduct investigations to determine why a sound becomes softer (quieter) as distance from the source increases.</li> </ul> <p><b>Videos</b></p> <ul style="list-style-type: none"> <li>• Kahn Academy video <i>Why Do Sounds Get Softer?</i></li> <li>• Kahn Academy video <i>Sound Properties: Amplitude, Period, Frequency, Wavelength</i></li> </ul>	<div data-bbox="793 245 1295 797"> </div> <div data-bbox="793 805 1295 1451"> <p><b>How Does Sound Travel?</b></p> <p><b>Scenario:</b> A bird is singing in a tree above a group of people. Everyone hears the bird at the same time, but some people hear a loud sound and others hear a soft sound.</p> <ul style="list-style-type: none"> <li>• Why do you think some people hear a soft sound instead of a loud sound?</li> <li>• What happens to sound as it travels farther from the source?</li> </ul> </div>	<p><b>Display Slide 30.</b> Content Deepening: Sound (Less than 1 min)</p> <p>a. “Are you ready to dig into today’s content deepening work on sound?”</p> <p><b>Note:</b> Throughout this content deepening phase, refer as needed to the Sound Content Background Document and Common Student Ideas about Sound.</p> <hr/> <p><b>Display Slide 31.</b> How Does Sound Travel? (10 min)</p> <p>a. “To review what we learned about sound in our last content deepening session, let’s begin with a scenario about a bird and a group of people.”</p> <p>b. Introduce the scenario and questions on the slide. Then have participants copy the questions into their science notebooks.</p> <p>c. <b>Individuals:</b> Give participants 2 minutes to think about these questions and write down their ideas. Ask, “What have you learned about sound so far that might help you answer these questions?”</p> <p>d. <b>Pairs:</b> Have participants pair up and share their ideas for answering the questions.</p> <p>e. <b>Whole group:</b> Invite a few participants to share their ideas with the group. Then let participants know you’ll revisit these questions later in the</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	<p><b>Posters and Charts</b></p> <ul style="list-style-type: none"> <li>• Common Student Ideas chart</li> </ul> <p><b>Handouts in PD Binder</b></p> <ul style="list-style-type: none"> <li>• 2.4 Bird Sounds</li> <li>• 2.5 Which Way Will the Sound Move? (from Sound lesson 5a)</li> </ul> <p><b>Supplies</b></p> <ul style="list-style-type: none"> <li>• Science notebooks</li> <li>• Chart paper and markers</li> <li>• A small soundmaker you can move around with your hand (such as a cell phone, a bell, car keys)</li> </ul> <p><b>PD Resources</b></p> <ul style="list-style-type: none"> <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>• Content background document</li> <li>• Common Student Ideas</li> </ul> <p><i>Pretabs section:</i></p> <ul style="list-style-type: none"> <li>• Sound: Learning Goals for Students and Teachers</li> </ul>	<div data-bbox="793 305 1293 724"> <p style="text-align: center;"><b>How Does Sound Travel?</b></p>  <p style="font-size: small;">RESPeCT illustrations - 2012</p> </div> <div data-bbox="793 737 1293 1458"> <p style="text-align: center;"><b>Drawing Sound Waves</b></p> <p><b>Circular Wavefront</b></p> <ol style="list-style-type: none"> <li>1. The source (bell) is at the center (inner circle).</li> <li>2. Circles (sound waves) travel away from the source in all directions.</li> <li>3. A person receives a sound when a circle reaches his or her ears.</li> <li>4. The distance between the circles is always the same. It represents wavelength.</li> </ol>  <p style="font-size: x-small; text-align: right;">Courtesy of BCS</p> </div>	<p>session.</p> <p><b>Display Slide 32.</b> How Does Sound Travel? (6 min)</p> <ol style="list-style-type: none"> <li>a. Distribute handout 2.4 (Bird Sounds).</li> <li>b. <b>Individuals:</b> Ask participants to complete the handout and be prepared to share their ideas with the group.</li> <li>c. <b>Whole group:</b> Invite pairs to share their ideas and reasoning with the group.</li> </ol> <p><b>Display Slide 33.</b> Drawing Sound Waves (8 min)</p> <ol style="list-style-type: none"> <li>a. Emphasize that sound waves originate at a single source and travel away from the source in all directions. Sound travels in every direction even if no one is there to hear it.</li> <li>b. “We can draw or illustrate sound in many ways. Some examples are <ul style="list-style-type: none"> <li>• lines coming out of a speaker,</li> <li>• musical notes coming out of a guitar,</li> <li>• circular waves moving away from a dog, or</li> <li>• an oscillatory wave traveling from a source to a listener.”</li> </ul> </li> <li>c. “The best way to draw sound waves is to use a <i>circular wavefront</i> convention.” <ol style="list-style-type: none"> <li>1. The source (a bell) is at the center of the diagram in the innermost circle.</li> <li>2. Circles moving away from the center represent sound waves traveling away from the source in all directions.</li> <li>3. The circles farther away from the source are</li> </ol> </li> </ol>

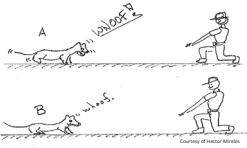
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p data-bbox="793 743 1293 768"></p> <p data-bbox="835 786 1192 846"><b>Review: Where Does Sound Come From?</b></p> <ol data-bbox="835 862 1247 1003" style="list-style-type: none"> <li>1. Can you hear the sound from this source?</li> <li>2. Can you identify where the sound is coming from?</li> <li>3. Can you identify where the sound is coming from <b>with one ear covered?</b></li> </ol>	<p data-bbox="1402 245 1923 331">bigger because these sound waves traveled away from the bell at an earlier time. The larger circles indicate weaker sound waves.</p> <ol data-bbox="1362 337 1923 574" style="list-style-type: none"> <li>4. The energy in larger circles is spread out more thinly.</li> <li>5. A person receives a sound when a circle reaches his or her ears.</li> <li>6. Ears capture less sound energy farther from the source, so the sound is less intense.</li> <li>7. The distance between the circles is always the same. That represents the wavelength.</li> </ol> <p data-bbox="1318 597 1902 711">d. "In a real three-dimensional world, the circles would actually be spherical shells, but not everyone can draw that well. For our purposes, circles are fine."</p> <p data-bbox="1318 750 1885 810"><b>Display Slide 34.</b> Review: Where Does Sound Come From? (15 min)</p> <ol data-bbox="1318 862 1944 1442" style="list-style-type: none"> <li>a. "Next, I'm going to make some sounds with a soundmaker, and you'll identify where the sounds are coming from. But there's one little catch. You have to close your eyes!"</li> <li>b. Read the questions on the slide and let participants know that you'll ask these questions at different points during the activity.</li> <li>c. Have participants stand in a wide circle and close their eyes. <b>Note:</b> Make sure you're able to move in and out of the circle easily.</li> <li>d. After participants close their eyes, move to different locations around the room and make a sound with a soundmaker. The object should be small enough to carry and move around with your hand (e.g., a handbell, a cell phone you can use to play music or a ringtone, car keys).</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>e. Make sounds in the following locations:</p> <ul style="list-style-type: none"> <li>• At the center of the circle</li> <li>• Moving through the circle</li> <li>• Outside the circle</li> <li>• As far away from the circle as possible</li> <li>• Walking around the room</li> </ul> <p>f. Each time you make a sound, ask participants the three questions on the slide:</p> <ol style="list-style-type: none"> <li>1. “Can you hear the sound from this source?”</li> <li>2. “Can you identify where the sound is coming from?”</li> <li>3. “Can you identify where the sound is coming from <i>with one ear covered?</i>”</li> </ol> <p>g. Following the activity, discuss whether participants could hear the sounds and identify where they were coming from.</p> <p>h. Ask probe and challenge questions to link the activity to key ideas about sound waves from slide 33: Sound waves originate at a single source and travel away from the source in all directions. Sound travels in every direction even if no one is there to hear it. Sound is less intense farther from the source.</p> <p><b>Sample probe and challenge questions:</b></p> <ul style="list-style-type: none"> <li>• “Did the sound travel in all directions? What is our evidence?”</li> <li>• “Did the sound travel everywhere in the room, even if no one was standing in some places?”</li> <li>• “Was the sound as loud or intense every time you heard it?”</li> </ul> <p>i. “Now let’s revisit the bird scenario we considered earlier.”</p> <p>j. <b>Individuals:</b> “Have participants locate their responses to the two questions from slide 31. Give them 2 minutes to review and revise their answers</p>

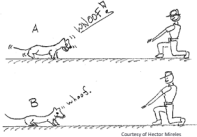
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p data-bbox="831 659 1171 683"><b>Review: Where Does Sound Go?</b></p> <p data-bbox="831 708 1255 781">Create a pictorial representation on the handout showing where sound travels from the source (the bell).</p> 	<p data-bbox="1346 245 1860 269">using evidence from the circle investigation.</p> <p data-bbox="1314 293 1913 350">k. <b>Whole group:</b> Invite a few participants to share their revised answers to the questions.</p> <hr data-bbox="789 610 1304 634"/> <p data-bbox="1314 618 1944 675"><b>Display Slide 35.</b> Review: Where Does Sound Go? (8 min)</p> <p data-bbox="1314 724 1944 1187"> a. “Now let’s think about where sound goes.”  b. Distribute handout 2.5 (Which Way Will the Sound Move?) and review the instructions.  c. <b>Individuals:</b> Ask participants to create a pictorial representation of sound traveling from the source (bell).  d. While participants are working on their diagrams, circulate around the room and ask probe and challenge questions as needed.  e. <b>Whole group:</b> Invite a few participants to share their diagrams with the group. Display each diagram on a document reader as participants explain where sound goes when the bell rings. </p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="background-color: #d9ead3; padding: 2px;">Review: Where Does Sound Go?</p> <p>When something makes a sound, where does the sound go? What is our evidence?</p> <ul style="list-style-type: none"> <li>• Write your ideas and evidence in your notebook.</li> <li>• Be prepared to share with the group.</li> </ul>	<p><b>Display Slide 36.</b> Review: Where Does Sound Go? (8 min)</p> <ol style="list-style-type: none"> <li>a. Read the questions on the slide.</li> <li>b. <b>Individuals:</b> Ask participants to write their ideas and evidence in their science notebooks.</li> <li>c. <b>Whole group:</b> Invite participants to share their ideas and evidence with the group. During this discussion, record key ideas and evidence on chart paper and ask probe questions to clarify participants' thinking.</li> </ol> <p><b>Ideal response:</b> Sound moves away from a soundmaker in all directions. The sound doesn't stop when a person hears it.</p> <ol style="list-style-type: none"> <li>d. Address any questions the group may have.</li> </ol>
		<p style="background-color: #d9ead3; padding: 2px;">STeLLA Strategy 3: Challenge Questions</p> <p><b>STL strategy 3:</b> Ask questions to challenge student thinking.</p> <p><b>Purposes:</b></p> <ul style="list-style-type: none"> <li>• Challenge students to develop deeper understandings of science ideas.</li> <li>• Help students change their thinking and move toward more-scientific understandings.</li> <li>• Scaffold/guide student thinking toward new connections and science vocabulary.</li> </ul> <p><b>How can we challenge our students to deepening their understandings of science concepts about sound?</b></p>	<p><b>Display Slide 37.</b> STeLLA Strategy 3: Challenge Questions (1 min)</p> <ol style="list-style-type: none"> <li>a. Review the purposes of Student Thinking Lens strategy 3: Ask questions to challenge student thinking.</li> <li>b. "As we deepen our own understandings of sound today, let's think about how we can challenge our students to deepen their understandings of these science concepts."</li> </ol>

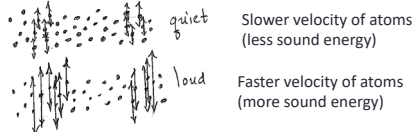
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>Main Learning Goals</b></p> <ul style="list-style-type: none"> <li>• Large vibrations in the air generate the loud sounds we hear, and smaller vibrations generate softer, quieter sounds.</li> <li>• When you're far away from the source of a sound, your ears receive a smaller portion of the sound energy than when you're close to the source. The vibrations of atoms are smaller (the sound is quieter) when you're farther away from the source.</li> </ul>	<p><b>Display Slide 38.</b> Main Learning Goals (Less than 1 min)</p> <p>a. Introduce the main learning goals for this session.</p>
		<p><b>Content Deepening Focus Questions</b></p> <ul style="list-style-type: none"> <li>• Why are some sounds loud, while other sounds are soft (quiet)?</li> <li>• Why does a sound get softer (quieter) as you walk away from the source?</li> </ul>	<p><b>Display Slide 39.</b> Content Deepening Focus Questions (1 min)</p> <p>a. "These are the content deepening questions we'll focus on throughout the rest of this session. The science ideas we explore will help us answer these questions."</p> <p>b. Have participants write the focus questions in their notebooks.</p> <p>c. Note that participants will answer these questions at the end of the session and share their ideas and evidence with the group.</p>

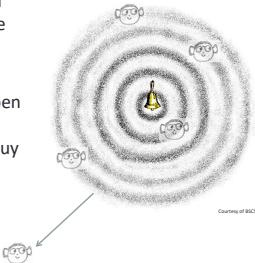
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="text-align: center;"><b>Content Deepening: Focus Question 1</b></p> <p>Why are some sounds loud, while other sounds are soft (quiet)?</p>	<p><b>Display Slide 40.</b> Content Deepening: Focus Question 1 (Less than 1 min)</p> <p>a. “First, let’s investigate why some sounds are loud, while others are soft.”</p>
		<p style="text-align: center;"><b>Investigation 1: Barking Dogs</b></p> <ol style="list-style-type: none"> <li>1. What is the source of the sound in this diagram?</li> <li>2. How does the sound travel from the source to the recipient?</li> </ol> 	<p><b>Display Slide 41.</b> Investigation 1: Barking Dogs (6 min)</p> <p>a. Introduce the scenario on the slide: Two dogs are barking. One is barking loudly, and the other is barking quietly.</p> <p>b. Ask participants the following questions:</p> <ol style="list-style-type: none"> <li>1. What is the source of the sound in this diagram?</li> <li>2. How does the sound travel from the source (the dog’s vocal chords) to the recipient (the man’s ears)?</li> </ol> <p>c. Ask probe and challenge questions during the discussion to clarify participants’ thinking.</p> <p>d. Highlight key ideas from the previous content deepening session that answer these questions:</p> <ul style="list-style-type: none"> <li>• The vibrating vocal cords of the dog are the source of the sound.</li> </ul>



PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p data-bbox="1003 175 1087 204" style="text-align: center;"><b>Slides</b></p>	<ul data-bbox="1367 245 1948 423" style="list-style-type: none"> <li>• The sound waves or vibrations from the source (dog) travel through the air in all directions.</li> <li>• When the sound waves reach the ears of the person, the person's eardrums vibrate and send a signal to the brain. The brain interprets the vibrations as a dog barking.</li> </ul>
		<p data-bbox="827 704 1129 734"><b>Investigation 1: Barking Dogs</b></p> <ol data-bbox="827 740 1260 902" style="list-style-type: none"> <li>1. What is the difference between the sound waves the loud dog (A) and the quiet dog (B) are emitting? Why?</li> <li>2. If both dogs bark this way for 40 minutes without stopping, which dog will get tired sooner? Why?</li> <li>3. What is the difference between the sound waves from each dog when they reach the ears of their respective owners?</li> </ol> 	<p data-bbox="1318 672 1898 737"><b>Display Slide 42.</b> Investigation 1: Barking Dogs (10 min)</p> <ol data-bbox="1318 792 1948 1354" style="list-style-type: none"> <li>a. Read the challenge questions on the slide.</li> <li>b. Direct participants to write the questions in their notebooks.</li> <li>c. Remind participants of the first main learning goal for this session: Large vibrations in the air generate the loud sounds we hear, and smaller vibrations generate softer, quieter sounds.</li> <li>d. Emphasize that it takes energy to make sound because sound transports energy away from the source. There is more energy in a loud sound than a soft (quiet) sound.</li> <li>e. <b>Pairs:</b> Have participants work through the challenge questions with an elbow partner and then record their answers in their notebooks.</li> <li>f. <b>Whole-group share out:</b> Invite pairs to share their responses for each question on the slide.</li> </ol> <p data-bbox="1346 1377 1556 1406"><b>Ideal responses:</b></p> <ol data-bbox="1367 1409 1877 1461" style="list-style-type: none"> <li>1. The sound waves (vibrations) dog A is emitting are much larger than the sound</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<div data-bbox="793 581 1293 613" style="background-color: #cccccc; height: 20px; margin-bottom: 10px;"></div> <p data-bbox="835 618 1073 646" style="color: #c00000;"><b>The Intensity of Sound</b></p> <ul data-bbox="835 662 1268 938" style="list-style-type: none"> <li data-bbox="835 662 1268 751">• When an object makes a sound, it causes the air around it to vibrate. These vibrations in the air travel from the source in all directions. Vibrating air molecules carry energy from the source.</li> <li data-bbox="835 764 1268 829">• <b>Intensity</b> refers to the amount of energy a sound wave possesses. (<b>Note:</b> Intensity is <b>not</b> frequency. This difference will be explored in depth next time.) <ul data-bbox="856 841 1247 938" style="list-style-type: none"> <li data-bbox="856 841 1247 881">• <b>Higher velocity</b> of air molecules = more sound energy (intensity)</li> <li data-bbox="856 894 1247 938">• <b>Lower velocity</b> of air molecules = less sound energy (intensity)</li> </ul> </li> </ul>	<p data-bbox="1402 245 1871 302">waves dog B is emitting because larger vibrations generate louder sounds.</p> <ol data-bbox="1360 306 1948 545" style="list-style-type: none"> <li data-bbox="1360 306 1948 423">2. Dog A will tire more quickly than dog B because dog A is consuming more energy. The energy consumed in barking goes into the sound wave.</li> <li data-bbox="1360 428 1948 545">3. The sound waves (vibrations) from dog A are larger and have more sound energy than the sound waves from dog B, so the owner of dog A will receive a louder sound.</li> </ol> <p data-bbox="1314 581 1913 610"><b>Display Slide 43.</b> The Intensity of Sound (3 min)</p> <ol data-bbox="1314 659 1940 1281" style="list-style-type: none"> <li data-bbox="1314 659 1940 808">a. Remind participants that when an object makes a sound, it causes the air around it to vibrate. These vibrations in the air travel from the source in all directions. Vibrating molecules carry energy from the source.</li> <li data-bbox="1314 824 1913 919">b. <i>Intensity</i> refers to the amount of energy a sound wave possesses. A loud sound has a high intensity, and a soft sound has a low intensity.</li> <li data-bbox="1314 935 1934 1118">c. Intensity is related to the velocity of atoms in the air. In a loud sound, atoms in the air exhibit a higher velocity. This implies that the energy in the atoms is greater when the sound is louder. The velocity of atoms in a softer sound is much lower, which implies less energy in the atoms.</li> <li data-bbox="1314 1135 1919 1281">d. Emphasize that intensity is not the same as frequency. <i>Frequency</i> refers to the rate at which vibrations in the air are repeated. This difference will be explored in more detail during the next session.</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>The Intensity of Sound</b></p> <ul style="list-style-type: none"> <li>• Air molecules in louder sounds have a greater intensity than air molecules in softer sounds.</li> <li>• A source (soundmaker) exerts more energy to make louder sounds than softer sounds.</li> <li>• Your eardrums vibrate more vigorously when your ears catch (receive) a higher-energy sound than a lower-energy sound. Higher-energy sounds are much louder!</li> </ul>	<p><b>Display Slide 44.</b> The Intensity of Sound (2 min)</p> <ol style="list-style-type: none"> <li>Walk participants through the key ideas on the slide.</li> <li>Invite participants to ask questions or offer comments.</li> </ol>
		<p><b>Drawing the Velocity of Atoms</b></p> <p>The individual motion or velocity of atoms in the air can be illustrated as follows:</p>  <p>This method should be used sparingly to illustrate the difference in the motion of atoms. It's less useful in other contexts because it zooms in too much.</p>	<p><b>Display Slide 45.</b> Drawing the Velocity of Atoms (Less than 1 min)</p> <ol style="list-style-type: none"> <li>Note that another way of drawing sound is to emphasize the individual motion of atoms in the air. But this method should be used sparingly and only to illustrate the difference in the motion of atoms. It's much less useful in other contexts because it zooms in too much.</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>What Intensity Is and Is Not</b></p> <p>What intensity is:</p> <ul style="list-style-type: none"> <li>• The amount of energy a sound wave possesses (how much the atoms in the air move)</li> <li>• Relates to how much the air pressure changes</li> <li>• Causes an object to receive the energy to move when sound reaches the recipient</li> <li>• Determines volume or loudness (High intensity = loud).</li> <li>• Can be too much for your ear to handle (Ouch! Be careful with loudness!)</li> </ul> <p>What intensity is not:</p> <ul style="list-style-type: none"> <li>• The rate at which vibrations are repeated (frequency)</li> <li>• The highness or lowness of a tone (pitch)</li> </ul>	<p><b>Display Slide 46.</b> What Intensity Is and Is Not (2 min)</p> <p>a. Review the key points on the slide about what intensity is and is not.</p> <p>b. Note that large vibrations of atoms in high-intensity sound waves should never be confused with higher frequency, which is the rate at which the vibrations (motion of atoms) are repeated.</p>
		<p><b>Sound-Intensity Challenge</b></p> <ul style="list-style-type: none"> <li>• Why would any of these guys receive more sound than the others?</li> <li>• What would happen to the sound intensity for the guy who is really far away from the source? Why?</li> </ul> 	<p><b>Display Slide 47.</b> Sound-Intensity Challenge (10 min)</p> <p>a. As needed, review key ideas about the circular wavefront convention from slide 33.</p> <ul style="list-style-type: none"> <li>• The source is at the center (inner circle).</li> <li>• Circles (sound waves) travel away from the source in all directions.</li> <li>• Larger circles or sound waves traveled away from the source at an earlier time. Larger circles indicate weaker sound waves.</li> <li>• The energy in larger circles is spread out more thinly.</li> <li>• A person receives a sound when a circle or sound wave reaches his or her ears.</li> <li>• Ears capture less sound farther from the source, so the sound is less intense.</li> <li>• The distance between the circles is always the same. This represents wavelength.</li> </ul>



PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<div data-bbox="793 824 1293 846" style="background-color: #808080; height: 13px; margin-bottom: 10px;"></div> <p data-bbox="842 870 1241 894"><b>Content Deepening: Focus Question 2</b></p> <p data-bbox="842 919 1241 967">Why does a sound get softer (quieter) as you walk away from the source?</p> <ul data-bbox="863 984 1236 1065" style="list-style-type: none"> <li>• Think about this question as we watch a video about how we perceive sound at different distances.</li> </ul> <p data-bbox="1066 1154 1247 1170" style="text-align: right;"><a href="#">Link to video clip: Intensity of Sound</a></p>	<p data-bbox="1318 261 1913 342">b. Remind participants that in a real three-dimensional world, the circles would actually be spherical shells.</p> <p data-bbox="1318 367 1898 391">c. Introduce the challenge questions on the slide.</p> <p data-bbox="1318 415 1898 496">d. Elicit ideas from participants. Ask probe and challenge questions to clarify their thinking and reasoning.</p> <p data-bbox="1350 521 1556 545"><b>Ideal responses:</b></p> <ul data-bbox="1367 553 1944 789" style="list-style-type: none"> <li>• Sound waves are more spread out at greater distances and less spread out at smaller distances, so those closest to the source would receive more sound than others.</li> <li>• Sound intensity is greatest closer to the source and diminishes the farther sound travels from the source. So the guy who is far away from the source might not hear any sound at all.</li> </ul> <hr/> <p data-bbox="1318 829 1871 886"><b>Display Slide 48.</b> Content Deepening: Focus Question 2 (8 min)</p> <p data-bbox="1318 935 1787 959">a. Read the focus question on the slide.</p> <p data-bbox="1318 984 1898 1065">b. “Think about this question as we watch a video about how we perceive sound at different distances.”</p> <p data-bbox="1318 1089 1929 1146">c. Introduce the context of the Kahn Academy video <i>Why Do Sounds Get Softer?</i></p> <p data-bbox="1318 1170 1944 1349">d. “Imagine that you’re a fan at a concert standing very close to a loudspeaker. Pretty soon, your ears start to hurt, so you back up and move farther away from the speaker. Why does the sound seem softer when you’re farther away from a speaker compared to when you’re close to a speaker?”</p> <p data-bbox="1318 1373 1871 1455">e. Click on the video link at the bottom of the PowerPoint slide and play the video <i>Why Do Sounds Get Softer?</i> Stop the video at time</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			segment 4:51. f. Following the video, invite participants to ask questions and share comments and observations. Relate the ideas presented in the video to the focus question.
		<div style="background-color: #cccccc; height: 10px; margin-bottom: 5px;"></div> <p style="color: #c00000; margin: 0;"><b>Why Do Sounds Get Softer?</b></p> <p style="margin: 0;">Why does the sound seem softer when you're farther away from a speaker compared to when you're close to a speaker?</p> <ul style="list-style-type: none"> <li>• Answer this question in your science notebook using evidence from the video to support your ideas.</li> <li>• Be prepared to share your ideas and reasoning.</li> </ul>	<p><b>Display Slide 49.</b> Why Do Sounds Get Softer? (8 min)</p> <p>a. Review the question and instructions on the slide.</p> <p>b. <b>Individuals:</b> Have participants write the question in their notebooks and answer it using evidence from the video.</p> <p>c. <b>Pairs:</b> Have participants pair up with an elbow partner and briefly share their responses to the question.</p> <p>d. <b>Whole group:</b> Invite a few participants to share their ideas and reasoning with the group.</p> <p><b>Ideal response:</b> The sound seems softer farther away the speaker because the intensity of the sound diminishes as the distance increases and the sound energy decreases.</p>
<b>10-MINUTE BREAK</b>			

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p><b>Sound Waves and Their Properties</b></p> <ul style="list-style-type: none"> <li>• Read sections 4 and 5 in the content background document (resources, lesson plans binder).</li> <li>• Pair up with an elbow partner and discuss the Stop and Think question on page 9: <ul style="list-style-type: none"> <li>What would a pressure-time wave or sine wave look like for a very loud sound compared to a very quiet sound?</li> </ul> </li> <li>• In your notebook, draw sine waves to show what a loud sound and a quiet sound would look like.</li> </ul>	<p><b>Display Slide 50.</b> Sound Waves and Their Properties (10 min)</p> <p>a. <b>Individuals:</b> Have participants read sections 4 and 5 in the content background document (resources section of lesson plans binder).</p> <p>b. <b>Pairs:</b> Have participants pair up with an elbow partner and discuss the Stop and Think question on page 9. Direct participants to draw their own sine waves for a quiet sound and a loud sound in their science notebooks.</p>
		<p><b>Sound Waves and Their Properties</b></p> <p>Let's watch a video clip about the different properties of sound:</p> <ul style="list-style-type: none"> <li>• amplitude</li> <li>• period</li> <li>• frequency</li> <li>• wavelength</li> </ul> <p style="text-align: center;"><a href="#">Link to video clip: Sound Properties</a></p>	<p><b>Display Slide 51.</b> Sound Waves and Their Properties (12 min)</p> <p>a. "Next, we'll watch a short video clip about the properties of sound."</p> <p>b. Click on the video link at the bottom of the PowerPoint slide and play the Kahn Academy video <i>Sound Properties: Amplitude, Period, Frequency, Wavelength</i>. Stop the video at time segment 3:38.</p> <p>c. Following the video, have participants review their answers to the Stop and Think question in the content background document (page 9) and revise them based on what they learned from the video clip.</p> <p>d. "What do the sine waves for loud and quiet sounds look like? Let's hear your ideas and see how you represented these sounds."</p> <p>e. Invite participants to share their responses and diagrams with the group. Ask probe and challenge questions to clarify participants' thinking.</p> <p><b>Alternative:</b> Ask participants, "If I were to draw</p>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			<p>representations of a loud and a quiet sound on chart paper, what would the amplitude of the wave look like for each wave?" Then draw sine waves based on participants' input. Ask probe questions to clarify participants' ideas.</p> <p>f. Emphasize that louder sounds have greater intensity (more sound energy) and larger amplitudes.</p>
		<p><b>Reflect: Content Deepening Focus Questions</b></p> <ul style="list-style-type: none"> <li>• Why are some sounds loud, while other sounds are soft (quiet)?</li> <li>• Why does a sound get softer (quieter) as you walk away from the source? <ul style="list-style-type: none"> <li>• Answer these questions in your notebook.</li> <li>• Use evidence from today's investigations to support your ideas.</li> <li>• Be prepared to share your ideas and evidence with the group.</li> </ul> </li> </ul>	<p><b>Display Slide 52.</b> Reflect: Content Deepening Focus Questions (8 min)</p> <p>a. Review the focus questions on the slide.</p> <p>b. <b>Individuals:</b> Ask participants to write their answers to these questions in their science notebooks and support their ideas with evidence from today's investigations.</p> <p>c. <b>Whole group:</b> Invite participants to share their ideas and evidence with the group. Encourage participants to listen carefully to the ideas others share and be prepared to agree or disagree, ask questions, or add other ideas.</p>



PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<div style="background-color: #d3d3d3; height: 10px; margin-bottom: 5px;"></div> <p> <b>Key Science Ideas</b></p> <ul style="list-style-type: none"> <li>• The loudness or quietness of a sound (volume) is a <b>subjective</b> human perception of sound.</li> <li>• When we measure the loudness of a sound, we have to be less subjective, so we call it the <b>intensity</b> of the sound.</li> <li>• Loudness relates to the amplitude or the “tallness” of the sound (pressure) waves.</li> </ul>	<p><b>Display Slide 53.</b> Key Science Ideas (Less than 1 min)</p> <ol style="list-style-type: none"> <li>a. Highlight the key science ideas on the slide.</li> <li>b. Ask participants if they would like to add or revise anything.</li> </ol>
		<div style="background-color: #d3d3d3; height: 10px; margin-bottom: 5px;"></div> <p> <b>Key Science Ideas</b></p> <ul style="list-style-type: none"> <li>• In louder sounds, the compressions in the sound wave have a higher pressure (density) than the compressions in quieter sounds.</li> <li>• Sounds with greater intensity transfer more energy.</li> <li>• Sound moves away from a soundmaker equally in all directions, so the farther away you are from the source of the sound, the less energy (perceived loudness) there will be, and the softer or quieter the sound.</li> </ul>	<p><b>Display Slide 54.</b> Key Science Ideas (Less than 1 min)</p> <ol style="list-style-type: none"> <li>a. Highlight the key science ideas on the slide.</li> <li>b. Ask participants if they would like to add or revise anything.</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
<p>3:15–3:30 15 min</p> <p><b>Wrap-Up: Summary, Homework, and Reflections</b></p> <p>Slides 55–57</p>	<p><b>Purpose</b></p> <ul style="list-style-type: none"> <li>Summarize and reflect on the day’s learning, including progress made in understanding sound and the relationship between lesson analysis and asking effective elicit, probe, and challenge questions.</li> </ul> <p><b>What Participants Do</b></p> <ul style="list-style-type: none"> <li>Synthesize key ideas about the science content, questioning strategies, and lesson analysis.</li> <li>Copy down the homework assignment for day 3.</li> <li>Write reflections on STeLLA strategies 1, 2, and 3, and the science content.</li> </ul> <p><b>Handouts in PD Binder</b></p> <ul style="list-style-type: none"> <li>2.6 Daily Reflections—Day 2</li> </ul> <p><b>Supplies</b></p> <ul style="list-style-type: none"> <li>Science notebooks</li> </ul>	<p><b>Summary: Today’s Focus Questions</b></p> <p>What progress have we made in addressing today’s focus questions?</p> <ol style="list-style-type: none"> <li>How can lesson analysis help us better understand how elicit, probe, and challenge questions can reveal and challenge student thinking?</li> <li>Why are some sounds loud, while other sounds are soft (quiet)?</li> <li>Why does a sound get softer (quieter) as you walk away from the source?</li> </ol>	<p><b>Display Slide 55.</b> Summary: Today’s Focus Questions (8 min)</p> <ol style="list-style-type: none"> <li>Divide participants into three groups. Have Group 1 come up with some conclusions/key ideas related to focus question 1. Have Group 2 come up with conclusions/key ideas for focus question 2, and have Group 3 do the same thing for focus question 3.</li> <li>Give each group 2 minutes to come up with ideas and conclusions.</li> <li>Allow a 2-minute share-out for each group.</li> </ol>
		<p><b>Homework</b></p> <ol style="list-style-type: none"> <li>For tomorrow, read the STeLLA strategies booklet and complete the Z-fold summary chart for these two Student Thinking Lens strategies: <ul style="list-style-type: none"> <li><b>Strategy 4:</b> Engage students in analyzing and interpreting data and observations.</li> <li><b>Strategy 5:</b> Engage students in constructing explanations and arguments.</li> </ul> </li> <li>Don’t forget about the lesson-plan reading-and-reporting assignment due on day 4.</li> </ol>	<p><b>Display Slide 56.</b> Homework (1 min)</p> <ol style="list-style-type: none"> <li>Forecast that tomorrow you’ll tackle two new, closely interconnected Student Thinking Lens strategies.</li> <li>Have participants copy the homework assignment into their science notebooks.</li> <li>Remind participants about their homework for Friday (becoming experts on the lesson plans assigned to them).</li> </ol>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		<p style="background-color: #c0c0c0; margin: 0; padding: 2px;"><b>Reflections on Today's Session</b></p> <p>Complete the Daily Reflections sheet (handout 2.7 in PD program binder).</p> <ol style="list-style-type: none"> <li>1. What value do you see in analyzing student thinking and practicing questions that elicit, probe, and challenge student thinking? What concerns do you have about enacting these practices?</li> <li>2. Did you identify any science ideas that you are unclear about? If so, what helped you identify this uncertainty?</li> <li>3. What questions do you have about the purposes and goals of the RESPeCT PD program?</li> <li>4. Which norms are we successfully implementing? Which norms need more work?</li> </ol>	<p><b>Display Slide 57.</b> Reflections on Today's Session (6 min)</p> <p>a. Make sure participants have <b>at least 5 minutes</b> to think about the questions on the reflections sheet (handout 2.6 in the PD program binder) and write down their reflections.</p>