RESPeCT Summer Institute Professional Development Leader Guide (PDLG)

Grade Level	3	**Day**	8	**STeLLA Strategy**	SCSL Strategy F: Link Science Ideas and Activities SCSL Strategy G: Link Science Ideas to Other Science Ideas SCSL Strategy H: Highlight Science Ideas and Focus Question	**Subject Matter Focus**	Forces
Focus Questions	• How can science content storyline coherence be enhanced by explicitly implementing STeLLA strategy F (Make explicit links between science ideas and activities), strategy G (Link science ideas to other science ideas), and strategy H (Highlight key science ideas and focus question throughout)? • How will the Student Thinking Lens and Science Content Storyline Lens strategies help you teach the Forces lessons in the fall? • How can ideas about forces help us explain the motion of objects? • What is the difference between mass and weight? • How does precision in defining quantities affect our ability to analyze relationships between quantities and understand the world around us?						
Main Learning Goals	Participants will understand the following: • Strategies F, G, and H are all useful in constructing a coherent science content storyline. Strategy F ensures that students are thinking about science ideas before, during, and after each activity; strategy G focuses on making connections among key science ideas that are developed within and across lessons; and strategy H makes sure that key science ideas are highlighted for students throughout a lesson. • All of the SCSL and STL teaching strategies are highlighted in the Forces lesson plans that teachers will use in the fall. These lessons will support teachers in using and deepening their understandings of the STeLLA strategies. • Understanding the difference between mass and weight is key to understanding forces on Earth and in space. • Ideas about forces, net force, gravity, normal force, friction, speed, velocity, and acceleration can be used to predict and explain real-world observations of objects at rest or in motion. • Precise language in defining quantities facilitates viable comparisons of those quantities. • Precise language in defining quantities requires a rich understanding of a problem and can be used as a tool for analyzing novel situations. • A carefully defined quantity will convey a meaning for all values of the quantity, especially a meaning for zero and positive-versus-negative values.						

Preparation	**Materials**	**Videos**
Daily Setup Tasks • Check that video clips are correctly linked to PowerPoint (PPT) slides. • Set up PowerPoint. • Make sure video clips play correctly with good	**Posters and Charts** • STeLLA Framework and Strategies poster • Day-8 Agenda (chart) • Day-8 Focus Questions (chart) • Norms for Working Together (chart)	Video clips from one Forces lesson: • Video Clip 8.1: Wilde classroom (strategy F; before the activity); 8.1_mspcp_gr.3 .forces_wilde_L4_c5 • Video Clip 8.2: Wilde classroom (strategy F;

sound.
- Arrange furniture and food.
- Arrange participant materials.
- Put up posters and charts.

Planning and Preparation Tasks

- Study the PDLG, PowerPoint slides (PPTs), video clips, and handouts. Make changes to PPTs if needed. Modify text highlighted in light-blue font on slides and/or in PDLG to make it specific for your group
- Review the reflections from day 7 and create a summary slide.
- Watch the video clips and anticipate participant responses.
- Prepare charts for the day's agenda and focus questions.
- Prepare two charts to use during the lesson plan review (see slides 16 and 17). These charts will highlight which STL and SCSL strategies are covered in each lesson.
- Insert some possible meeting dates for school-year study-group meetings on PPT slide 20.
- Decide how you want to celebrate the end of the Summer Institute and insert those plans on the relevant PPT slide. (See some celebration suggestions in the leader notes for slide 52.)
- Review the activity for Forces lesson 6b in the lesson plans binder.
- For content deepening:
  - Make enough copies of the scenario pictures from handout 8.10 so that each team member will have a picture corresponding to the team's assigned scenario (from handout 8.9).
  - Assemble props for team skits (see Supplies section).
  - Review the four investigations that correspond with handouts 8.12–8.15 and decide which would be most beneficial for participants if there isn't enough time to

- Effective Science Teaching chart (from day 1)
- Strategy charts from days 1–7 (STL strategies 1–7 and SCSL strategies A, B, C, D, I)
- Chart of STL strategies highlighted in lesson plans (see PPT 16 for model)
- Chart of SCSL strategies highlighted in lesson plans (see PPT 17 for model)
- Parking Lot poster

Handouts in RESPeCT PD Binder Front Pocket

- Z-fold summary chart: Science Content Storyline Lens Strategies

Handouts in RESPeCT PD Binder, Day 8

- 8.1 Analysis Guide F: Making Explicit Links between Science Ideas and Activities
- 8.2 Analysis Guide G: Linking Science Ideas to Other Science Ideas (optional)
- 8.3 Analysis Guide H: Highlighting Key Science Ideas and Focus Question (optional)
- 8.4 Transcript for Video Clip 8.1
- 8.5 Transcript for Video Clip 8.2
- 8.6 Transcript for Video Clip 8.3
- 8.7 Transcript for Video Clip 8.4 (optional)
- 8.8 Overview of School-Year RESPeCT Study Groups
- 8.9 Scenario Cards (1 card/page per team) (from Forces lesson 6b)
- 8.10 Scenario Pictures (1 per participant for assigned scenario) (from Forces lesson 6b)
- 8.11 Mass versus Weight
- 8.12 Paddleball
- 8.13 Toy Car
- 8.14 Hockey Puck in Motion
- 8.15 Ball on an Incline
- 8.16 Carefully Defining Quantities

Supplies

- Science notebooks
- Chart paper and markers

during the activity); 8.2_mspcp_gr.3.forces_wilde_L4_c6–7
- Video Clip 8.3: Wilde classroom (strategy F; after the activity); 8.3_mspcp_gr.3.forces_wilde_L4_c8–9

Optional video clip from another Forces lesson:

- Video Clip 8.4: Wilde classroom (strategies G and H; review of the activity); 8.4_mspcp_gr.3.forces_wilde_L5_c10

For content deepening:

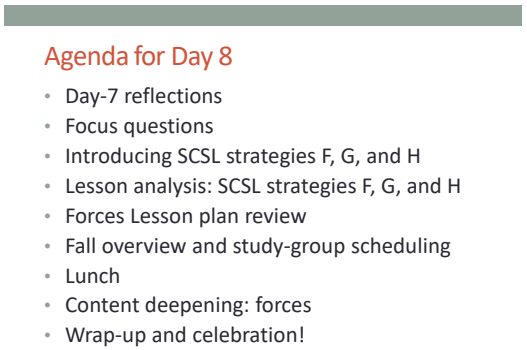
- *Explanation: Inclined Plane by Dr. Hector Mireles* (YouTube video); English version: https://www.youtube.com/watch?v=wB1IbcG-rpk; Spanish version: https://www.youtube.com/watch?v=V8aYEwPW-Es

conduct all of them. To allow time for the optional Ball-on-an-Incline investigation and the corresponding video clip, you may need to skip one or two of the other investigations.
• Check the links to the YouTube video clip *Explanation: Inclined Plane by Dr. Hector Mireles*—English version: https://www.youtube.com/watch?v=wB1IbcG-rpk; Spanish version: https://www.youtube.com/watch?v=V8aYEwPW-Es.
	• Colored pencils (for drawing vectors)
	• For content deepening investigation from lesson 6b:
	  • 10-foot rope (for tug-of-war)
	  • Shoes with heavy tread and shoes with smooth (slick) soles
	  • Sheet of smooth (slick) plastic or tarp (for slip and slide)
	  • 2 baseballs
	  • Foam-board arrows (2 short, 2 medium, 2 long)
	
	PD Resources
	• STeLLA strategies booklet
	• RESPeCT PD program binder
	• RESPeCT lesson plans binder
	
	Resources in Lesson Plans Binder
	Resources section:
	• Forces and Motion: Climate Content Background Document
	• Common Student Ideas about Forces and Motion	

DAY 8 SESSION OUTLINE

Time	Activities	Purpose
8:00–8:15 15 min	**Getting Started: Housekeeping, Agenda, Day-7 Reflections, Norms, Focus Questions**	• Build community by sharing participants' reflections from day 7. • Set the stage for a day of learning.
8:15–8:55 40 min	**Introducing SCSL Strategies F, G, and H**	• Deepen participants' knowledge of the purposes and key features of SCSL strategies F, G, and H. • Develop participants' understandings of the similarities and differences among strategies F, G, and H.
8:55–10:30 95 min (Includes 10-min break)	**Lesson Analysis: SCSL Strategies F, G, and H**	• Develop participants' ability to identify and analyze strategies F, G, and H in Forces lesson video clips. • Deepen participants' science-content knowledge of forces through lesson analysis.
10:30–12:00 90 min	**The Forces Lesson Plan Review and Fall Overview/Logistics**	• Deepen participants' understandings of the Forces lesson plans and the opportunities they provide to practice using STeLLA STL and SCSL strategies. • Help participants understand and feel comfortable with the fall activities and logistics.
12:00–12:45 45 min	**LUNCH**	
12:45–3:00 135 min (Includes 10-min break)	**Science and Math Content Deepening: Forces**	• Engage participants in synthesizing and summarizing science ideas about forces by explaining and acting out real-life scenarios from Forces lesson 6b. • Deepen participants' understandings of the difference between mass and weight and how they can be used to explain forces on Earth and in space. • Improve participants' abilities to analyze forces, speed, velocity, acceleration, and net force in real-world examples. • Facilitate participants' understandings of the importance of precision in defining quantities for better comprehension of quantitative relationships.
3:00–3:30 30 min	**Wrap-Up and Celebration**	• Help participants understand the relationships among the Science Content Storyline Lens strategies and when each strategy occurs in the lesson flow. • Facilitate understanding which SCSL strategies must be addressed in the planning process and which need to be anticipated in planning but occur responsively during the actual teaching of the lesson. • Recognize and celebrate participants' learning so far and anticipate further growth in the coming year.

DAY 8

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
8:00–8:15 15 min **Getting Started** Slides 1–5	**Purpose** • Build community by sharing participants' reflections from day 7. • Set the stage for a day of learning. **Posters and Charts** • STeLLA Framework and Strategies poster • Day-8 Agenda (chart) • Day-8 Focus Questions (chart)		**Display Slide 1.** RESPeCT PD Program (5 min) a. Take care of any housekeeping issues.
			**Display Slide 2.** Agenda for Day 8 (2 min) a. Talk through today's agenda.

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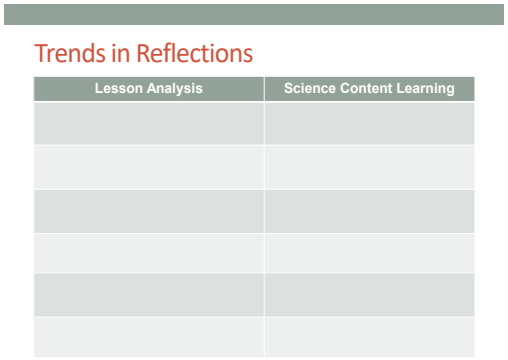
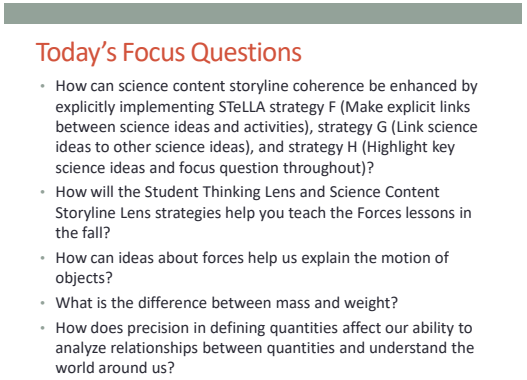
			**Display Slide 3.** Trends in Reflections (5 min) a. Give participants time to review your feedback on their reflections from day 7 and offer reactions, comments, or follow-up questions.
			**Display Slide 4.** Today's Focus Questions (2 min) a. Introduce the focus questions that will guide today's work.

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		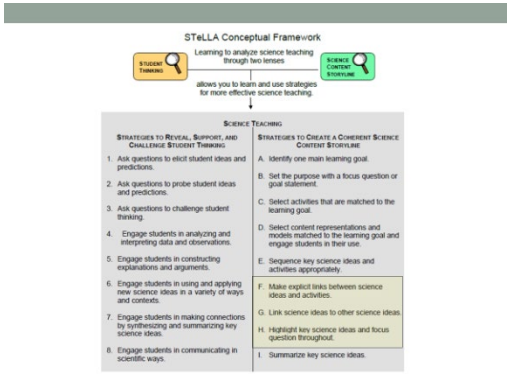	**Display Slide 5.** STeLLA Conceptual Framework (1 min) a. "Today we'll focus on three Science Content Storyline Lens strategies, all of which make explicit links to science ideas: • Strategy F explicitly links science ideas to activities that students are doing. • Strategy G explicitly links science ideas to other science ideas. • Strategy H explicitly highlights key science ideas and links them back to the focus question." b. "We won't address strategy E about sequencing science ideas and activities until the school year, since you'll learn a lot about sequencing from teaching the RESPeCT lesson plans."
8:15–8:55 40 min **Introducing SCSL Strategies F, G, and H**	**Purpose** • Deepen participants' knowledge of the purposes and key features of SCSL strategies F, G, and H. • Develop participants' understandings of the similarities and differences among strategies F, G, and H. **Content** • While strategies F, G, and H help students construct meaning from	Lesson Analysis: Focus Question 1 How can science content storyline coherence be enhanced by explicitly implementing STeLLA strategy F (Make explicit links between science ideas and activities), strategy G (Link science ideas to other science ideas), and strategy H (Highlight key science ideas and focus question throughout)?	**Display Slide 6.** Lesson Analysis: Focus Question 1 (Less than 1 min) a. Read the focus question on the slide.

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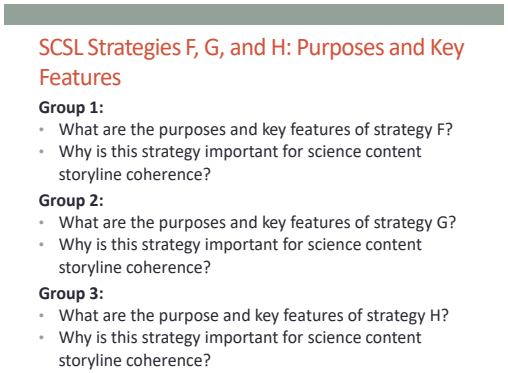
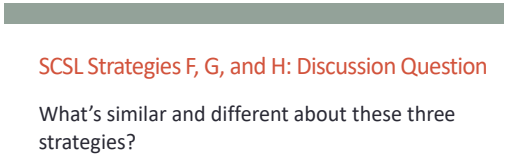
Slides 6–8	the science content storyline, each strategy has its own specific purpose. • In strategy F, activities that students carry out should be explicitly linked to the science content storyline so the science ideas are made visible to students before, during, and after an activity. • In strategy G, science ideas introduced in a lesson should be clearly and explicitly linked to the main learning goal(s) within and across lessons. • In strategy H, the science content storyline is easier for students to construct if the main learning goal, supporting science ideas, and flow of events are highlighted at key points during the lesson. **What Participants Do** • Make, share, and discuss charts summarizing the purposes and key features of strategies F, G, and H. **PD Resources** • STeLLA strategies booklet • SCSL Z-fold summary chart (front pocket of PD binder)		**Display Slide 7.** SCSL Strategies F, G, and H: Purposes and Key Features (30 min) a. **Small groups:** Divide participants into three groups to make charts that capture the purposes and key features of strategies F, G, and H. Direct groups to refer to their Z-fold summary charts and the STeLLA strategies booklet. b. **Whole group:** Have small groups share their charts with the entire group. c. Challenge participants to imagine themselves in their Teacher Leader roles. Ask them, "How would you explain these strategies to the teachers you're leading?"
			**Display Slide 8.** SCSL Strategies F, G, and H: Discussion Question (10 min) **Note:** This slide may be skipped if similarities and differences were addressed in the previous discussion. a. **Individuals (3 min):** "Look at your three strategy charts, your Z-fold summary charts, and the strategies booklet as you think about the question on the slide." b. **Whole group:** Have participants share their ideas about the three strategies. **Key ideas about strategies F, G, and H:** 1. Similarities: a. These strategies are all focused on linking complete sentence-length science ideas: Strategy F links science ideas to activities,

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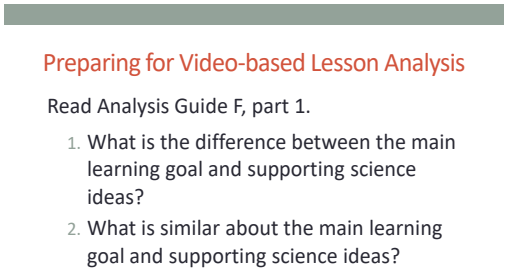
			strategy G links science ideas to other science ideas, and strategy H highlights key science ideas and links them to the focus question throughout the lesson. b. All of these strategies emphasize making the links **explicit**, not just assuming that students will see the intended links. c. All of these strategies can and should occur throughout the lesson. 2. Differences: a. Strategy F explicitly links science ideas to student activities. b. Strategy G explicitly links science ideas to other science ideas. c. Strategy H explicitly highlights key science ideas and links them back to the focus question.
8:55–10:20 95 min (Includes 10-min break) **Lesson Analysis: SCSL Strategies F, G, and H** Slides 9–13	**Purpose** • Develop participants' ability to identify and analyze strategies F, G, and H in Forces lesson video clips. • Deepen participants' science-content knowledge of forces through lesson analysis. **Content** • In strategy F, activities that students carry out should be explicitly linked to the science content storyline so the science ideas are made visible to students before, during, and after an		**Display Slide 9.** Preparing for Video-based Lesson Analysis (5 min) a. "Next we're going to watch a series of three classroom video clips from one lesson on forces. The first clip takes place before students begin the activity. The second shows students while they're working on the activity, and the third clip shows the teacher following up with students after the activity. Our focus for this analysis will be strategy F." b. Have participants locate Analysis Guide F (handout 8.1) in their PD program binders. c. Tell participants that part 1 of the guide provides the context for the video clips. d. **Individuals:** "Read part 1 of the analysis guide and

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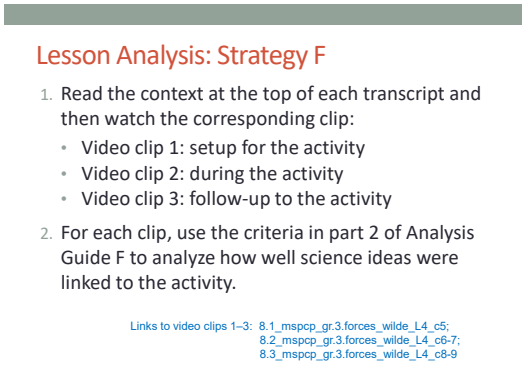
	activity. • In strategy G, science ideas introduced in a lesson should be clearly and explicitly linked to the main learning goal(s) within and across lessons. • In strategy H, the content storyline is easier for students to construct if the main learning goal, supporting science ideas, and flow of events are highlighted at key points during the lesson. **What Participants Do** • Identify and analyze the use of strategy F in four classroom video clips. • Identify and analyze the use of strategies F, G, and H in transcripts from the same four video clips. **Videos** • Video Clip 8.1, Wilde classroom (before the activity) • Video Clip 8.2, Wilde classroom (during the activity) • Video Clip 8.3, Wilde classroom (after the activity) • Video Clip 8.4, Wilde classroom (review of the activity) (optional) **Handouts in PD Binder** • 8.1 Analysis Guide F • 8.2 Analysis Guide G (optional) • 8.3 Analysis Guide H (optional) • 8.4 Transcript for Video Clip 8.1		be prepared to discuss the two questions on the slide." e. **Whole group:** • Discuss the questions on the slide. • Ask whether participants have any questions about the activity they'll be observing in the video clips. **Key ideas:** • *Difference between the main learning goal and supporting science ideas:* The main learning goal is the big idea that is the focus of the lesson. Supporting science ideas are smaller, connected ideas that build upon each other to support the main learning goal. • *Similarity between the main learning goal and supporting science ideas:* The main learning goal and supporting science ideas are all expressed as complete-sentence science ideas (not as topics, phrases, or activities).
			**Display Slide 10.** Lesson Analysis: Strategy F (45 min—15 min/clip) a. Have participants review part 2 of Analysis Guide F. After they watch each video clip, ask them to study the corresponding transcript, answer the questions in part 2 of the analysis guide, and then analyze the links between science ideas and activities that were (or were not) made before, during, or after the activity. b. Have participants read the context for video clip 1 at the top of the transcript (handout 8.4 in PD program binder). c. Show video clip 1. Then guide participants through

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	• 8.5 Transcript for Video Clip 8.2 • 8.6 Transcript for Video Clip 8.3 • 8.7 Transcript for Video Clip 8.4 (optional) **PD Resources** • STeLLA strategies booklet		these tasks: • **Individuals:** "Study the video transcript and then complete part 2, section 1 of the analysis guide, Setup for the Activity." • **Whole group:** Ask participants to share their analyses of the video clip. d. Have participants read the context for video clip 2 at the top of the transcript (handout 8.5 in PD binder). e. Show video clip 2 and then guide participants through these tasks: • **Individuals:** "Study the video transcript and then complete part 2, section 2 of the analysis guide, During the Activity." • **Whole group:** Ask participants to share their analyses of the video clip. f. Have participants read the context for video clip 3 at the top of the transcript (handout 8.6 in PD binder). g. Show video clip 3 and then guide participants through these tasks: • **Individuals:** "Study the video transcript and complete part 2, section 3 of the analysis guide, Follow-up to the Activity." • **Whole group:** Ask participants to share their analyses of the video clip. **Sample analysis for video clip 1:** • **Overview:** In the setup, the teacher helps students clarify that the force that made the car move—gravity—was always the same regardless of the surface it rolled over. This is a key idea, since the common misconception is that the car stops because it "runs out of force." Since the initial force is the same each time, something else must be

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			causing the car to stop at different distances. In this clip, the teacher allows students to surface their initial ideas. When Eliza voices the common misconception that the force must be different each time, the teacher uses probe and challenge questions to support the whole class in reconsidering and solidifying their thinking around what force made the car start moving versus what force caused the car to stop moving.
			• **Question a:** Students don't discuss or write about the focus question. Instead, the teacher uses a review of the car-and-ramp data to set up the focus question, *If gravity is the force that started the motion and gravity didn't change, then why do the cars stop?*
			• **Question b:** Explicit links are made between the car-and-ramp activity and science ideas:
			  • Video segments 00:02–00:52—Gravity starts the motion by pulling the car (not pushing it).
			  • Segments 00:57–02:19—The force of gravity doesn't change as the car continues to roll down the ramp.
			• **Question c:** If students are following the teacher's logic, they should understand that the force of gravity keeps pulling on the car as it goes down the ramp. So what causes the car to stop? Thus, the teacher uses data and science ideas to set up the focus question.
			
			Sample analysis for video clip 2:
			• **Question a:** Yes, students make links to science ideas. They're trying to use their observations of the bumps on the three surfaces to come up with explanations for why the car stops at different distances as it travels over different surfaces. They're also using the hand-strip content representation in their reasoning (video segments 01:31–01:45; 02:23–03:05. Students come up with the idea that the smoother surfaces have tinier

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			"hands" to slow down the car. • **Question b:** Yes, students should know they're expected to link science ideas to their observations because the context at the top of the transcript indicates that students were examining the three surfaces in order to generate an explanation for why the toy car stopped at a different distance on each surface. **Sample analysis for video clip 3:** • **Question a:** Yes, science ideas are explicitly linked to the activity in the follow-up. Students first use their own ideas and language (e.g., "negativity," "blocking," "gravity") to explain what causes the car to stop. The teacher then tells them that the force that stops the car is friction and has them write this word in their notebooks. • **Question b:** Yes, students are involved in making links between science ideas and the activity by identifying other examples of friction in their daily lives that causes objects to slow down and stop. • **Missed opportunity:** At video segment 03:56, the teacher asks a student, "What is the object that slows the ball down?"This is a missed opportunity to have students think about grass pushing on the ball as a force, not as an object. At segment 04:11, a student starts talking in a way that could suggest he's thinking about grass applying a force. A probe question here would have been very helpful!

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		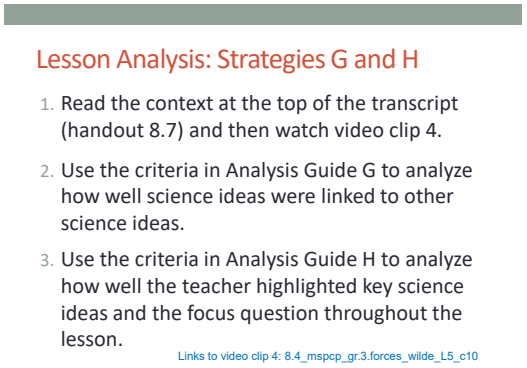	**Display Slide 11.** Lesson Analysis: Strategies G and H (15 min)
			
			Note: This analysis is optional.
			
			a. Have participants review the criteria in Analysis Guides G and H. After they watch the video clip, ask them to study the corresponding transcript (handout 8.7) and answer the questions in the analysis guides.
			
			b. Have participants read the context for video clip 4 at the top of the transcript (handout 8.7 in PD program binder).
			
			c. Show video clip 4. Then guide participants through these tasks:
			• **Individuals:** "Study the video transcript and then complete Analysis Guides G and H."
			• **Whole group:** Ask participants to share their analyses of the video clip.
			
			Key ideas to highlight:
			• How strategy G might look in a classroom setting:
			  • The teacher or students link ideas from one lesson to another.
			  • The teacher asks questions that encourage students to link ideas (make comparisons or connections). Examples:
			  • "Do these new ideas about x, y, z help you think about the focus question in new ways?"
			  • "Use the ideas we've been talking about to do this activity."
			  • "What does energy have to do with plants? Animals?"
			  • The teacher or students create concept maps or thinking maps to show relationships among

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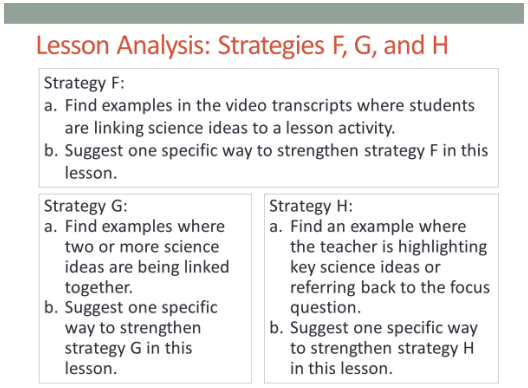
			ideas.
			• How strategy H might look in a classroom setting
			  • The teacher highlights key ideas on the board or chart paper.
			  • The teacher states, “This is an important idea.”
			  • The teacher summarizes key science ideas at key points during the lesson (not just at the end).
			  • The teacher uses content representations to highlight key science ideas.
			  • The teacher refers back to the focus question during the lesson.
			  • The teacher repeats or revisits key ideas multiple times in a lesson.

			**Display Slide 12.** Lesson Analysis: Strategies F, G, and H (20 min) **Note:** If time is running short, have participants work only on part A of their assigned tasks. a. Assign participants one of the strategies (F, G, or H) to analyze for this activity, and then go over the directions on the slide. Emphasize the importance of using the STeLLA strategies booklet and strategy charts as resources. **Note:** Participants may also refer to the analysis guides for strategies G and H during this analysis, but there isn’t enough time to work through each part. b. **Individuals:** “Study the transcripts for video clips 1–4 and search for examples of your assigned strategy being used during the lesson. Be ready to share your ideas with the group, and make sure to support your answers with evidence.” c. **Whole group:** Have participants share their

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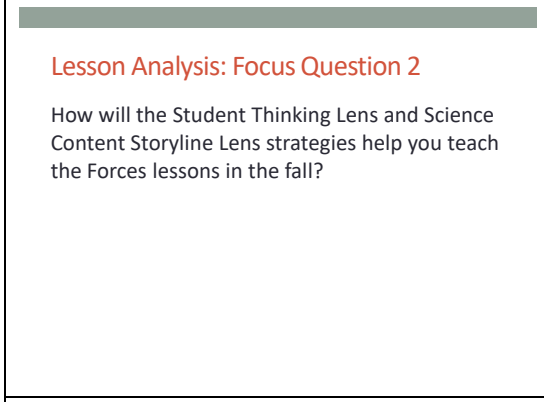
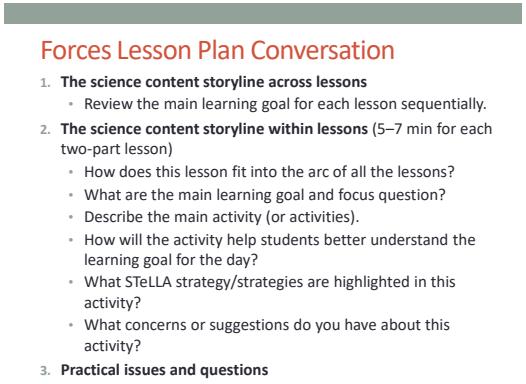
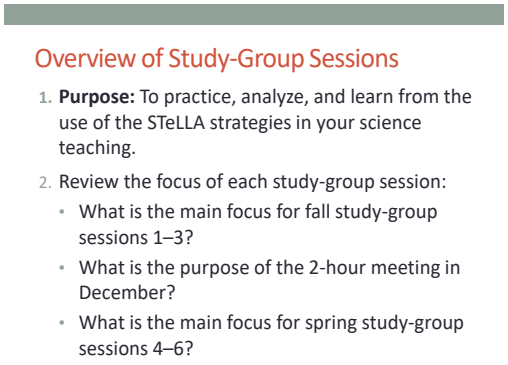
			findings. Encourage listeners to agree or disagree, ask clarification questions, and add on. **Sample analyses from the transcript for clip 4:** • **Strategy F:** In this clip, students clearly link their ideas about friction to the previous day's activity, referencing how far the car traveled, the bumps on a surface, and the push caused by the bumps (pushing "hands") as a force causing the car to slow down and stop. • **Strategy G:** An excellent example of a student making a link between two science ideas occurs at segment 04:17 when Giselle mentions that "you always can't see friction, just like you can't see gravity" (i.e., forces aren't visible; we can only observe the results of forces when an object's motion changes). Here the student is comparing and connecting what she knows about gravity and friction. • At video segments 02:50–04:11, students discuss whether air is a pushing force. In this discussion, they're linking ideas about the bumps on solid surfaces with ideas about how air might push back against a ball's motion. • **Strategy G, strengthened:** At segments 02:05–02:44, Lucy begins to connect the ideas about different-sized "hands" pushing back against motion and the amount of friction that the carpet, sandpaper, and tile surfaces generate. Perhaps with some probing (e.g., "Say more about …"), Lucy could have explicitly connected pushing with friction. Then a challenge question might have helped her connect pushing and friction to the concept of forces (e.g., "What do the ideas of pushing and friction have to do with forces?"). • **Strategy H:** In this clip, the teacher's primary highlighting strategy is to more clearly restate key ideas from student responses. Examples: • Segment 01:11: "So he's saying the friction is

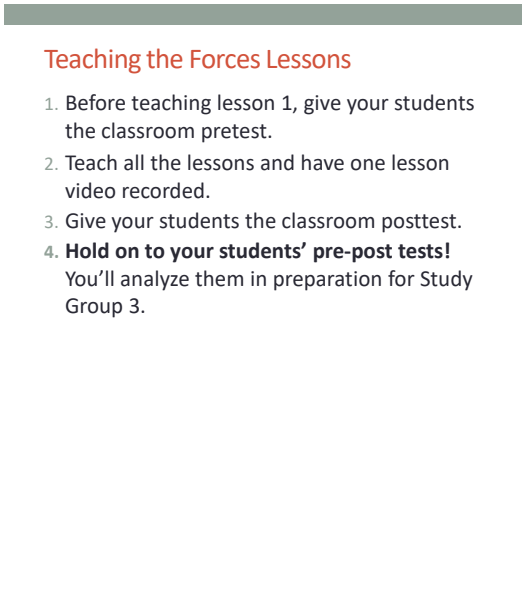
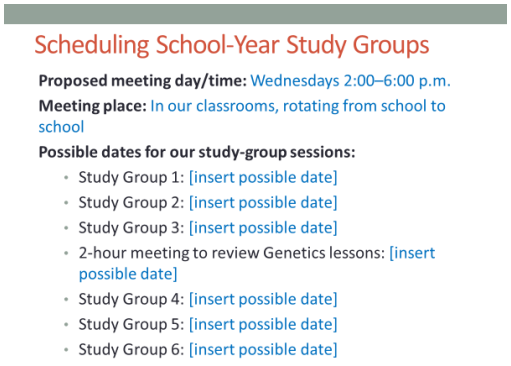
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			causing the car to stop." • Segment 05:52: "So Storm is saying the car is going this way, [and] the friction is pushing back the opposite way on the car." • **Strategy H, strengthened:** The teacher could have done more to highlight key ideas. Examples: • Segment 02:44: At this point, the teacher could have engaged students in a Turn and Talk to highlight the concept of friction (e.g., "Why does the carpet create more friction than the sandpaper or tile? Come up with a sentence or two to summarize what we've learned."). • Segment 04:11: The teacher could have engaged students in an activity highlighting the idea that friction can be present even if it can't be seen (e.g., "Everyone draw a picture to show why the ball thrown against the wind won't go as far as the ball thrown when there is no wind. What does this have to do with friction?").
		Summary: Strategies F, G, and H • Use linking strategies to make the science ideas explicit to the whole class (strategies F and G). • Engage **students** in linking science ideas to activities before, during, and after an activity (strategy F). • Engage **students** in linking science ideas to other science ideas (strategy G). • Highlight key science ideas throughout the lesson (strategy H). • Keep returning to the focus question throughout and at the end of the lesson (strategy H).	**Display Slide 13.** Summary: Strategies F, G, and H (Less than 1 min) a. Read the summary statements on the slide or give participants time to read them silently. b. Ask participants whether they have a brief comment or question about the summary.
10:20–10:30 10 min	**BREAK**		

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
10:30–12:00 90 min **The Forces Lesson Plan Review and Fall Overview/ Logistics** Slides 14–20	**Purpose** • Deepen participants' understandings of the Forces lesson plans and the opportunities they provide to practice using STeLLA STL and SCSL strategies. • Help participants understand and feel comfortable with the fall activities and logistics. **Content** • The Forces lesson plans highlight STeLLA strategies and support teachers in using these strategies. **What Participants Do** • Share key aspects of an assigned Forces lesson plan. • Chart which STeLLA strategies are highlighted in each lesson. • Decide on academic-year study-group meeting dates after the PD leader describes what will happen in the fall. **Handouts in PD Binder** • 8.8 Overview of School-Year RESPeCT Study Groups **PD Resources** • STeLLA strategies booklet • RESPeCT lesson plans binder		**Display Slide 14.** Lesson Analysis: Focus Question 2 (Less than 1 min) a. Read the focus question on the slide.
			**Display Slide 15.** Forces Lesson Plan Conversation (60 min in conjunction with the next two slides) **Note:** Create charts like the samples on the next two slides so that participants can view both as they report out. **Timing note:** Make sure you limit the time for each lesson conversation so you can get through them all. Aim for 5–7 minutes for each lesson. a. Give a brief overview of the science content storyline across lessons and then begin the lesson conversation. b. For step 1 on the slide, review the main learning goal for each lesson sequentially and how it connects to the lesson before and after it. (5 min) c. For steps 2 and 3, ask each participant to report on her/his two-part lesson, which was assigned on day 5. **Note:** Encourage participants to present the **big picture** using the questions in step 2 on the slide, **not to walk through every step in their lesson**

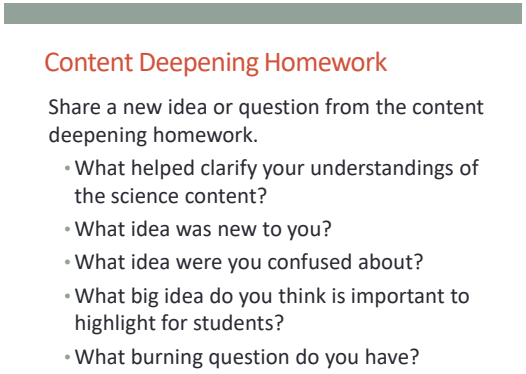
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			plans. They should bring up details only when they have some concern, question, or suggestion about a modification. d. As participants give their reports, fill in the charts you've created, checking off the main strategies highlighted in each lesson. (See the chart format on the next two slides.) **Note:** Encourage participants to pick just one or two Student Thinking Lens strategies and one or two Science Content Storyline Lens strategies that are actually highlighted in the lesson. (Each lesson uses several strategies.) **Ideal pattern to highlight for the Student Thinking Lens strategies:** • Lesson 1 should highlight questions that elicit and probe student thinking. Probe questions should continue throughout the lesson sequence, but the emphasis should shift to challenge questions throughout the later lessons as questioning strategies help to push student thinking forward. • Lessons 3 and 4 highlight analyzing and interpreting data and generating explanations. • Lessons 5 and 6 highlight use-and-apply tasks. **Ideal pattern to highlight for the Science Content Storyline Lens strategies:** • Each lesson should have a clear content storyline with an identifiable main learning goal, focus questions, and opportunities for students to summarize their thinking at the end of the lesson. Beginning with lesson 1, some connection should be made between what students learned in this lesson and what they'll learn in the next lesson. Beginning with lesson 2, clear links should be made between student learning in previous lessons and what students will learn in the current lesson.

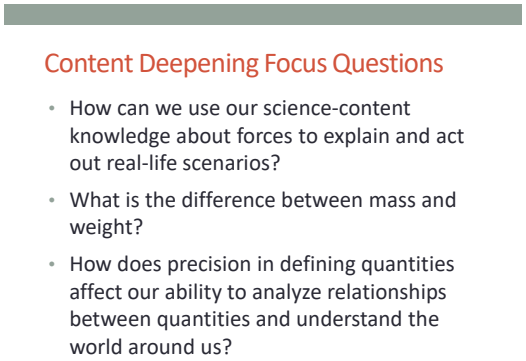
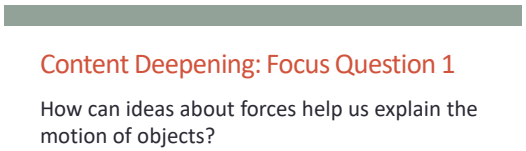
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 16.** STL Strategies Highlighted in the Forces Lessons a. As participants report out, complete the chart, indicating with check marks the STL strategies highlighted in the Forces lessons. b. Discuss the reasons certain strategies appear at specific times in the lesson sequence. (See ideal patterns on slide 15 and refer to the summary charts in the STeLLA strategies booklet as needed.)
			**Display Slide 17.** SCSL Strategies Highlighted the Forces Lessons a. As participants report out, complete this chart, indicating with check marks the SCSL strategies highlighted in the Forces lessons. b. Discuss the reasons certain strategies appear at specific times in the lesson sequence. (See ideal patterns on slide 15 and refer to the summary charts in the STeLLA strategies booklet as needed.)

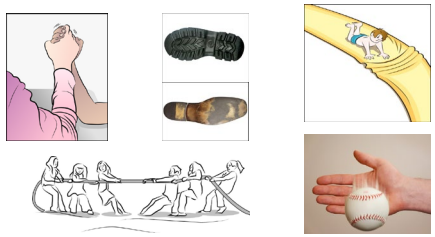
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 18.** Overview of Study-Group Sessions (5 min) a. Have participants locate handout 8.8—Overview of School-Year RESPeCT Study Groups—in their PD program binders. b. **Emphasize:** "The purpose of the study-group sessions is to practice, analyze, and learn from using the STeLLA strategies in your teaching of the Forces lessons in the fall and the Variation in Traits lessons in the spring." c. Talk participants through Study Groups 1–3 on the handout. d. Pause for questions and a summary task. Ask participants, "What is the main focus for fall study-group sessions 1–3?" e. Talk participants through the 2-hour meeting in December/January and Study Groups 4–6 on the handout. f. Pause for questions and a summary task. Ask participants, "What is the purpose of the 2-hour meeting in December/January?" and "What is the main focus for spring study-group sessions 4–6?"

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 19.** Teaching the Forces Lessons (10 min) a. Before going over this slide, have participants locate the Forces classroom pre-post test in their lesson plans binders (pretabs section). • **The classroom pre-post test:** "This test is in your lesson plans binder. After you administer the pre- and posttest to your students, you'll need to save all of them, since you'll be analyzing them as part of our study-group work in the fall." b. Review the steps on the slide. c. **Emphasize:** "It's very important to follow these steps in order and **save all of your classroom pre-post tests**. Don't return them to students until after Study Group 3."
			**Display Slide 20.** Scheduling School-Year Study Groups (15 min) **Note:** Include on this slide some possible dates for six 4-hour study-group meetings and the 2-hour meeting that occurs between Study Groups 3 and 4. a. Suggest possible dates for the study-group sessions, starting with the Wednesday afternoon slot from 2:00 to 6:00 p.m. **Note:** As you schedule the meetings, keep in mind that you'll need some time between the end of the school day and the beginning of the meeting to get to the location and set up everything. • **Study Group 1:** Early October. Round-1

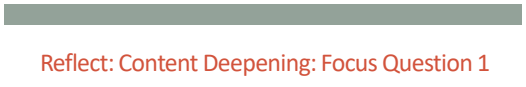
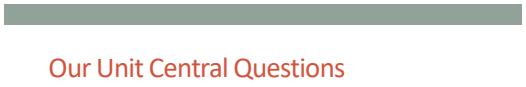
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			teachers should have their classroom video recordings completed at least three weeks before this session. You will need three weeks to watch the classroom video(s), select the ones you'll use during the study groups, and prepare the video-clip selections and transcripts. • **Study Group 2:** Mid-November. Round-2 teachers should have their classroom video recordings completed at least three weeks before this session. You will need three weeks to watch the classroom video(s), select the ones you'll use during the study groups, and prepare the video-clip selections and transcripts. • **Study Group 3:** Early December. This session can occur anytime after Study Group 2 and before the holiday break. • **2-hour meeting:** December/January. The purpose of this meeting is to review the Variation in Traits lesson plans in preparation for teaching them. • **Study Group 4:** Early February. Round-1 teachers should have their classroom video recordings completed at least three weeks before this session. You will need three weeks to watch the classroom video(s), select the ones you'll use during the study groups, and prepare the video-clip selections and transcripts. • **Study Group 5:** March. Round-2 teachers should have their classroom video recordings completed at least three weeks before this session. You will need three weeks to watch the classroom video(s), select the ones you'll use during the study groups, and prepare the video-clip selections and transcripts. • **Study Group 6.** April. This session can occur

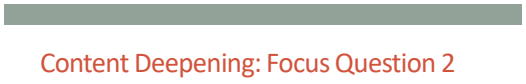
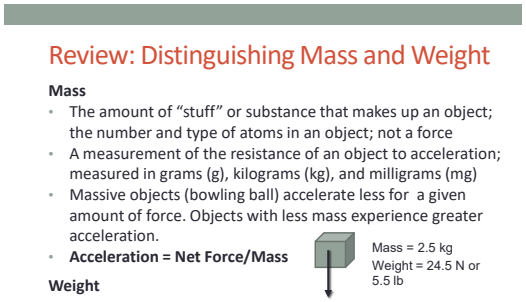
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			anytime after, but preferably within a month of, Study Group 5.
12:00–12:45 45 min	**LUNCH**		
12:45–3:00 135 min (Includes 10-min break) **Content Deepening: Forces** Slides 21–49	**Purpose** • Engage participants in synthesizing and summarizing science ideas about forces by explaining and acting out real-life scenarios from Forces lesson 6b. • Deepen participants' understandings of the differences between mass and weight and how they can be used to explain forces on Earth and in space. • Improve participants' abilities to analyze forces, speed, velocity, acceleration, and net force in real-world examples. • Facilitate participants' understandings of the importance of precision in defining quantities for better comprehension of quantitative relationships. **Content** • Science ideas about forces can be used to explain the forces acting on objects in everyday life. • Understanding the difference between mass and weight is key to understanding forces on Earth and in space.		**Display Slide 21.** Content Deepening: Forces (Less than 1 min) a. "Now we'll engage in some science and math content deepening to strengthen our understandings of forces and motion." **Note:** Throughout this content deepening phase, refer as needed to the content background document and Common Student Ideas about Forces and Motion.
			**Display Slide 22.** Content Deepening Homework (3 min) a. Invite participants to briefly share a new idea or question related to the content deepening homework from the previous session. b. Quickly address any misunderstandings or confusion, but don't spend time discussing ideas that will be presented during today's session (e.g., forces in outer space).

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	• Ideas about forces, net force, gravity, normal force, friction, speed, velocity, and acceleration can be used to predict and explain real-world observations of objects at rest or in motion. • Precise language in defining quantities facilitates viable comparisons of those quantities. • Precise language in defining quantities requires a rich understanding of a problem and can be used as a tool for analyzing novel situations. • A carefully defined quantity will convey a meaning for all values of the quantity, especially a meaning for zero and positive-versus-negative values. **What Participants Do** • Use science ideas about forces and motion to explain real-life scenarios and act them out. • Explore the difference between weight and mass and their relationship to forces on Earth and in space. • Use and apply science ideas to analyze the forces acting on objects in various scenarios. • Brainstorm and describe examples of quantities. • Define quantities in various scenarios using precise language.		**Display Slide 23.** Content Deepening Focus Questions (Less than 1 min) a. Read the focus questions on the slide that will be the focus of today's content deepening work.
			**Display Slide 24.** Content Deepening: Focus Question 1 (Less than 1 min) a. "We'll begin today's content deepening work by exploring how science ideas about forces can help us explain the motion of objects. This activity comes from Forces lesson 6b." b. Have participants write the focus question in their science notebooks and draw a box around it.

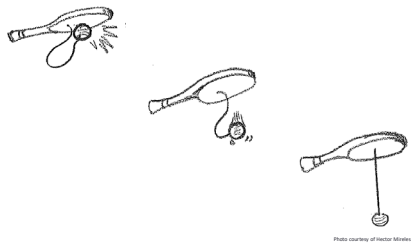
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Videos • *Explanation: Inclined Plane by Dr. Hector Mireles* (YouTube video) **Handouts in PD Program Binder** • 8.9 Scenario Cards (1 card/page per team) (from Forces lesson 6b) • 8.10 Scenario Pictures (1 per participant for assigned scenario) (from Forces lesson 6b) • 8.11 Mass versus Weight • 8.12 Paddleball • 8.13 Toy Car • 8.14 Hockey Puck in Motion • 8.15 Ball on an Incline • 8.16 Carefully Defining Quantities **Supplies** • Science notebooks • Chart paper and markers • Colored pencils (for drawing vectors) **Resources in Lesson Plans Binder** *Resources section:* • Content background document • Common Student Ideas	Investigation 1: Show What You Know Each team will explain and illustrate a scenario that might happen in everyday life. 	**Display Slide 25.** Investigation 1: Show What You Know (2 min) a. "For this investigation, you'll work in teams to explain the forces acting on objects in real-life scenarios and then act out these scenarios." b. Divide the group into teams of three or four participants and distribute one scenario from handout 8.9 (Scenario Cards) to each team. Then give each team member the corresponding picture for the team's scenario from handout 8.10 (Scenario Pictures).
		Investigation 1: Show What You Know 1. Have one team member read the scenario and instructions aloud. 2. Discuss the scenario with your teammates. Identify and describe all of the forces acting on the people or object(s) in your scenario. 3. Reach an agreement as a team on the strength and direction of the forces acting on the people or object(s). Then draw arrows (and bumps for some scenarios) on your own pictures to represent the forces involved.	**Display Slide 26.** Investigation 1: Show What You Know (6 min) a. Read through the directions on the slide before teams begin working on their assigned scenarios. b. Circulate among the teams and provide support as needed.

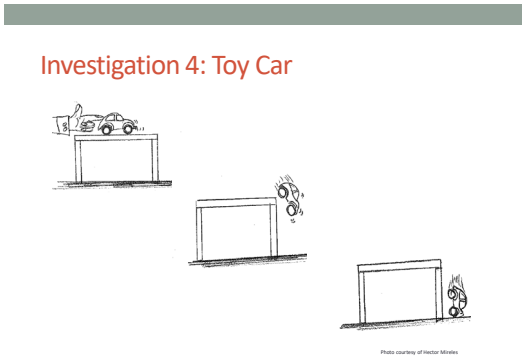
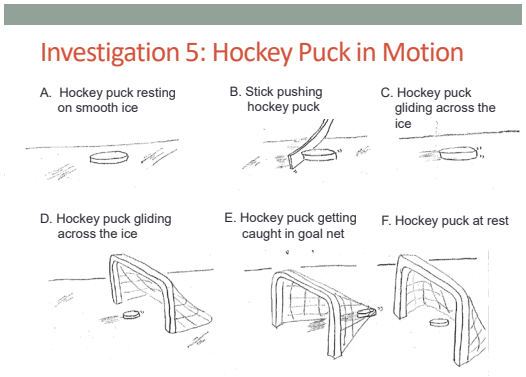
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		Investigation 1: Show What You Know 1. After you finish your drawings, discuss how your team can act out the forces in your scenario using the foam arrows. Keep our focus question in mind as you plan your skits! 2. You have 3 minutes to make these decisions as a group: • Who will act out the forces in the scenario? • Who will hold the arrows that represent the forces? • Which arrows will you use to represent the strength (size) and direction of the forces? 3. Let me know when you've made these decisions and finished planning your skit, and I'll give you some props to act out your scenario.	**Display Slide 27.** Investigation 1: Show What You Know (4 min) a. Read through the directions on the slide. Then give teams 3 minutes to decide how they'll act out their scenarios. b. Distribute the props for each scenario when teams have finished planning their skits.
		Investigation 1: Show What You Know Presenting the Physics Players in *Forces and Motion* 	**Display Slide 28.** Investigation 1: Show What You Know (10 min) a. Announce that each team will have 2 or 3 minutes to act out the forces in their scenario, using the props to illustrate the action taking place and the foam arrows to represent the strength and direction of the forces. b. Direct participants in the audience to pay close attention during the skit and be prepared to engage in scientific communication following the skit. c. Proceed through the skits in the following order: 1. Arm Wrestling 2. Tug-of-War 3. Shoes on the Ice 4. Slip and Slide 5. The Ball Drop d. Following each skit, engage in a brief group discussion. Encourage participants ask questions, offer comments, and agree or disagree with the

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			team's explanations of the forces in the scenario.
			**Display Slide 29.** Reflect: Content Deepening Focus Question 1 (2 min) a. Revisit the focus question on the slide. b. Ask participants to reflect on the previous investigation and answer the question in their science notebooks.
			**Display Slide 30.** Unit Central Questions (5 min) a. Review the unit central questions on the slide. b. **Individuals:** "Next, I'd like you to think about what you've learned about forces during our content deepening work this week. Then write your best answers for these questions in your science notebooks. Make sure to support your explanations with evidence and reasoning and include key science words like *force*, *friction*, and *gravity*." **Note:** Encourage participants to use their notes and resources from the investigations to help them develop their best answers to the questions. c. **Whole group:** Invite one or two participants to briefly share their explanations and reasoning with the group.

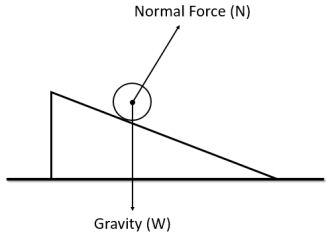
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 31.** Content Deepening: Focus Question 2 (Less than 1 min) a. Read the second content deepening focus question on the slide. b. "Next, we'll deepen our understandings of the distinctions between mass and weight." c. Ask participants to write the focus question in their science notebooks.
			**Display Slide 32.** Review: Distinguishing Mass and Weight (6 min) a. Quickly review the science ideas on the slide. b. **Pairs:** Ask participants to pair up with an elbow partner and develop a one-sentence statement summarizing the key differences between mass and weight. c. **Whole group:** Invite one pair of participants to share their statements with the group. Record key ideas on chart paper. d. Ask participants whether they would like to add or change anything. e. "In our next investigation, we'll continue exploring the differences between mass and weight on Earth and in space and why these differences matter."

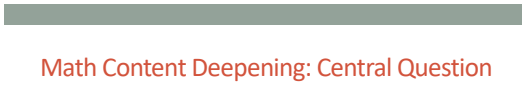
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		Investigation 2: Mass versus Weight • For each scenario, draw vectors representing the strength and direction of the forces acting on the astronaut. • Describe how the astronaut's mass in each scenario compares with his mass in the other scenarios. 	**Display Slide 33.** Investigation 2: Mass versus Weight (8 min) a. Distribute handout 8.11 (Mass versus Weight) and introduce the three scenarios. b. Emphasize that the astronaut's motion doesn't change in any of the scenarios. c. **Individuals:** Have participants complete the handout independently. d. **Whole group:** Invite participants to share their drawings and descriptions with the group.
		Reflect: Content Deepening Focus Question 2 What is the difference between mass and weight?	**Display Slide 34.** Reflect: Content Deepening Focus Question 2 (3 min) a. Revisit the focus question on the slide. b. **Individuals:** Have participants answer the question in their science notebooks, making sure to include any new ideas and evidence they gathered from the previous investigation. c. **Whole group:** Invite one or two participants to share their ideas and evidence with the group.
	10-MINUTE BREAK		

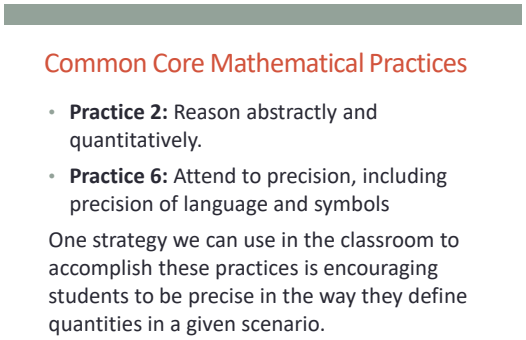
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		Investigation 3: Paddleball 	**Display Slide 35.** Investigation 3: Paddleball (7 min) **Note:** The next four investigations are use-and-apply tasks. They also require participants to synthesize and summarize the science concepts they've learned this week. If there isn't enough time to complete all of the investigations, select the ones you feel would be most beneficial for participants. a. "Next, we'll analyze phenomena that students will encounter during the Forces lesson sequence. In the first scenario, we'll use science ideas to analyze the forces acting on a paddleball." b. Distribute handout 8.12 (Paddleball) and describe the scenario. c. You may want to note that in each frame, the ball is the object receiving a push or pull from one or more other objects. This is the answer for column 3 (Object Experiencing Force[s]) on the handout. Alternatively, you can wait to provide this information after participants have completed the handout. d. **Pairs:** Have participants work with a partner to complete the table on the handout. e. "As you work through each frame, think about how you can use your science-content knowledge to analyze the forces acting on the paddleball, and how you can support students in their analyses." f. **Whole group:** Ask one or two pairs to share their responses and describe the way the ball's motion changes in each frame.

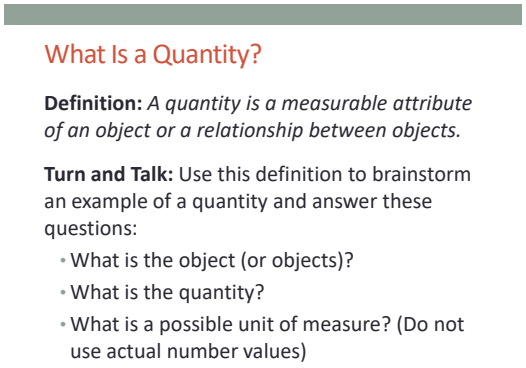
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 36.** Investigation 4: Toy Car (6 min) a. "In this scenario, we'll use science ideas to analyze the forces acting on a toy car." b. Distribute handout 8.13 (Toy car) and describe the scenario. c. **Pairs:** Have participants work with a partner to complete the table on the handout. d. "As you work through each frame, think about how you can use your science-content knowledge to analyze the forces acting on the car, and how you can support students in their analyses." e. **Whole group:** Ask one pair of participants to share their responses and describe the way the car's motion changes in each frame.
			**Display Slide 37.** Investigation 5: Hockey Puck in Motion (7 min) a. "In this scenario, we'll use science ideas to analyze the forces acting on a hockey puck." b. Distribute handout 8.14 (Hockey Puck in Motion) and describe the scenario. Participants should assume that the ice has recently been resurfaced, so it's perfectly smooth, with no friction. c. Review the three unique characteristics of motion: force, speed, and acceleration. d. **Individuals:** Have participants draw the forces acting on the hockey puck in each frame and answer the questions on the handout. e. "As you work through each frame, think about how you can use your science-content knowledge to

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			analyze the forces acting on the hockey puck, and how you can support students in their analyses." f. **Whole group:** Invite participants to share their drawing for each frame. Then discuss their responses to the questions.

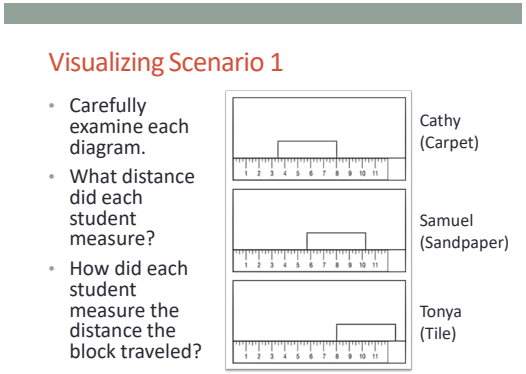
		Investigation 6: Ball on an Incline
		 
		
			Display Slide 38. Investigation 6: Ball on an Incline (10 min) (20 min including YouTube video)
			a. "In our final scenario, we'll use science ideas to predict the acceleration of a ball rolling down an incline."
			b. Distribute handout 8.15 (Ball on an Incline) and describe the diagram.
			c. **Individuals:** Have participants work through the challenge.
			d. An object rolling down a ramp can create confusion, since gravity causes the object to accelerate, but the acceleration isn't straight down. If participants are struggling with the task, engage them in the following discussion:
			• Ask, "If gravity alone acted on the ball, what would be the direction of gravity?"
			• Key ideas:
			  • To predict a net force, add the two forces on the diagram (gravity and normal force).
			  • Net force predicts the acceleration of an object.
			  • The ball experiences a downward pull (weight) and an upward pushing force from the ramp surface (normal force).
			• Ask, "What is the sum of these two vectors?"
			e. **Whole group:** Invite participants to share their predictions and justifications.

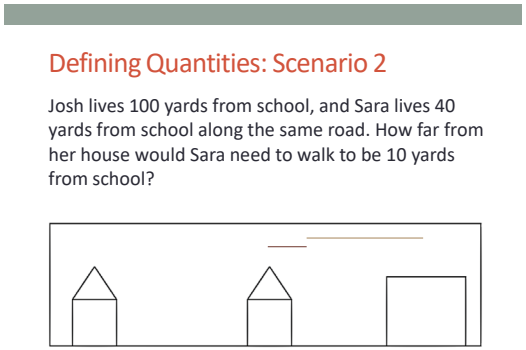
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			f. Show the YouTube video of Dr. Mireles explaining the solution to the challenge in detail (*Explanation: Inclined Plane by Dr. Hector Mireles*). **Note:** The video is optional if time is running short. To allow enough time for both the investigation and the video, you may need to skip one or two of the previous investigations.
			**Display Slide 39.** Math Content Deepening: Central Question (Less than 1 min) a. Introduce the central question that will guide the math content deepening sessions participants engage in over the summer and during the school year.
			**Display Slide 40.** Content Deepening: Focus Question 3 (Less than 1 min) a. Introduce the third content deepening focus question on the slide. b. "This focus question will guide our thinking for the rest of this content deepening session."

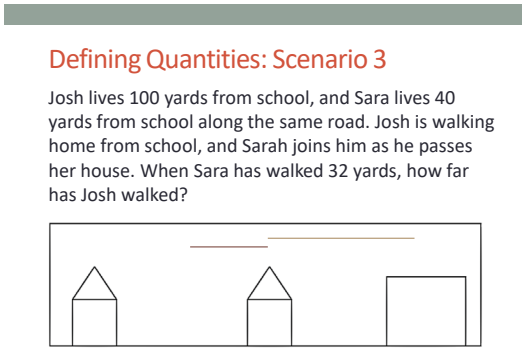
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 41.** Common Core Mathematical Practices (Less than 1 min) **Note:** This slide may be skipped if time is running short. a. Highlight the Common Core practices on the slide. **Key ideas to emphasize:** • **Practice 2:** Quantitative reasoning entails (1) creating a coherent representation of the problem at hand; (2) considering the units involved; (3) attending to the meaning of quantities, not just how to compute them; and (4) knowing and flexibly using different properties of operations and objects. • **Practice 6:** Attending to precision includes the need for precision using language and symbols when communicating about mathematical ideas. b. "One strategy we can use in the classroom to accomplish these practices is encouraging students to be precise in the way they define quantities in a given scenario."

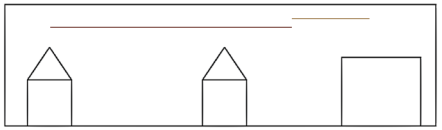
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 42.** What Is a Quantity (8 min) a. Introduce the definition on the slide. b. **Turn and Talk:** Ask participants to pair up with an elbow partner and brainstorm one example of a quantity. Participants should indicate what the object and quantity are, as well as the possible unit of measure. Discourage them from using actual number values. c. If participants are struggling to communicate what a quantity is beyond saying it's "a number" or "an amount," provide an example, such as the following: • **The height of a desk.** [*Answers:* The object is a desk; a measurable attribute is the height of the desk from the bottom of the leg to the surface of the tabletop; a possible unit of measure is inches.] • **The height of an airplane above ground.** [*Answers:* The objects are the airplane and the ground; a measurable attribute is the distance between the airplane and the ground; a possible unit of measure is feet.] • **The distance of a football scrimmage line from the 50-yard line**. [*Answers:* The object is the scrimmage line in a football game; a measurable attribute is the distance between the scrimmage line and the 50-yard line on the football field; a possible unit of measure is yards.] d. Listen to participants during the Turn and Talk and note any vague references to quantities (e.g., distance, time, speed, length). e. **Whole group:** Invite one or two pairs to share their

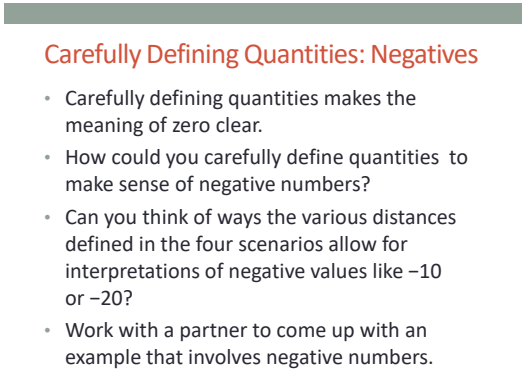
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			examples with the group. Make sure they answer all of the questions on the slide. f. Emphasize that quantities can be defined *without* using numerical values. A quantity is something that *can* be measured, but that doesn't mean we *must* measure it. When a quantity is defined as something measurable, the description of that quantity must clearly indicate the meaning of zero and directionality. For instance, we could define a quantity as the number of hours since noon. • If the value of the quantity is zero, then we know that corresponds to a clock reading 12:00 p.m. • If the value of the quantity is −1.5, then we know that corresponds to a clock reading 10:30 a.m. • If the value of the quantity is 2.75, then we know that corresponds to a clock reading 2:45 p.m.
		Defining Quantities: Scenario 1 Three students conduct an experiment to see how far a block of wood moves on different surfaces—carpet, sandpaper, and tile—before stopping. Each student measures the distance the block moved without discussing their results. This is the data they reported: Student (Surface) / Cathy (Carpet) / Samuel (Sandpaper) / Tonya (Tile) Distance Measurement / 8 in / 8 in / 8 in	**Display Slide 43.** Defining Quantities: Scenario 1 (4 min) a. "Next, we'll analyze how quantities are defined in four different scenarios." b. Distribute handout 8.16 (Carefully Defining Quantities) and introduce scenario 1. c. **Turn and Talk:** Direct participants to work with an elbow partner to generate possible explanations for the identical distance measurements in spite of the logical expectation that friction would cause the block to travel different distances on different types of surfaces. d. **Whole group:** Invite one pair of participants to share their explanation with the group. Encourage

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			others to agree, disagree, add on, and ask questions during this discussion. **Note:** If time is running short, you may need to scale back or skip the group discussion.
			**Display Slide 44.** Visualizing Scenario 1 (4 min) a. "To figure out why the distance measurements were identical, we need to determine exactly how each student measured the distance the block traveled on each surface." b. **Individuals:** Ask participants to carefully study the diagrams on the slide and precisely define the quantity each student measured. Tell them to assume that the ruler was placed at the base of the ramp starting at 0 inches in each instance. c. **Whole group:** Invite participants to share their ideas with the group. Encourage those listening to ask questions if a definition is vague or open to multiple interpretations. For example, if a participant says, "Cathy measured the distance from the base of the ramp in inches," someone might ask whether a value of 3.5 inches could be used to describe that distance. A more precise description would be that Cathy measured the distance in inches from the base of the ramp to the front of the block (the end closest to the ramp). **Ideal responses:** • Cathy measured the distance in inches from the base of the ramp to the front of the block (the end closest to the ramp). • Samuel measured the distance in inches from the base of the ramp to the middle of the block. • Tonya measured the distance in inches from the base of the ramp to the back of the block (the end

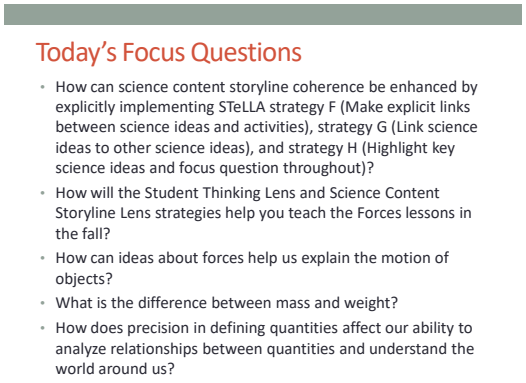
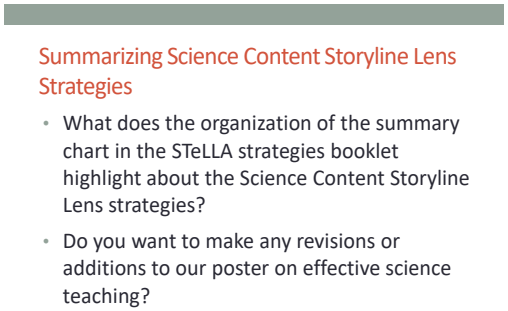
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			farthest from the ramp).
			**Display Slide 45.** Defining Quantities: Scenario 2 (7 min) a. Introduce scenario 2 on the handout. b. Ask, "Which buildings represent the school, Josh's house, and Sara's house?" c. **Individuals:** Have participants work through the tasks on the handout and answer the question. Challenge them to reflect throughout the activity on how being careful with their definitions helps them better understand the relationships they're investigating. **Note:** The ruling lines on the slide measure distances from the center of the buildings rather than the perimeter. If you prefer having participants measure from the perimeter of each building, you may want to adjust the lines on the slide. d. **Whole group:** Invite participants to share their definitions and solutions with the group. Remind them to use precise definitions to define the quantities involved. For example, if a participant says, "Sara's distance," there is no exact reference point, so the participant could be talking about Sara's distance from Josh's house, her school, her own house, or any other location. **Ideal response:** • In this scenario, Sara is walking from home to school. That's the activity. The quantities of interest are as follows: 1. The distance in yards from Sara's house as she walks to the school.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			2. The distance in yards from Sara to the school. • A measure of 0 for the first quantity signifies that Sara's distance from her home is 0 yards, which means that she hasn't left her house yet. A measure of 0 for the second quantity signifies that Sara is 0 yards from school, which means that she has arrived at school. • We know the sum of these two distances is 40 yards because Sara's house is 40 yards from the school. So for Sara to be 10 yards from the school, she must walk a distance of 30 yards from her house.
			**Display Slide 46.** Defining Quantities: Scenario 3 (7 min) a. Introduce scenario 3 on the handout. b. **Individuals:** Have participants work through the tasks on the handout and answer the question. **Note:** The ruling lines on the slide measure distances from the center of the buildings rather than the perimeter. If you prefer having participants measure from the perimeter of each building, you may want to adjust the lines on the slide. c. **Whole group:** Invite participants to share their definitions and solutions with the group. Make sure they're using precise definitions and reasoning to define the quantities involved. **Ideal response:** • In this scenario, Josh is walking from school to his house. As he passes Sara's house, she joins him and walks with him to his house. That's the activity. The quantities of interest are as follows: 1. The distance in yards from Sara's house to Josh's house.

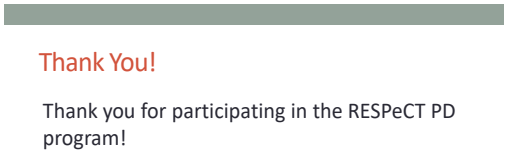
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			2. The distance in yards from the school to Josh's house. • A measure of 0 for the first quantity signifies that the distance from Sara's house is 0 yards, which means that Josh and Sara are right in front of Sara's house. A measure of 0 for the second quantity signifies that the distance from school to Josh's house is 0 yards, which means that Josh is at the school. • The distance Josh walks from the school will be the distance he walks before Sara joins him (40 yards), plus the distance Sara walks with him to his house. So when Sara has walked 32 yards, Josh will have walked 72 yards.
		Defining Quantities: Scenario 4 Josh lives 100 yards from school, and Sara lives 40 yards from school along the same road. How far does Josh need to walk from home to meet Sara halfway through her walk home from school? 	**Display Slide 47.** Defining Quantities: Scenario 4 (5 min) a. Introduce scenario 4 on the handout. b. **Individuals:** Have participants work through the tasks on the handout and answer the question. **Note:** The ruling lines on the slide measure distances from the center of the buildings rather than the perimeter. If you prefer having participants measure from the perimeter of each building, you may want to adjust the lines on the slide. c. **Whole group:** Invite one or two participants to share their definitions and solutions with the group. Make sure they're using precise definitions and reasoning to define the quantities involved. **Ideal response:** • In this scenario, Josh is walking from home to the school. He is going to meet up with Sara when she is halfway from the school to her house and walk with her the rest of the way. That's the activity. The

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			quantities of interest are as follows: 1. The distance in yards from the school to Sara's house. 2. The distance in yards from Josh's house to the school. • We know the sum of the two defined quantities will equal 100 yards because Josh's house is 100 yards from school, and Sara is walking home from school. When Sara is halfway home, the distance from the school to her house will be half of 40, or 20 yards. So Josh must walk 80 yards to meet her halfway through her walk.
			**Display Slide 48.** Carefully Defining Quantities Negatives (7 min) a. Walk participants through the scenario on the slide. b. **Turn and Talk:** Have participants pair up with an elbow partner and come up with an example of how carefully defined quantities in one of the scenarios would allow for interpretations of negative values. c. If participants are struggling with this challenge, use the following example: If Josh walked a distance of −20 yards from Sara's house toward the school, then he's actually 20 yards in the opposite direction of school from Sara's house. d. **Whole group:** Invite participants to share their examples with the group. e. Note that using a number line or measuring tools like rulers can support the practice of carefully defining quantities. If time allows, discuss why a ruler is placed with 0 at a specific location and is pointed in a specific direction.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		 Reflect: Content Deepening Focus Question 3 How does precision in defining quantities affect our ability to analyze relationships between quantities and understand the world around us?	**Display Slide 49.** Reflect: Content Deepening Focus Question 3 (4 min) a. Review the focus question on the slide. b. **Individuals:** Ask participants to reflect on the big ideas from the previous investigations regarding precision in defining quantities. Then have them answer the focus question in their notebooks using two or three complete sentences. c. **Whole group:** Invite a one or two participants to share their answers with the group. d. Highlight these takeaways: • Language precision in defining quantities allows for viable comparisons of the quantities involved (e.g., the block-and-ramp experiment was a failure because the quantities weren't precisely or consistently defined). • Language precision in defining quantities requires a rich understanding of the problem scenario and can be used as a tool for analyzing novel situations. • A carefully defined quantity will convey a meaning for all values of the quantity, especially a meaning for zero and positive versus negative values. • Focusing on language precision in defining quantities supports thinking about number lines, a reference point (and a corresponding frame of reference), and measurement.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
3:00–3:30 30 min **Wrap-Up and Celebration** Slides 50–53	**Purpose** • Help participants understand the relationships among the Science Content Storyline Lens strategies and when each strategy occurs in the lesson flow. • Facilitate understanding which SCSL strategies must be addressed in the planning process and which need to be anticipated in planning but occur responsively during the actual teaching of the lesson. • Recognize and celebrate participants' learning so far and anticipate further growth in the coming year. **Content** • Many of the SCSL strategies must be completed during the planning stage. Strategies B, F, G, H, and I are moves the teacher makes while teaching. But planning and anticipating how these strategies will help develop the lesson is critical to success. • The RESPeCT lesson plans provide examples of how strategies B, F, G, H, and I might be used during the lessons. • Strategies F, G, and H should be used throughout the lesson. Strategy B is used at the beginning of a lesson, and strategy I is used at the end.		**Display Slide 50.** Today's Focus Questions (5 min) a. **Individuals:** Give participants a couple of minutes to think about today's focus questions and then answer them in their notebooks. **Note:** If time is running short, have participants choose one question to answer. b. **Whole group:** If time allows, have a share-out of ideas.
			**Display Slide 51.** Summarizing Science Content Storyline Lens Strategies (10 min) **Note:** Display one question at a time on the slide. a. "This week we focused on the Science Content Storyline Lens and strategies. Let's synthesize and summarize our learning by looking at the summary chart in your strategies booklet—Summary of the STeLLA Science Content Storyline Lens Strategies." **Note:** Participants may also refer to their SCSL Z-fold summary charts for this activity. b. **Individuals:** "Look at this summary chart and how it's organized. What do you think the organization highlights? Write your observations in your notebooks." c. **Whole group:** "What did you notice about the organization of this chart? What does it highlight about the science content storyline strategies?" d. Reveal the second discussion question on the slide

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	What Participants Do • Participants study the SCSL summary chart in the STeLLA strategies booklet to identify key patterns and relationships among the strategies. **Posters and Charts** • Effective Science Teaching chart **Supplies** • Science notebooks **PD Resources** • STeLLA strategies booklet • **Optional:** SCSL Z-fold summary chart (front pocket of PD binder)		and invite participants to suggest additions or changes to the Effective Science Teaching chart. **Key ideas:** 1. Many of the SCSL strategies must be completed during the lesson planning stage. For example, the main learning goal and activities that match them must be selected ahead of time. 2. Strategies B, F, G, H, and I are moves the teacher makes while teaching the lesson, but planning and anticipating how these strategies will help develop the lesson is critical to success. 3. The RESPeCT lesson plans provide examples of how strategies B, F, G, H, and I might be used during the lessons. 4. Strategies F, G, and H should be applied throughout the lesson. Strategy B is used at the beginning of a lesson, and strategy I is used at the end. 5. Each strategy has its own distinct purpose(s), but all of them contribute to creating a coherent science content storyline.
		Let's Celebrate! Design your own end-of-program celebration and insert any comments or instructions here.	**Display Slide 52.** Let's Celebrate! (15 min) a. Decide how you'll celebrate the end of the RESPeCT PD program, and modify the slide accordingly. Here are a few ideas: • Have refreshments and toast the group's success with a bubbly, nonalcoholic drink. • Have everyone write on an index card a "golden nugget" that represents something they're taking away from the Summer Institute experience. Pass around a bowl filled with chocolates wrapped in gold paper, and have participants take a piece of chocolate when they drop their cards in the bowl. After the bowl

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			is passed around, share the golden nuggets with the group. • Take a group photo.
			**Display Slide 53.** Thank You! (Less than 1 min) a. Before dismissing participants, thank them for participating in the RESPeCT PD program.