RESPeCT Summer Institute Professional Development Leader Guide (PDLG)

Grade Level	6	**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**	The Sun's Effect on Climate (SEC)
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 SEC lessons in the fall? • Approximately how large and far from Earth would the Sun need to be in a scale model in which a marble represents Earth? • What objects could *most accurately* represent the Sun and Earth in a scale model in which Earth's orbit fit just inside your classroom? • Why is an inaccurate Earth-Sun model used in SEC lesson 3?						
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 SEC lesson plans that teachers will use in the fall. These lessons will support teachers in using and deepening their understandings of the STeLLA strategies. • By creating a scale model in which a marble represents Earth, ratios and proportions can be used to visualize and determine the relative scale of objects in the Earth-Sun system. • By using ratios and proportions, simple equations can be set up and solved to determine the relative scale of the Sun and Earth based on a scale model of Earth's orbit around the Sun. • The Earth-Sun model used in SEC lesson 3 (consisting of a lightbulb, a Hula Hoop, and a Styrofoam ball) intentionally exaggerates the size of Earth and diminishes the scale of Earth's orbit to highlight the lesson's main learning goal.						

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 sound.	**Posters and Charts** • STeLLA Framework and Strategies poster • Day-8 Agenda (chart) • Day-8 Focus Questions (chart) • Norms for Working Together (chart) • Effective Science Teaching chart (from	Video clips from one SEC lesson: • Video Clip 8.1: Anderson classroom (strategies F, G, H; before the activity); 8.1_stella_SEC_anderson_c2 • Video Clip 8.2: Anderson classroom (strategies F, G, H; before the activity);

- 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 15 and 16). 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 19.
- 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 48.)
- For content deepening:
  - Set up the Vimeo video *To Scale: The Solar System*. Make sure the Internet connection, projection system, sound system, and web browser are working properly.
  - Locate the North Star image used on day 6 and display it again near the ceiling on a north-facing wall.

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 15 for model)
- Chart of SCSL strategies highlighted in lesson plans (see PPT 16 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 Transcript for Video Clip 8.1
- 8.3 Transcript for Video Clip 8.2
- 8.4 Transcript for Video Clip 8.3
- 8.5 Transcript for Video Clip 8.4
- 8.6 Overview of School-Year RESPeCT Study Groups

Handouts in RESPeCT Lesson Plans Binder

- 3.2 Image of North Star (Teacher Master) (from SEC lesson 3b)

PD Leader Masters, Days 5–8

- PD Leader Master: Script for Outdoor Activity

Supplies

- Science notebooks
- Chart paper and markers
- Small blue marble
- Cup of water deep enough to dunk the marble in
- 20-watt appliance lightbulb
- Earth-Sun model from lesson 3 materials kit (lightbulb setup, Styrofoam ball on stand, Hula Hoop)

8.2_stella_SEC_anderson_c3

- Video Clip 8.3: Anderson classroom (strategies F, G, and H; during the activity); 8.3_stella_SEC_anderson_c4
- Video Clip 8.4: Anderson classroom (strategy F, G, H; after the activity); 8.4_stella_SEC_anderson_c5

For content deepening:

- *To Scale: The Solar System* (Vimeo video)

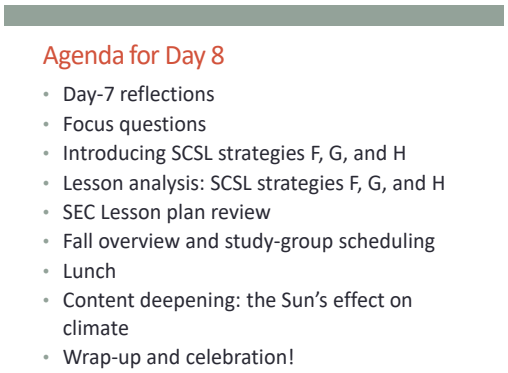
	• 2 sheets of chart paper and markers (2 colors) **PD Resources** • STeLLA strategies booklet • RESPeCT PD program binder • RESPeCT lesson plans binder **Resources in Lesson Plans Binder** *Resources section:* • The Sun's Effect on Climate Content Background Document • Common Student Ideas about the Sun's Effect on Climate and Seasons	

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 SEC lesson video clips. • Deepen participants' science-content knowledge of the Sun's effect on climate through lesson analysis.
10:30–12:00 90 min	**The Sun's Effect on Climate Lesson Plan Review and Fall Overview/Logistics**	• Deepen participants' understandings of the SEC 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)	**Math Content Deepening: The Sun's Effect on Climate**	• Engage participants in applying ratios and proportional reasoning to construct a relatively accurate scale model that enables them to experience the vast range of scales involved in the lesson series and discern which features of the system are relevant in explaining seasonal temperature patterns. • Engage participants in using and applying ratios and proportional reasoning to design a scale model of the Earth-Sun system in which a small appliance lightbulb represents the Sun, a grain of sand represents Earth, and the radius of Earth's orbit is about 4 meters. • Understand that the Earth-Sun model used in SEC lesson 3 is far from being an accurate scale model of the Earth-Sun system, but the distortions are intended to highlight key features involved in the lesson's main learning goal.

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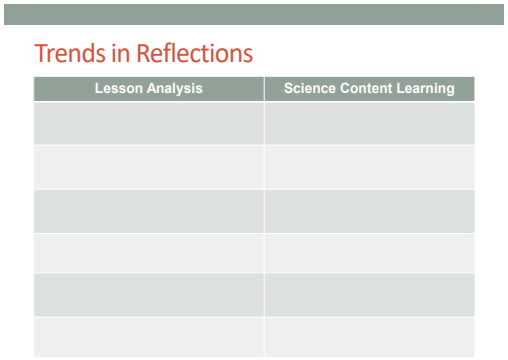
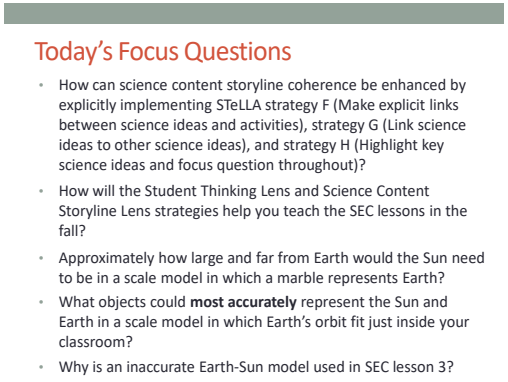
			**Display Slide 3.** Trends in Reflections (5 min) a. Give participants time to review your feedback on their reflections from day 7 and offer reactions, comments, or follow-up questions.
			**Display Slide 4.** Today's Focus Questions (2 min) a. Introduce the focus questions that will guide today's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

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		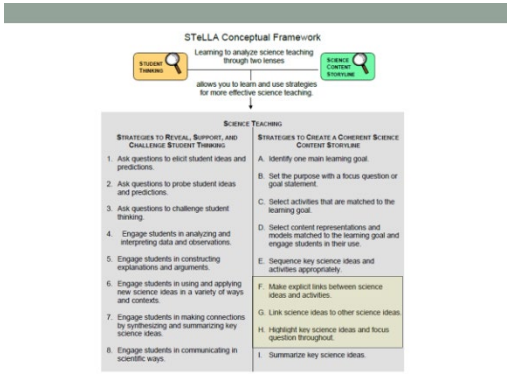	**Display Slide 5.** STeLLA Conceptual Framework (1 min) a. "Today we'll focus on three Science Content Storyline Lens strategies, all of which make explicit links to science ideas: • Strategy F explicitly links science ideas to activities that students are doing. • Strategy G explicitly links science 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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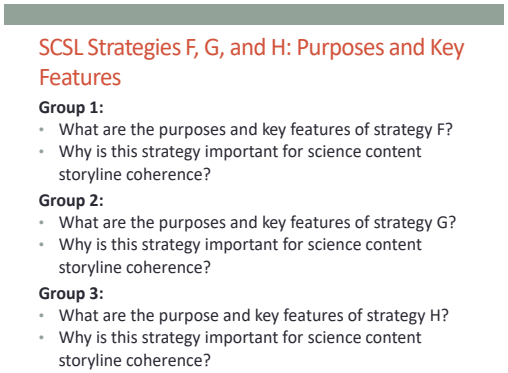
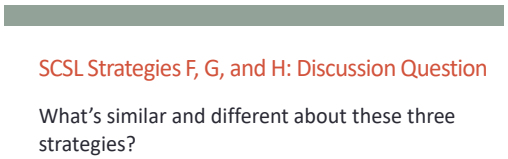
Slides 6–8	the science content storyline, each strategy has its own specific purpose. • In strategy F, activities that students carry out should be explicitly linked to the science content storyline so the science ideas are made visible to students before, during, and after an activity. • In strategy 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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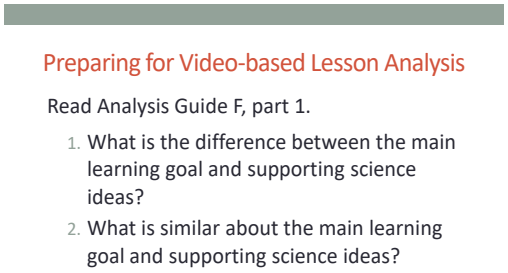
			strategy G links science ideas to other science ideas, and strategy H highlights key science ideas and links them to the focus question throughout the lesson. b. All of these strategies emphasize making the links **explicit**, not just assuming that students will see the intended links. c. All of these 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 9–12	**Purpose** • Develop participants' ability to identify and analyze strategies F, G, and H in SEC lesson video clips. • Deepen participants' science-content knowledge of the Sun's effect on climate 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		**Display Slide 9.** Preparing for Video-based Lesson Analysis (5 min) a. "Next we're going to watch a series of four classroom video clips from one lesson about the Sun's effect on climate. The first two clips take place before students begin the activity on Earth's orbit and tilt. The third clip shows students while they're working on the activity, and the fourth 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

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	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 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, Anderson classroom (before the activity) • Video Clip 8.2, Anderson classroom (before the activity) • Video Clip 8.3, Anderson classroom (during the activity) • Video Clip 8.4, Anderson classroom (after the activity) **Handouts in PD Binder** • 8.1 Analysis Guide F • 8.2 Transcript for Video Clip 8.1 • 8.3 Transcript for Video Clip 8.2		the context for the video clips. d. **Individuals:** "Read part 1 of the analysis guide and 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). **Example of a main learning goal:** • Earth's consistent tilt and the angle at which sunlight strikes the surface at different times of the year cause the Northern and Southern Hemispheres to experience different intensities of sunlight and, as a result, opposite periods of warmer and cooler temperatures (seasons). **Examples of supporting ideas:** • Earth is tilted on its axis at 23.5 degrees from a perpendicular line to its orbital plane around the Sun. • Earth's axis always tilts toward the North Star, regardless of the Sun's position.

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	• 8.4 Transcript for Video Clip 8.3 • 8.5 Transcript for Video Clip 8.4 **PD Resources** • STeLLA strategies booklet		• Because of Earth's tilt and yearly orbit, the Sun at the equator isn't directly overhead at midday all year long. This happens only twice a year—March 21 and September 21—during the solar equinoxes. • From June through August, the entire Northern Hemisphere tilts toward the Sun, and the angle of sunlight is more direct and concentrated, resulting in warmer temperatures (summer). This pattern occurs in the Southern Hemisphere from December through February. • Earth maintains a consistent 23.5-degree tilt toward the North Star as it orbits the Sun during the year, but the locations on Earth that receive the most direct sunlight vary. The Northern Hemisphere receives the most direct sunlight (intense, concentrated, and closest to a perpendicular angle) between the spring and fall equinoxes. The Southern Hemisphere receives the most direct sunlight between the fall and spring equinoxes.
		Lesson Analysis: Strategy F 1. For each of the video clips, read the context at the top of the transcript and then watch the clip: • Video clips 1 and 2: setup for the activity • Video clip 3: during the activity • Video clip 4: follow-up to the activity 2. For each clip, use the criteria in part 2 of Analysis Guide F to analyze how well science ideas were linked to the activity. Links to Anderson video clips 1–4: 8.1_stella2_03_488_Anderson_c2; 8.2_stella2_03_488_Anderson_c3; 8.3_stella2_03_488_Anderson_c4; 8.4_stella2_03_488_Anderson_c5	**Display Slide 10.** Lesson Analysis: Strategy F (60 min—15 min/clip) **Note:** These video clips are from an earlier version of the lesson plan. 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.

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			b. Have participants read the context for video clips 1 and 2 at the top of each transcript (handouts 8.2 and 8.3 in PD program binder). c. Show video clips 1 and 2. Then guide participants through these tasks: • **Individuals:** "Study the video transcripts 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 clips. d. Have participants read the context for video clip 3 at the top of the transcript (handout 8.4 in PD binder). e. Show video clip 3 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 4 at the top of the transcript (handout 8.5 in PD binder). g. Show video clip 4 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 analyses for video clips 1 and 2:** • In clip 1, students are reminded of the model components and directed to think about the model

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			in relation to today's focus question. In clip 2, students have an opportunity to explore their own thinking about seasonal temperature patterns, but they haven't yet been introduced to the notion that Earth's axis consistently tilts toward the North Star. The teacher intentionally withholds this key piece of information. In clip 2, students should begin to realize that they can't explain seasons simply by moving the Styrofoam ball around the Sun in a yearly orbit. • The activity setup should provide an opportunity for students' initial ideas to surface regarding the science concepts they'll work with during the lesson. Often, the lesson setup allows a number of student ideas to surface so that students wonder which of these ideas fit the observations, data, or evidence that arise during the lesson. • In the first two clips, students reorient themselves to the Earth-Sun model and then try to answer the day's focus question based on their current understandings of how Earth orbits the Sun. In clip 2, the teacher allows students to explain their thinking without correcting them and focuses their attention only on where the most direct sunlight hits Earth's surface. Allowing students to realize for themselves that their explanations don't explain the temperature data motivates them to dig deeper for ideas about seasonal temperature patterns. During this discussion, students also reveal their confusion about Earth's orbit around the Sun (revolution) and the daily spin of Earth on its axis (rotation). Their confusion is acknowledged but not dealt with at this point. The teacher and students simply agree that more information is needed to resolve the issue. **Sample analysis for video clip 3:** • In this clip, the teacher highlights the apparent

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			mismatch between Earth's variable tilt and opposite seasons in the Northern and Southern Hemispheres in different orbital positions. This sets up introducing the importance of Earth's consistent tilt toward the North Star. Following this clip, students return to their small groups and work with their Earth-Sun models to make sense of seasons when Earth is tilted in the same direction (toward the North Star). The teacher links science ideas to the activity by emphasizing that the current model isn't working but could be modified to show opposite seasons in the Northern and Southern Hemispheres—the lesson's main learning goal. This is a high-quality link. The orientation of Earth's tilt is stated in complete sentences, modeled for students, and discussed prior to students returning to their own models to make sense of the idea themselves. **Sample analysis for video clip 4:** • In this follow-up to the activity, students are encouraged to summarize what they learned about seasons in the Southern and Northern Hemispheres when sunlight strikes Earth in different orbital positions. During this discussion, a misconception that came up in the lesson setup reemerges. One student equates the daily spin of Earth on its axis (rotation) with Earth's yearly revolution around the Sun. The student confuses the phrases they've been using in class in relation to Earth's tilt ("facing the Sun" or "not facing the Sun"). The teacher helps this student and other students negotiate the difference between the impact of Earth's daily rotation and its tilt and yearly revolution by first restating the student's idea and asking others to respond. The teacher highlights the importance of the direction of Earth's tilt when he asks the student to reorient

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			the tilt toward the North Star, linking the key science idea to the activity. • A second student notes how this misconception describes only day and night, not seasonal temperatures. The first student still seems to be confused about Earth's daily rotation (night and day) versus the impact of Earth's revolution and tilt on seasons, but the teacher runs out of time. It's interesting that the teacher still doesn't give students the right answer as the class ends. He simply states that they'll revisit the idea in the next lesson. Some teachers might think that exploring Earth's daily rotation distracts from the lesson's main learning goal, but if students don't understand the difference between Earth tilting toward or away from the Sun during different seasons in Earth's revolution and specific locations facing toward or away from the Sun at different times of the day in Earth's rotation, they'll never be able to connect the angle of sunlight hitting Earth with differential heating in opposite seasons. • **Alternative:** The teacher might have had the first student focus on the angle of sunlight striking different latitudes to emphasize that it's the same during the daytime and at night. This would have linked the activity more closely to the day's focus question and learning goal.

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		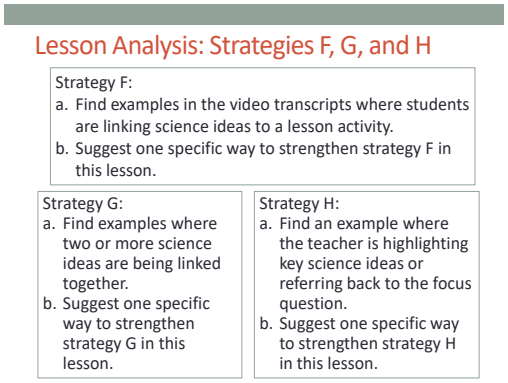	**Display Slide 11.** Lesson Analysis: Strategies F, G, and H (20 min) **Note:** If time is running short, have participants work only on part A of their assigned tasks. a. Assign participants one of the strategies (F, G, or H) to analyze for this activity, and then go over the directions on the slide. Emphasize the importance of using the STeLLA strategies booklet and strategy charts as resources. 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 findings. Encourage listeners to agree or disagree, ask clarification questions, and add on. **Observations:** • In the transcript for the second video clip, a couple of students are finishing each other's sentences (segments 0:00:11.0–0:00:15.8). One student mentions that part of Earth is "farther away," and another student says, "[The light is] spread out, and there's more surface area." Each student in this exchange linked his or her ideas—one was a science idea, and one might have been a misconception. To clarify and highlight this idea that might be a misconception (strategy H), the teacher asks Micah to explain what he means by "farther away" (segments 0:00:19.0 and 0:00:38.6) and probes to determine whether he's referring to distance from the Sun or the angle (Earth's tilt). • A nice example of strategy H appears at the end

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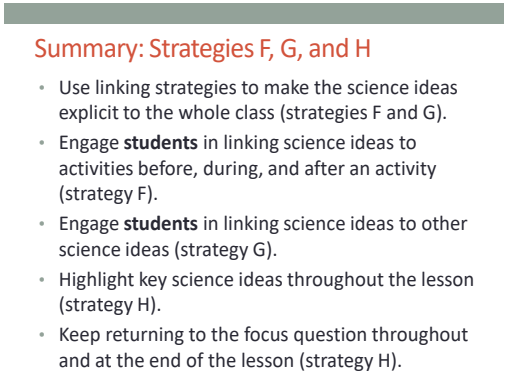
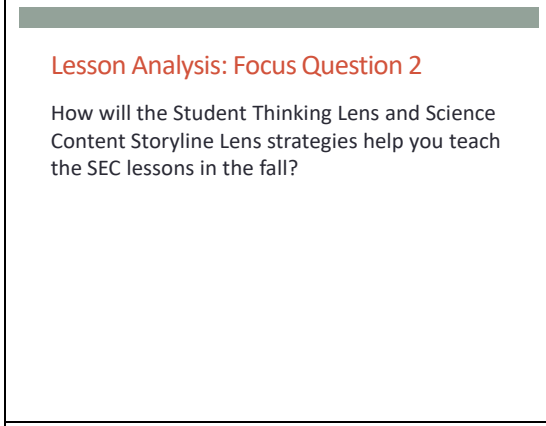
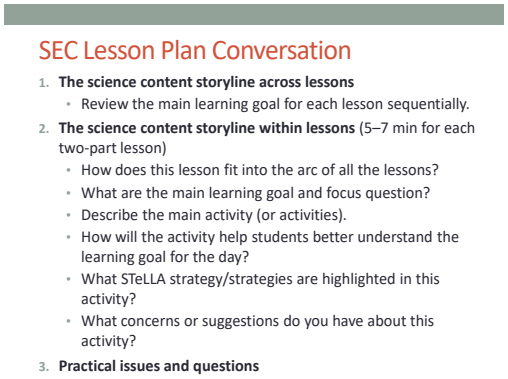
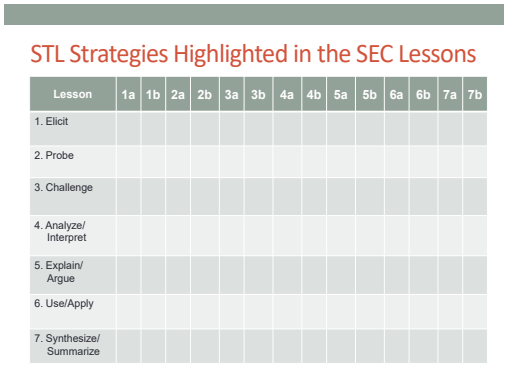
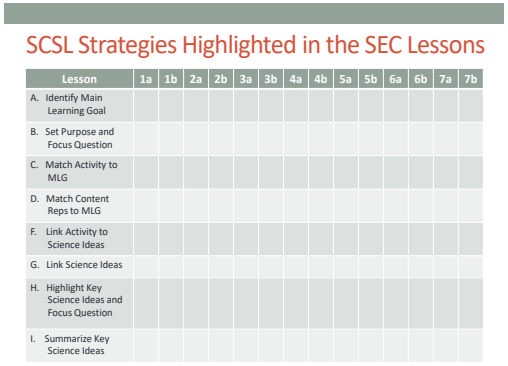
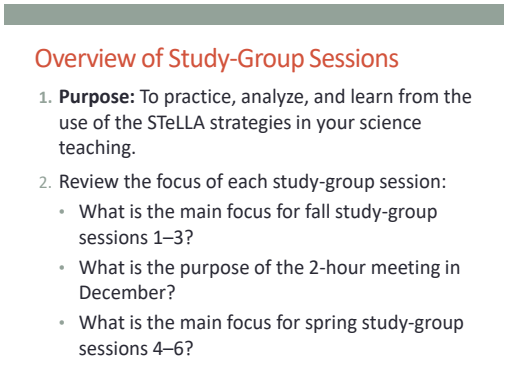
			of this exchange (segments 0:01:22.4–1:28.1) when the teacher directs students back to the focus question. • In the transcript for video clip 3, the teacher highlights the key science idea by referring to the focus question (segments 0:00:23.5 and 0:01:41.0). He missed an opportunity to help students make an important link between science ideas (strategy G) in this clip. Although he encourages students to focus on Earth's tilt, he doesn't draw their attention to the link between Earth's consistent tilt and the angle of sunlight striking the surface. In other words, how does the consistent tilt of Earth's axis toward the North Star solve the problem students encountered earlier when they realized that changing the direction of Earth's tilt caused the Northern Hemisphere to receive the most direct sunlight all the time?
			**Display Slide 12.** 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**		

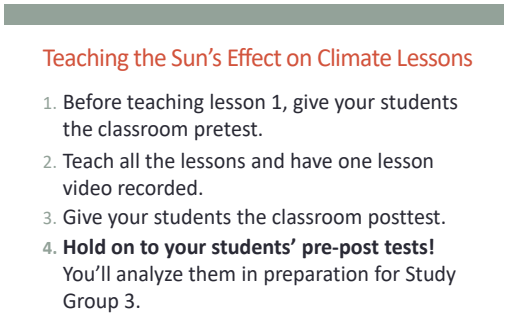
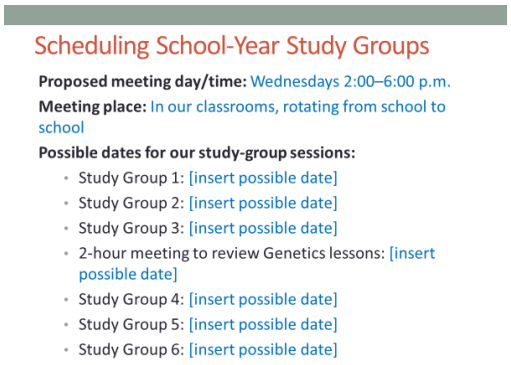
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
10:30–12:00 90 min **The Sun's Effect on Climate Lesson Plan Review and Fall Overview/ Logistics** Slides 13–19	**Purpose** • Deepen participants' understandings of the SEC lesson plans and the opportunities they provide to practice using STeLLA STL and SCSL strategies. • Help participants understand and feel comfortable with the fall activities and logistics. **Content** • The SEC lesson plans highlight STeLLA strategies and support teachers in using these strategies. **What Participants Do** • Share key aspects of an assigned SEC 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** • 8.6 Overview of School-Year RESPeCT Study Groups **PD Resources** • STeLLA strategies booklet • RESPeCT lesson plans binder	 	**Display Slide 13.** Lesson Analysis: Focus Question 2 (Less than 1 min) a. Read the focus question on the slide. **Display Slide 14.** SEC 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,

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			not to walk through every step in their lesson 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:** • In lesson 1, participants should notice an emphasis on questions that elicit and probe student thinking. Probe questions continue throughout the lesson sequence, but the emphasis shifts to challenge questions throughout the later lessons as questioning strategies help to push student thinking forward. • In lesson 1, students analyze and interpret data to identify a pattern. In lessons 2–6, students analyze data to gather evidence that supports their explanations and arguments regarding why each of these patterns occurs. In lesson 1, students should focus only on identifying patterns, not explaining them. In lessons 2–6, students are required to not only identify patterns in the data (e.g., more rays of sunlight strike Earth at latitudes closer to the equator than the poles) but to also be able to use this information to generate an explanation with supporting evidence. In each lesson, students are asked to use science ideas from earlier lessons to build a more complete

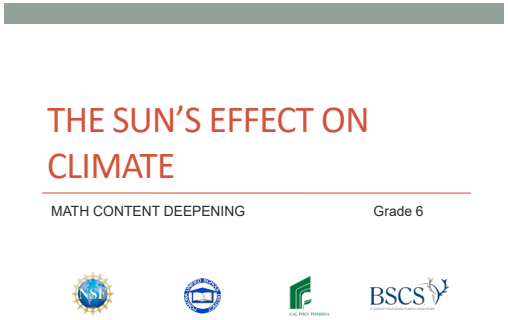
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			understanding of the Sun's effect on climate; however, the entire focus of lesson 7 is on having students use and apply ideas from the lessons to explain specific scenarios. **Ideal pattern to highlight for the Science Content Storyline Lens strategies:** • In lesson 1, students identify two patterns in the data: (1) Temperatures are warmer toward the equator and cooler toward the poles, and (2) the Northern and Southern Hemispheres experience opposite periods of warmer temperatures (summer) and cooler temperatures (winter). Lesson 2 helps students explain the first pattern, and lessons 3 and 4 help students explain the second pattern. Lessons 5 and 6 help students explain exceptions to the general patterns, and lesson 7 engages students in using and applying these ideas in specific examples of temperature patterns on Earth. Teachers should support students in understanding this storyline across lessons by referring back to the temperature patterns from lesson 1 and linking them to ideas they learned about in later lessons (i.e., "How do the science ideas we learned about today help us explain one of these temperature patterns or why there are exceptions to these patterns?").

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 15.** STL Strategies Highlighted in the SEC Lessons a. As participants report out, complete the chart, indicating with check marks the STL strategies highlighted in the SEC lessons. b. Discuss the reasons certain strategies appear at specific times in the lesson sequence. (See ideal patterns on slide 14 and refer to the summary charts in the STeLLA strategies booklet as needed.)
			**Display Slide 16.** SCSL Strategies Highlighted the SEC Lessons a. As participants report out, complete this chart, indicating with check marks the SCSL strategies highlighted in the lessons. b. Discuss the reasons certain strategies appear at specific times in the lesson sequence. (See ideal patterns on slide 14 and refer to the summary charts in the STeLLA strategies booklet as needed.)

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 17.** Overview of Study-Group Sessions (5 min) a. Have participants locate handout 8.6—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 SEC lessons in the fall and the Genetics 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?"

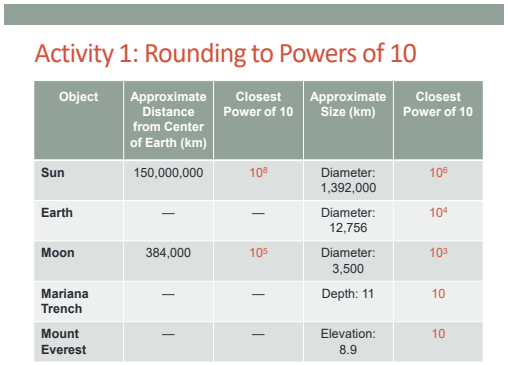
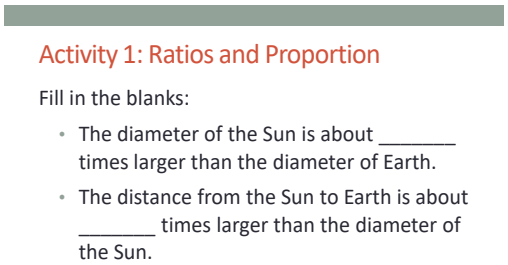
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 18.** Teaching the Sun's Effect on Climate Lessons (10 min) a. Before going over this slide, have participants locate the SEC classroom pre-post test in their lesson plans binders (pretabs section). • **The 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 19.** 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.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			• **Study Group 1:** Early October. Round-1 teachers should have their classroom video recordings completed at least three weeks before this session. You will need three weeks to watch the classroom video(s), select the ones you'll use during the study groups, and prepare the video-clip selections and transcripts. • **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 Genetics 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.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			• **Study Group 6.** April. This session can occur 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) **Math Content Deepening: The Sun's Effect on Climate** Slides 20–45	**Purpose** • Engage participants in applying ratios and proportional reasoning to construct a relatively accurate scale model that enables them to experience the vast range of scales involved in the lesson series and discern which features of the system are relevant in explaining seasonal temperature patterns. • Engage participants in using and applying ratios and proportional reasoning to design a scale model of the Earth-Sun system in which a small appliance lightbulb represents the Sun, a grain of sand represents Earth, and the radius of Earth's orbit is about 4 meters. • Understand that the Earth-Sun model used in SEC lesson 3 is far from being an accurate scale		**Display Slide 20.** Math Content Deepening: The Sun's Effect on Climate (Less than 1 min) **Note:** Throughout this content deepening phase, refer as needed to the Sun's Effect on Climate Content Background Document and Common Student Ideas about the Sun's Effect on Climate and Seasons. a. "Now we'll engage in some math content deepening to strengthen our understandings of the Sun's effect on climate."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	model of the Earth-Sun system, but the distortions serve the purpose of highlighting key features involved in the lesson's main learning goal. **Content** • By creating a scale model in which a marble represents Earth, ratios and proportions can be used to visualize and determine the relative scale of objects in the Earth-Sun system. • By using ratios and proportions, simple equations can be set up and solved to determine the relative scale of the Sun and Earth based on a scale model of Earth's orbit around the Sun. • The Earth-Sun model used in SEC lesson 3 (consisting of a lightbulb, a Hula Hoop, and a Styrofoam ball) intentionally exaggerates the size of Earth and diminishes the scale of Earth's orbit to highlight the lesson's main learning goal. **What Participants Do** • Apply ratios and proportional reasoning to construct an accurate scale model of the Earth-Sun system. **Videos** • *To Scale: The Solar System* (Vimeo video) **Handouts in RESPeCT Lesson**		
		Content Deepening Focus Questions • Approximately how large and far from Earth would the Sun need to be in a scale model in which a marble represents Earth? • What objects could **most accurately** represent the Sun and Earth in a scale model in which Earth's orbit fit just inside your classroom? • Why is an inaccurate Earth-Sun model used in SEC lesson 3?	**Display Slide 21.** Content Deepening Focus Questions (Less than 1 min) a. Read the focus questions on the slide to orient participants to the content deepening work they'll be doing in this phase.
		Content Deepening: Focus Question 1 Approximately how large and far from Earth would the Sun need to be in a scale model in which a marble represents Earth?  Image courtesy of NASA, Visible Earth Project	**Display Slide 22.** Content Deepening: Focus Question 1 (Less than 1 min) a. "Our first focus question is inspired by James Irwin, an *Apollo* astronaut who was one of only 24 human beings who have viewed Earth from the Moon (either in orbit or on the surface). Reflecting on his experience, Irwin said, 'As we got further and further away, [Earth] diminished in size. Finally it shrank to the size of a marble, the most beautiful you can imagine.'" b. "Today we'll consider how we can experience this perspective of Earth by creating a scale model of

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Plans Binder • 3.2 North Star image (Teacher Master) (for display) (from SEC lesson 3b) **PD Leader Masters** • PD Leader Master: Script for Outdoor Activity **Supplies** • Science notebooks **Resources in Lesson Plans Binder** *Resources section:* • Content background document • Common Student Ideas		the Earth-Sun system. In a scale model in which a marble represents Earth, approximately how large and far away from Earth would the Sun need to be?"
	Purpose • Compare distances in the Earth-Sun system using powers of 10. **Content** • Distances in the Earth-Sun system can be estimated and compared by using powers of 10, ratios, and proportion. **What Participants Do** • Approximate large distances in kilometers using powers of 10.	Activity 1: A Sense of Scale Object / Approximate Distance from Center of Earth (km) / Closest Power of 10 / Approximate Size (km) / Closest Power of 10 Sun / 150,000,000 / ? / Diameter: 1,392,000 / ? Earth / — / — / Diameter: 12,756 / ? Moon / 384,000 / ? / Diameter: 3,500 / ? Mariana Trench / — / — / Depth: 11 / ? Mount Everest / — / — / Elevation: 8.9 / ?	**Display Slide 23.** Activity 1: A Sense of Scale (7 min) a. "To answer this question, we need a sense of scale. This data table shows approximate distances and sizes, in kilometers, of a range of objects. We'll use this data to develop that sense of scale for our Earth-Sun model." b. Direct participants to copy the table into their science notebooks and replace the question marks with the closest powers of 10. The entries marked with a dash should be left blank.

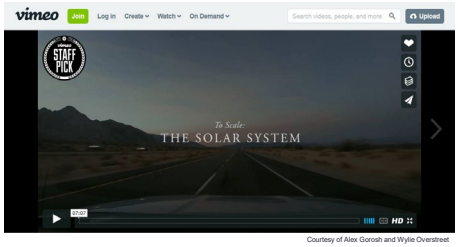
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	• Convert ratios of powers of 10 to equivalent ratios using unit fractions and laws of arithmetic. • Apply proportional reasoning to explain relative scale.		**Display Slide 24.** Activity 1: Rounding to Powers of 10 (3 min) a. Have participants compare their results with the closest powers of 10 on the slide. If they discover any discrepancies, remind them of the relationship between the power of 10 and the place of the leading digit. For example, the closest power of 10 to 150,000,000 is 100,000,000 which equals 10^8, since there are eight zeros to the right of the 1.
			**Display Slide 25.** Activity 1: Ratios and Proportion (10 min) a. Read the statements on the slide and direct participants to fill in the blanks using data from the data table. The title of the slide suggests what they'll need to do (use ratios to compute a proportion). b. **Individuals:** Give participants time to reason through these computations on their own. c. **Pairs:** Have participants share their answers with a partner. If they get different answers, have them check each other's computations and try to reach a consensus. d. **Whole group:** Have pairs share their results with the group.

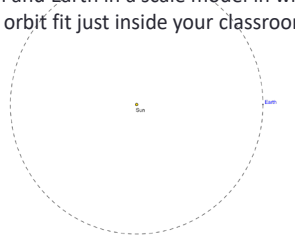
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process

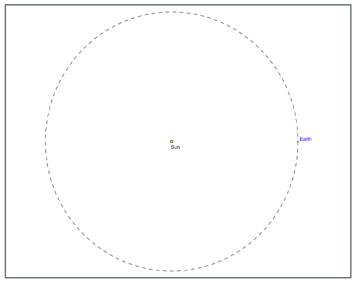
		Activity 1: Summary
		• The ratio of the diameter of the Sun to the diameter of Earth is **about** 10^6:10^4, which is equivalent as a ratio to 10^2:1.
		  • The diameter of the Sun is **about** 10^2 = 100 times larger than the diameter of Earth.
		• The ratio of the distance from the Sun to Earth to the diameter of the Sun is **about** 10^8:10^6, which is equivalent to 10^2:1.
		  • The distance from the Sun to Earth is **about** 10^2 = 100 times larger than the diameter of the Sun.
			Display Slide 26. Activity 1: Summary (2 min)
			a. Summarize the computation using ratios of the powers of 10 as indicated on the slide.
			b. Encourage participants to record the computation in their notebooks so they can recall later on how the ratios and equivalencies were determined.
			c. "To review, $10^6 = 10^{2+4} = 10^2 \times 10^4$, so we can organize 10^6 km into 10^2 groups of 10^4 km each. Thus 10^6:10^4 is equivalent to 10^2:1, where the 1 represents one group of 10^4 km."
			d. "Since the diameter of Earth is about 10^4 km, this means that if we place about 10^2 Earths side by side in a line, they would stretch across the diameter of the Sun. Thus, the diameter of the Sun is about 10^2 = 100 times larger than the diameter of Earth."

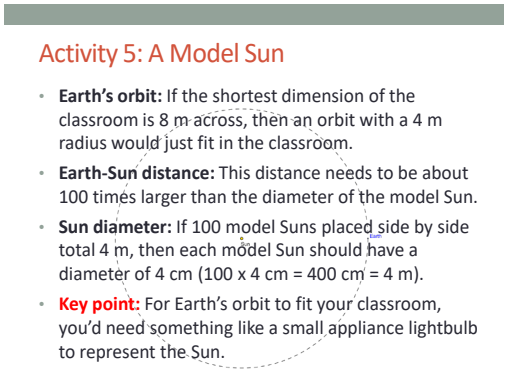
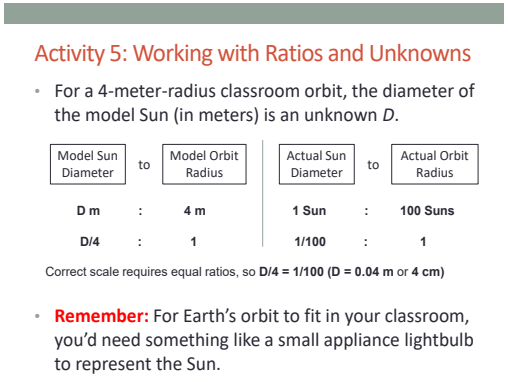
	Purpose • Determine the size of the Sun and its distance from Earth in a scale model. **Content** • The size of the Sun and its distance from Earth can be determined in a scale model by applying proportional reasoning. **What Participants Do** • Use and apply the proportions determined in activity 1. • Convert units of measurement from centimeters (cm) to meters (m).	**Activity 2: Earth-Marble Model** • The diameter of a marble is **about** 1 cm. • **Approximately** how large and far from Earth would the Sun need to be in a scale model in which a marble represents Earth?	**Display Slide 27.** Activity 2: Earth-Marble Model (5 min) a. Hold up the marble and tell the group that the diameter is approximately 1 cm. b. Then review focus question 1: *Approximately how large and how far from Earth would the Sun need to be in a scale model in which a marble represents Earth?* c. Elicit predictions from the group and ask probe and challenge questions to make participant thinking visible. d. "The learning goal here is to recognize that the ratios we just computed give us proportions we can apply in this context to answer the focus question."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Supplies • Small blue marble representing Earth		e. The answer to the first part of the question (how large the Sun would need to be) is either 100 cm or 1 m. Emphasize that by definition, these measurements are the same, since there are 100 cm in 1 m. The answer to the second part of the question (how far from Earth the Sun would need to be) is about 100 m.
		Activity 2: Summary • The diameter of a marble is **about** 1 cm. • **Approximately** how large and far from Earth would the Sun need to be in a scale model in which a marble represents Earth? • In a scale model, if Earth were a marble (with a 1 cm diameter), the Sun would be a boulder (with a diameter of **about** 100 x 1 cm = 1 m) at a distance of **about** 100 x 1 m = 100 m from Earth.	**Display Slide 28.** Activity 2: Summary (1 min) a. Summarize the computation on the slide and emphasize the unit conversion from centimeters to meters.
	Purpose • Construct an approximate scale model of the Earth-Sun system in which a marble represents Earth. **Content** • An approximate scale model of the Earth-Sun system can be constructed by applying proportional reasoning. **What Participants Do** • Create and experience a scale model of the Earth-Sun system in which a marble represents Earth.	Activity 3: Experience the Scale! To experience the scale of the Earth-Sun system, let's head outside and create a scale model. Bring your science notebooks and pens with you.	**Display Slide 29.** Activity 3: Experience the Scale! (30 min) a. Take the group outside to create a scale model of the Earth-Sun system. Bring with you the marble and a cup of water, as well as the PD leader master (Script for Outdoor Activity). b. Direct the participants to bring their notebooks and pens with them. c. Use the talking points on the leader master to guide participants through the activity. d. Following the activity, bring the group back inside and advance to the next slide.

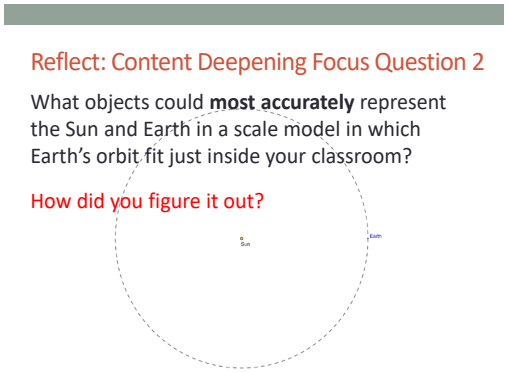
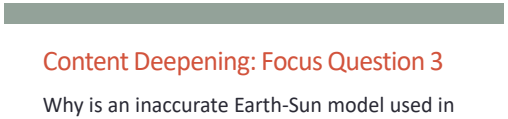
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	• Apply proportional reasoning to explain the relative scale of other objects, such as the Moon, mountains, and oceans, as well as the distance from Earth to the Moon. **Supplies** • Small blue marble representing Earth • Boulder (1 m diameter) representing the Sun • Walkable, straight-line distance of about 100 m from boulder • Cup of water deep enough to dunk the marble in	Activity 3: The Power of Powers of 10 • Scientists use powers of 10 to quickly and easily track the difference in scale between various elements of a system so they can determine which features are relevant and which are not. • Estimating large numbers by powers of 10 makes it easy to compute ratios and compare large numbers, but we sacrifice accuracy for convenience.	**Display Slide 30.** Activity 3: The Power of Powers of 10 (Less than 1 min) a. "Keep in mind that scientists use powers of 10 to quickly and easily track the difference in scale between various elements of a system so they can determine which features are relevant and which are not." b. "In this activity, we estimated distance using powers of 10 to make it easier to quickly compare the large numbers involved and compute ratios and proportions in our heads. But we sacrifice accuracy in the process."
	Purpose • Engage participants in experiencing a more accurate scale model of the solar system. **Content** • The scale of the solar system and the distance between the Sun and Earth can be experienced by developing a more accurate model. **What Participants Do** • Watch a short video showing a scale model of the solar system.	Activity 4: A Scale Model of the Solar System  Link to video clip: https://vimeo.com/139407849	**Display Slide 31.** Activity 4: A Scale Model of the Solar System (8 min) a. "In 2015, a group of people built a scale model of the entire solar system, not just a model of the Sun and Earth. Let's watch their video and experience the scale." b. Play the Internet video using a web browser (7 min, 7 sec). **Note:** A careful viewer might notice that in the scale model, Earth is 176 m from the Sun, not the 100-m estimate that participants computed using powers of 10 in the previous activity. Remind participants that they rounded down the actual Earth-Sun distance of about 150,000,000 km to 100,000,000 km. Also, the diameter of the marble isn't *exactly* 1 cm. This is why the video scale model is more accurate than theirs, but at least the numbers involved are the same powers of 10.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		Reflect: Content Deepening Focus Question 1 Approximately how large and far from Earth would the Sun need to be in a scale model in which a marble represents Earth? How do you know?  Image courtesy of NASA, Visible Earth Project	**Display Slide 32.** Reflect: Content Deepening Focus Question 1 (5 min) a. Direct participants to answer the first content deepening focus question in their notebooks and reflect on the reasoning they used in applying ratios and proportions to answer the question.
	10-MINUTE BREAK		
	Purpose • Engage participants in applying ratios and proportions to design a scale model of the Earth-Sun system in a classroom. **Content** • A scale model of the Earth-Sun system can be designed by applying ratios and proportions. **What Participants Do**	Content Deepening: Focus Question 2 What objects could **most accurately** represent the Sun and Earth in a scale model in which Earth's orbit fit just inside your classroom?  	**Display Slide 33.** Content Deepening: Focus Question 2 (Less than 1 min) a. Read the second content deepening focus question on the slide. b. "Next we'll use and apply what we've learned about the Earth-Sun system to identify objects we could use to *most accurately* represent the Sun and Earth in a scale model in which Earth's orbit fit just inside our classrooms."

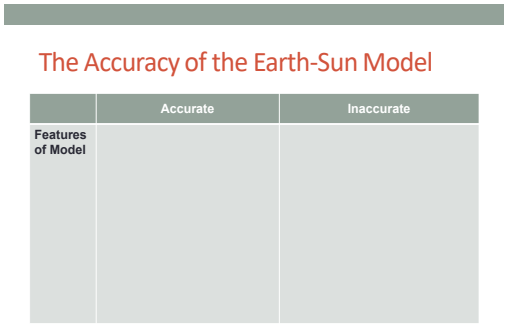
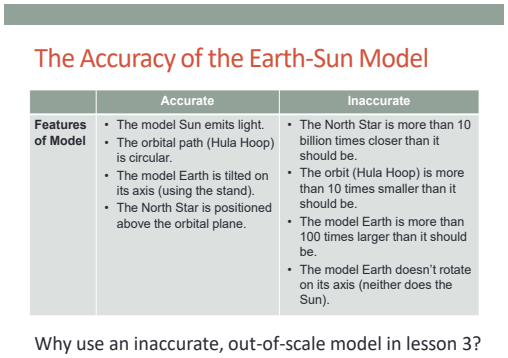
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	• Use and apply ratios and proportions to determine the diameter of a model Sun in a scale model of the Earth-Sun system that fits just inside their classrooms. • Relate the diameter of a model Sun to that of a small lightbulb. • Determine the diameter of a model Earth in the same scale model. **Supplies** • 20-watt appliance lightbulb	Activity 5: Creating an Earth-Sun Model 	**Display Slide 34.** Activity 5: Creating an Earth-Sun Model (15 min) a. **Pairs:** "Work on this challenge with a partner, drawing a top-down view of your classroom in your notebooks and estimating the dimensions (size/diameter) of the Sun and Earth in meters." b. Circulate among pairs as they work on this problem. If they're unsure of the dimensions, remind them that 1 m is the length of one large step, and ask them how many large steps it would take to cross their classroom. If they're still unsure, ask them how their room compares to the room you're in now and invite them to walk across the room to estimate distance for their own classroom. c. Make sure everyone is clear that the orbit circle for Earth should be as large as possible within the space available in their classrooms. So the distance between the model Sun and the model Earth should be half the length of the shortest dimension of the room. d. As pairs continue working on the problem, offer suggestions and encourage participants to introduce a *D* to represent the unknown diameter of the model Sun and then write down ratios using the unknown *D*. e. Allow participants to struggle with this calculation until everyone reaches a solution or progress stalls.

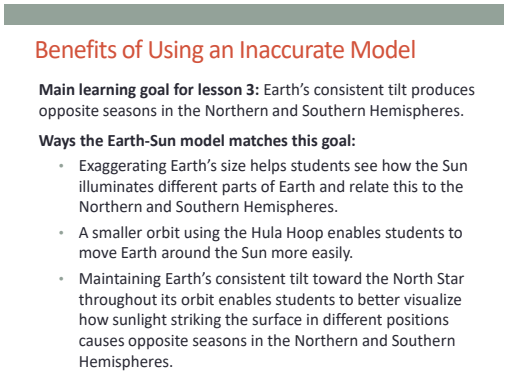
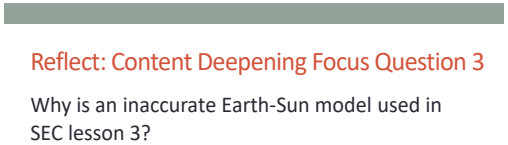
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 35.** Activity 5: A Model Sun (3 min) a. Walk participants through the calculation on the slide. Since all classrooms are approximately the same size and shape (rectangular), the size of their model Sun should be similar to the one in the sample (i.e., a few centimeters in diameter). b. "Remember, the radius of a circle is one half the diameter of the circle. So if the largest orbit in a classroom has a diameter of 8 meters, the distance from the model Earth to the model Sun should be 4 meters." c. Emphasize that an object representing the Sun would need to be something like a small appliance lightbulb. Hold up a 20-watt appliance lightbulb next to the 60-watt bulb from the SEC lesson materials kit so participants can see the difference.
			**Display Slide 36.** Activity 5: Working with Ratios and Unknowns (3 min) a. Summarize the calculation in mathematical notation on the slide. The point is that the ratio of the Model Sun Diameter to the Model Orbit Radius should be equal to the ratio of the Actual Sun Diameter to the Actual Orbit Radius. Expressing each as a ratio of a dimensionless fraction of 1 allows you to equate the fractions and solve for the unknown *D*. A standard 60-watt lightbulb is 6 cm in diameter, so a smaller bulb, such as a 20-watt appliance bulb, would need to be used to represent the Sun. b. **Challenge (time permitting):** "This calculation used an approximate ratio of the Actual Sun Diameter to the Actual Orbit Radius. What would the diameter of the model Sun be if we wanted a

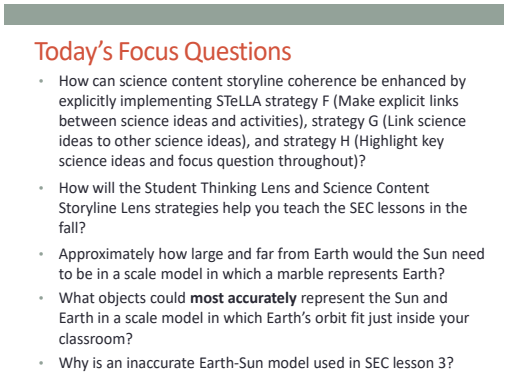
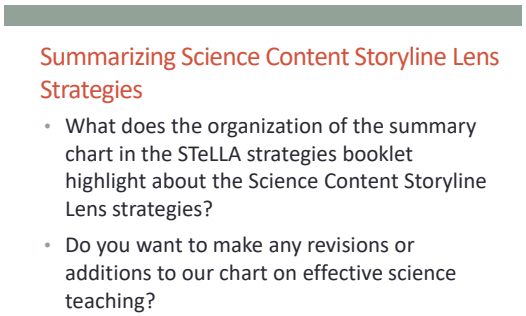
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			more accurate ratio?" c. Direct participants to use the original data from the NASA table to compute a more accurate diameter (D).
		 Activity 5: A Model Earth Now let's focus on identifying an object that could **most accurately** represent Earth in a scale model. If the shortest dimension of a classroom is 8 m across, then a small appliance lightbulb about 4 cm in diameter could represent the Sun. What object could most accurately represent Earth?	**Display Slide 37.** Activity 5: A Model Earth (3 min) a. "Now that we've identified an object we could use to represent the Sun in our scale model, let's figure out what kind of object would *most accurately* represent Earth." b. Elicit predictions about the dimensions of an object representing Earth and challenge participants' reasoning. c. Ask probe and challenge questions to draw out this response and reasoning: Since the diameter of Earth is about 100 times smaller than the diameter of the Sun, we would need a round object with a diameter of 4 cm/100 = 0.04 cm = 0.4 mm to represent Earth. This is about the size of a large grain of sand, which would be hard for students to see at a distance. If we used a grain of sand to represent Earth, the model would be accurate but not practical. d. Hold up the Styrofoam ball used in lesson 3 to represent Earth and emphasize how far out of scale this model is.

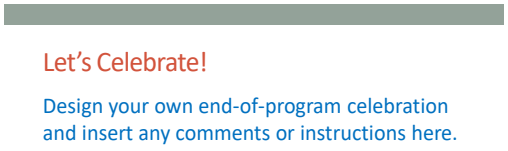
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 38.** Reflect: Content Deepening Focus Question 2 (5 min) a. Direct participants to answer the focus question and the follow-up question in their notebooks.
			**Display Slide 39.** Content Deepening: Focus Question 3 (Less than 1 min) a. Introduce the third content deepening focus question on the slide. b. Remind participants of the activity in lesson 3, where students used a model of the Earth-Sun system and the North Star to explore how the consistent tilt of Earth throughout its orbit explains opposite seasons in the Northern and Southern Hemispheres.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Purpose • Understand the advantages and disadvantages of the Earth-Sun model used in SEC lesson 3. **Content** • A mathematical perspective is helpful in using and applying STeLLA strategy D: Select content representations and models matched to the learning goal and engage students in their use. **What Participants Do** • Identify the accuracies and inaccuracies of the Earth-Sun model used in SEC lesson 3. • Reflect on the advantages and disadvantages of using an inaccurate model. • Understand the use of this model in terms of strategy D. **Supplies** • Chart paper and markers • Earth-Sun model from lesson 3 (lightbulb setup, Styrofoam ball on stand, Hula Hoop)	Lesson 3: The Earth-Sun Model Components: • An incandescent lightbulb (representing the Sun) • A Hula Hoop (representing Earth's orbit) • A Styrofoam ball on a stand (representing Earth tilted on its axis) • A rubber band around the center of the ball (representing the equator) • An image of the North Star (posted on a wall near the ceiling)	**Display Slide 40.** Lesson 3: The Earth-Sun Model (2 min) a. Review the key components of the Earth-Sun model that students explore in lesson 3. Display the items from the lesson materials kit, highlighting their size and scale.
		The North Star • **Fun fact:** Astronomers estimate that the North Star is about 3 x 10^{15} km away from the Sun. • **Remember:** Earth is about 10^{8} km away from the Sun. • **Question:** How far away from your model Sun (lightbulb) would you have to place the North Star image for the classroom model to be accurate?	**Display Slide 41.** The North Star (5 min) a. Share the fun fact on the slide and direct participants to answer the question in their science notebooks. Circulate around the room as participants work and offer help as needed. **Note:** To answer the question, participants will need to look at the ratio of the distance from the Sun to Polaris (the North Star) to the diameter of the Sun. From the data they recorded earlier in their notebooks, that ratio would be about (3 x 10^{15}):(1 x 10^{6}) = (3 x 10^{9}):1. If the lightbulb representing the Sun has a diameter of 5 cm, then the distance from the model Sun to the North Star image would be 5 x 3 x 10^{9} cm = 15 x 10^{7} m = 15 x 10^{4} km = 1.5 x 10^{5} km. For comparison, the Moon is actually about 3.8 x 10^{5} km away from Earth. So to create an accurate classroom model, participants would need to tape the image of the North Star to a spacecraft about one third of the way to the Moon!

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 42.** The Accuracy of the Earth-Sun Model (7 min) a. "The Earth-Sun model used in lesson 3 has accurate and inaccurate features. Charting these features will help us analyze this content representation." b. **Small groups:** Direct participants to form two groups and make a chart on chart paper like the one on the slide. On the chart, have the groups list the accurate and inaccurate features of the Earth-Sun model. c. After both groups have completed their charts, have each group review the other group's chart and add any features they think are missing.
			**Display Slide 43.** The Accuracy of the Earth-Sun Model (3 min) a. **Whole-group discussion:** Have participants compare their group charts with the chart on the slide. b. Draw participants' attention to the inaccuracies of the Earth-Sun model on the slide. Then discuss the potential benefits of using an inaccurate model. c. Ask participants, "Do you think the benefits of using an inaccurate model outweigh the costs in terms of the misconceptions this model may introduce or reinforce? Why?"

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 44.** Benefits of Using an Inaccurate Model (1 min) a. Read the main learning goal for lesson 3 on the slide, as well as the key benefits of using an *inaccurate* model that matches this goal. b. Point out that although the relative scale of the model may be inaccurate, the size distortion makes this model easier for students to work with and enables them to identify system features that are essential to the learning goal. c. Emphasize these points as well: • Earth's *consistent* tilt toward the North Star throughout its orbit, not just the fact that Earth is tilted on its axis, explains opposite seasons in the Northern and Southern Hemispheres. • Earth's rotation involves short-term temperature patterns (night versus day), while its orbit around the Sun (revolution) involves long-term temperature patterns, which relates to the main learning goal.
			**Display Slide 45.** Reflect: Content Deepening Focus Question 3 (5 min) a. Ask participants to reflect on the inaccuracies of the Earth-Sun model from lesson 3 and answer the focus question in their notebooks, giving practical reasons for using this model in spite of the inaccuracies. b. Emphasize again that Earth's consistent tilt toward the North Star throughout its orbit is the main factor that explains opposite seasons in the Northern and Southern Hemispheres.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
3:00–3:30 30 min **Wrap-Up and Celebration** Slides 46–49	**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 46.** Today's Focus Questions (5 min) a. Give participants a couple of minutes to think about today's focus questions and then answer them in their notebooks. b. If time allows, have a share-out of ideas.
			**Display Slide 47.** 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.
			**Display Slide 48.** 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

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			participants take a piece of chocolate when they drop their cards in the bowl. After the bowl is passed around, share the golden nuggets with the group. • Take a group photo.
			**Display Slide 49.** Thank You! (Less than 1 min) a. Before dismissing participants, thank them for participating in the RESPeCT PD program.