RESPeCT Summer Institute Professional Development Leader Guide (PDLG)

Grade Level	5	Day	7	STeLLA Strategy	SCSL Strategy D: Select Content Representations and Models	Subject Matter Focus	Food Webs

Focus Questions	• How do you know when a content representation is appropriate and matched to the main learning goal? • How can we engage students in using content representations and models in meaningful ways? • What happens to matter as it moves from organism to organism in a food chain?

Main Learning Goals	Participants will understand the following:
	• Content representations can be helpful tools if they're matched to the learning goal of a lesson, are scientifically accurate, and address common student misconceptions. In addition, they must be comprehensible to students without reinforcing or introducing misconceptions and without distracting students with too many details or new terms.
	• To ensure meaningful learning from content representations, students need to be engaged in modifying or creating the representations, in analyzing their meaning, and in critiquing them.
	• Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die.
	• Food Webs learning goals for teachers:
	  • 2T. The feeding level an organism occupies in a food web is its trophic level, which includes producers, primary consumers (herbivores), secondary consumers (small predators that are carnivores or omnivores) and top-level consumers (large predators that are carnivores or omnivores).
	  • 3Ta. The process of photosynthesis converts carbon dioxide and water into sugars and released oxygen.
	  • 3Tb. Photosynthesis produces sugars that can be used immediately or stored for growth or later use.
	  • 3Tc. Most of the matter plants use for growth originates from carbon dioxide and water.
	  • 3Td. The sugar molecules made in photosynthesis plus inorganic nutrients like nitrogen and phosphorus are used to make larger molecules like proteins and DNA that in turn are used to form new cells, for example.
	  • 3Te. Food molecules undergo a series of reactions in the process of cellular respiration and eventually react with oxygen molecules in living organisms to release the energy needed for life processes (growth, movement, warmth, and repair).
	  • 3Tf. During cellular respiration, carbon dioxide and water are produced.
	  • 4Ta. Photosynthesis converts light energy to stored chemical energy in food (sugar) molecules.

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. • Arrange furniture and food. • Arrange participant materials. • Put up posters and charts.	**Posters and Charts** • STeLLA Framework and Strategies poster • Day-7 Agenda (chart) • Day-7 Focus Questions (chart) • Norms for Working Together (chart) • Strategy charts from days 1–6 (STL strategies 1–7 and SCSL strategies A, B, C, I) • Parking Lot poster	Video clips from one Food Webs lesson: • Video Clip 7.1: Belcastro classroom (strategy D, beginning of lesson); 7.1_stella_FW_belcastro_L3_c1 • Video Clip 7.2: Belcastro classroom (strategy D, end of lesson); 7.2_stella_FW_belcastro_L3_c2

Planning and Preparation Tasks

- Study the PDLG, PowerPoint slides (PPTs), video clips, and handouts. Make changes to PPTs if needed.
- Review the content deepening slides and determine the amount of time to allot for each slide based on the needs of your group. Add timing cues to PPTs, if desired, to help you stay on track.
- Review the reflections from day 6 and create a summary slide (PPT 2).
- Watch the video clips and anticipate participant responses.
- Prepare charts for the day's agenda and focus questions.
- Analysis of content representations:
  - Assemble materials and review instructions for demonstrating the mixing-bowl model of photosynthesis from Food Webs lesson 2b (slides 15–17).
  - Assemble materials and review instructions for demonstrating the linking-cubes activity from Food Webs lesson 3 (slides 18–20). Decide whether you want participants to do this activity rather than just observe a demonstration. If it hasn't already been done as a content-deepening activity, it would be a good idea to do it as a group.

Handouts in RESPeCT PD Binder Front Pocket

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

Handouts in RESPeCT PD Binder, Day 7

- 7.1 Analysis Guide D: Selecting and Using Content Representations (five copies: D1 for the photosynthesis equation, D2 for the mixing-bowl model, D3 for the linking-cubes model of growth, D4 for the role-play, and a blank copy for the content deepening analysis)
- 7.2 Transcript for Video Clip 7.1
- 7.3 Transcript for Video Clip 7.2
- 7.4 Mixing-Bowl Model to Illustrate Photosynthesis
- 7.5 Matter in a Simple Food Chain (from Food Webs lesson 5a)
- 7.6 Daily Reflections—Day 7

Handouts in RESPeCT Lesson Plans Binder

- 5.2 Rotting Is a Good Thing! (from Food Webs lesson 5b)

Supplies

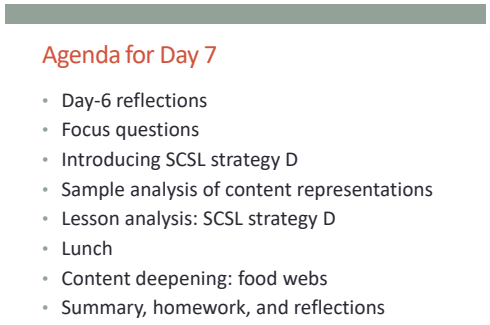
- Science notebooks
- Chart paper and markers
- Materials for demonstration of mixing-bowl model of photosynthesis from Food Webs lesson 2b:
  - Large green mixing bowl
  - Flashlight
  - Baggie filled with air
  - Bottle of water
  - Wire whisk or hand-crank mixer
  - 4–5 sugar cubes in a baggie
- Materials for linking-cube demonstration from Food Webs lesson 3 (1–3 sets depending on whether you want participants to observe a demonstration or actually do the activity):

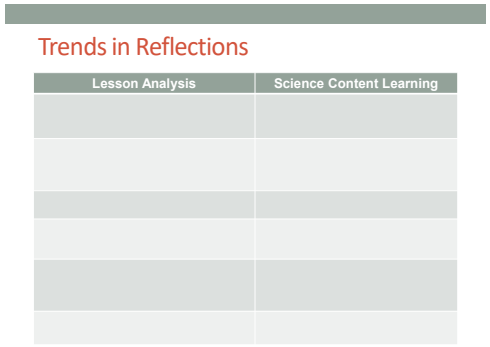
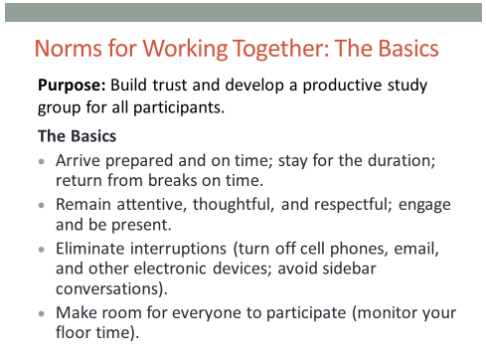
	• For each set:
	  • 10 linking-cube water molecules
	  • 20 linking-cube carbon-dioxide molecules
	  • 4 linking-cube food/sugar molecules
	  • 3 gallon-sized plastic bags to store the linking cubes
	  • 3 organism posters/place mats (tree, squirrel, mountain lion)
	• Materials for content deepening activity from Food Webs lesson 4:
	  • Laminated tree, squirrel, and mountain lion posters/mats (from lesson 3b)
	  • Plastic bags containing 16 linking-cube carbon-dioxide molecules (2 white and 1 red cubes per molecule) and 8 linking-cube water molecules (2 blue and 1 white cubes per molecule); total linking cubes needed: 16 red, 16 blue, 40 white
	  • 4 small bowls labeled: Water, CO_2, Oxygen, Wastes
	
	PD Resources
	• STeLLA strategies booklet
	• RESPeCT PD program binder
	• RESPeCT lesson plans binder
	
	Resources in Lesson Plans Binder
	Resources section:
	• Food Webs Content Background Document
	• Common Student Ideas about Food Chains and Food Webs	

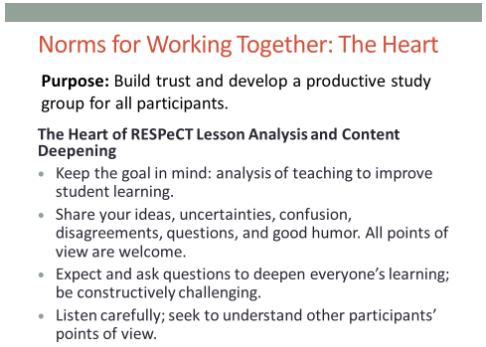
DAY 7 SESSION OUTLINE

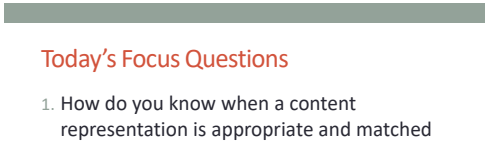
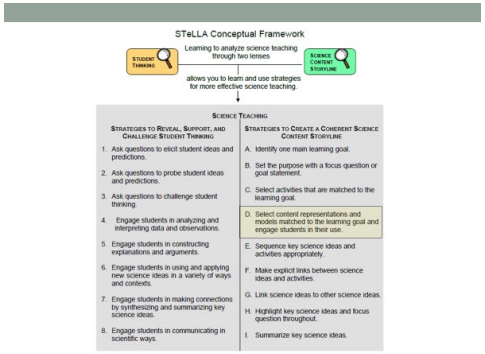
Time	Activities	Purpose
8:00–8:25 25 min	**Getting Started: Housekeeping, Agenda, Day-6 Reflections, Norms, Focus Questions**	• Build community by sharing participants' reflections from day 6. • Set the stage for a day of learning.
8:25–9:00 35 min	**Introducing SCSL Strategy D**	• Deepen participants' knowledge of the purpose and key features of SCSL strategy D.
9:00–10:20 80 min (Includes 10-min break)	**Sample Analysis of Content Representations**	• Develop participants' ability to analyze content representations to determine how well they match the main learning goal. • Deepen participants' science-content knowledge as it emerges from analyzing content representations.
10:20–12:00 100 min	**Lesson Analysis: SCSL Strategy D**	• Develop participants' ability to analyze content representations to determine how well engaged students are in their use. • Use lesson analysis of classroom videos to better understand STeLLA strategy D. • Deepen participants' science-content knowledge of the Sun's effect on climate through lesson analysis.
12:00–12:45 45 min	**LUNCH**	
12:45–3:15 150 min (Includes 10-min break)	**Content Deepening: Food Webs**	• Deepen participants' understandings of the science content that is part of the Food Webs unit.
3:15–3:30 15 min	**Wrap-Up: Summary, Homework, and Reflections**	• Summarize and reflect on key ideas about SCSL strategies A, B, C, D, and I and the Food Webs science content, lesson plans, and lesson analysis work.

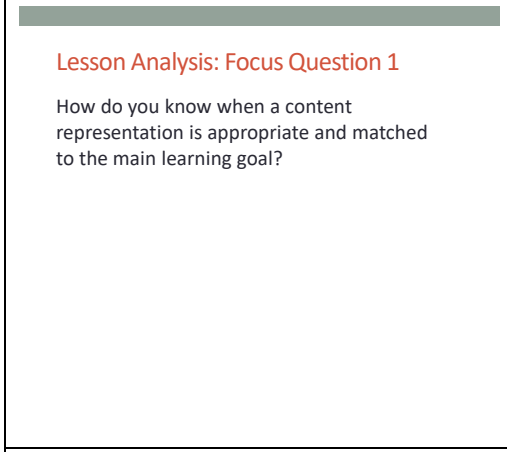
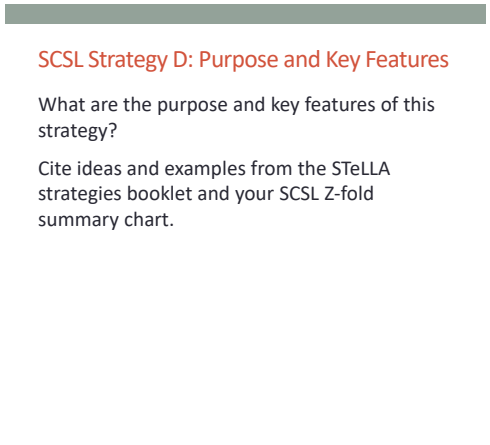
DAY 7

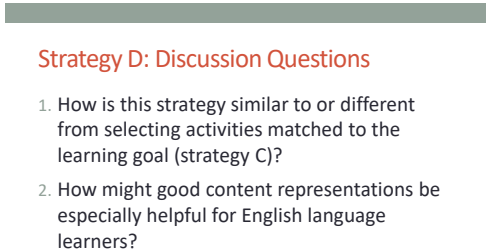
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
8:00–8:25 25 min **Getting Started** Slides 1–7	**Purpose** • Build community by sharing participants' reflections from day 6. • Set the stage for a day of learning. **What Participants Do** • Review the day's agenda. • Discuss reflections from day 6. • Review and discuss progress on the RESPeCT program norms. • Read today's focus questions. **Posters and Charts** • STeLLA Framework and Strategies poster • Day-7 Agenda (chart) • Norms for Working Together (chart) • Day-7 Focus Questions (chart)		**Display Slide 1.** RESPeCT PD Program (5 min) a. Take care of any housekeeping issues.
			**Display Slide 2.** Agenda for Day 7 (5 min) a. Talk through the agenda for the day.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 3.** Trends in Reflections (5 min) a. Give participants time to review your feedback on their reflections from day 6 and offer reactions, comments, or follow-up questions.
			**Display Slide 4.** Norms for Working Together: The Basics (2 min) a. Review the norms and ask participants to think about areas where they could improve individually or as a group. b. "How do you think we're doing individually and as a group applying these norms? Do you have any comments or suggestions about areas where we could improve?"

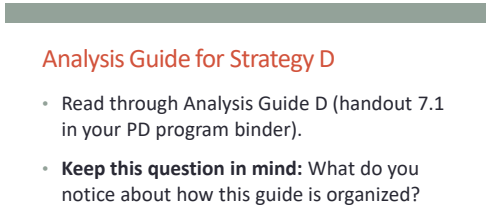
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 5.** Norms for Working Together: The Heart (5 min) a. Review the norms that are at the heart of the RESPeCT program and ask participants to think about areas where they could improve individually or as a group. b. **Emphasize:** "We're doing quite well with our norms, but as we approach the fall, I hope to see our interactions evolving so that you feel comfortable interacting less through your PD leaders as the 'teachers' and direct more of your questions and comments to one another, challenging each other, piggybacking on each other's ideas, and listening carefully to one another so that everyone is contributing to the kind of productive analysis that will help us figure out ways to strengthen our students' science learning." c. Offer an opportunity for participants to comment on how the group is doing with these norms. Ask, "Are there any areas where we could improve? Any suggested changes?"

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 6.** Today's Focus Questions (1 min) a. Introduce the focus questions on the slide.
			**Display Slide 7.** STeLLA Conceptual Framework (2 min) a. "We'll be focusing on STeLLA strategy D today. Notice that this SCSL strategy has two parts. The first part—select content representations and models matched to the learning goal—sounds similar to strategy C—select activities that are matched to the learning goal. The second part focuses on *engaging* students in the use of content representations. This ensures that students aren't just *looking* at diagrams or models but are *actively engaging* with them."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
8:25–9:00 35 min **Introducing SCSL Strategy D** Slides 8–10	**Purpose** • Deepen participants' knowledge of the purpose and key features of SCSL strategy D. **Content** • Strategy D content representations can be especially useful in helping students see how the science content storyline fits together. • Content representations (such as diagrams, analogies, graphs, concept maps, models, videos, simulations, and role-plays) can make science ideas more concrete and real for students. • Content representations are most meaningful when students are engaged in constructing and critiquing them. • Content representations support English language learners by providing a variety of ways for them to understand science ideas that extend beyond words. **What Participants Do** • Make, share, and discuss charts summarizing the purpose and key features of SCSL strategy D. • Discuss questions about strategy D. **Supplies**		**Display Slide 8.** Lesson Analysis: Focus Question 1 (Less than 1 min) a. "Now let's explore the first part of strategy D and our first focus question." b. Read the focus question on the slide.
			**Display Slide 9.** SCSL Strategy D: Purpose and Key Features (25 min) a. **Small groups (12 min):** Divide participants into two groups and have each group make a chart identifying the purpose and key features of strategy D described in their SCSL Z-fold summary charts and the STeLLA strategies booklet. b. **Whole group (8 min):** Have groups report out. Then ask, "What differences do you notice between the two charts?" **Key ideas:** • Content representations can help students envision things that are too big or too small for them to see firsthand in the classroom, or processes that take place too quickly or slowly for them to perceive. • Content representations give students access to different ways of making sense of

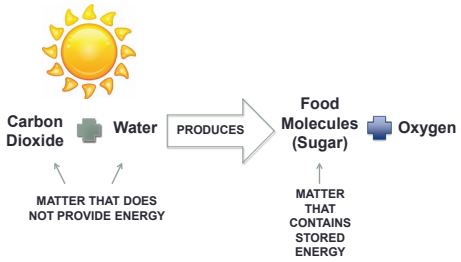
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	• Chart paper and markers **PD Resources** • STeLLA strategies booklet • SCSL Z-fold summary chart (front pocket of PD binder)		key science ideas. • If content representations or models are closely matched to the main learning goal, they can be especially useful in helping students see how the science content storyline fits together. • There are many different types of content representations (analogies, metaphors, and visual representations, such as diagrams, charts, graphs, concept maps, models, and role-plays). • Content representations can reveal and challenge student thinking if students are involved in creating, modifying, and analyzing the representations (instead of just listening to the teacher explain them).
			**Display Slide 10.** Strategy D: Discussion Questions (10 min) a. **Whole group:** Discuss the questions on the slide. **Key ideas:** • **Slide question 1:** Both strategy C and strategy D emphasize that all activities must be matched to the main learning goal. Strategy D, however, emphasizes a very important kind of activity: content representations. It also emphasizes that teachers should actively engage students in creating, modifying, and using content representations. • **Slide question 2:** Good content representations can benefit all students, but they especially benefit ELL students because they present science ideas in

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			pictures, images, and other visual formats in addition to words.

9:00–10:20
80 min
(Includes 10-min break)
 	
Sample Analysis of Content Representations
 	
Slides 11–20
	Purpose
	• Develop participants' ability to analyze content representations to determine how well they match the main learning goal.
	• Deepen participants' science-content knowledge as it emerges from analyzing content representations.
	
	Content
	• Six criteria are used in analyzing and selecting a content representation that is matched to the main learning goal.
	• The following Food Webs science ideas should be addressed in these analyses:
	  • Plants are producers that make their own food by using energy from the Sun to transform matter from the air (carbon dioxide) and the soil (water) into energy-supplying food.
	  • Matter that originated from producers (in the form of food molecules) moves from one organism to another in food chains, and each organism uses this matter to build body structures and grow bigger.
			**Display Slide 11.** Analysis Guide for Strategy D (6 min)
			
			a. Have participants locate Analysis Guide D in their PD program binders (handout 7.1).
			
			b. **Individuals:** "As you read the analysis guide, keep in mind the discussion question on the slide."
			
			c. **Whole group:** Discuss the question on the slide.
			
			Key ideas:
			• This analysis guide focuses on the main learning goal by having participants write that down first.
			• The guide is divided into three parts. Part 1 focuses on how well matched the content representation is to the main learning goal. Part 2 focuses on how well engaged students are in using the content representation.
			• The guide ends with identifying ways to improve the content representation and its use in a lesson (part 3).

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

	What Participants Do
	• Study how Analysis Guide D is organized.
	• Use the analysis guide to analyze three examples of food-web content representations (drawn from the Food Webs lessons).
	
	Handouts in PD Binder
	• 7.1 Analysis Guide D (three copies—one for the photosynthesis diagram, one for the mixing-bowl model of photosynthesis, and one for the linking-cubes model of growth)
	• 7.4 Mixing-Bowl Model to Illustrate Photosynthesis
	
	Supplies
	• Materials to demonstrate the mixing-bowl model of photosynthesis:
	  • Large green mixing bowl
	  • Flashlight
	  • Baggie filled with air
	  • Bottle of water
	  • Wire whisk or hand-crank mixer
	  • 4–5 sugar cubes in a baggie
		Content Representation 1: Photosynthesis Diagram
		Read the main learning goal and the description of the content representation in **Analysis Guide D1** (page 1 of handout 7.1).
		Main learning goal: Plants are producers that make their own food by using energy from the Sun to transform matter from the air (carbon dioxide) and matter from the soil (water) into energy-supplying food.
		Description of content representation: photosynthesis "equation" diagram
			Display Slide 12. Content Representation 1: Photosynthesis Diagram (2 min)
			
			a. **Set the context:** "Now we're going to analyze a content representation to see how well it's matched to the learning goal stated on the slide."
			b. Have participants read the main learning goal and the description of the content representation in **Analysis Guide D1** (page 1 of handout 7.1).

		Plants Are Producers That Make Food!  	**Display Slide 13.** Plants Are Producers That Make Food! (8 min) a. **Individuals:** Have participants work independently on part 1 of Analysis Guide D1. b. **Pairs:** "Now pair up and discuss your answers to the analysis questions."

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

	• Materials to demonstrate the linking-cubes model of growth (per set):
	  • 10 linking-cube water molecules
	  • 20 linking-cube carbon-dioxide molecules
	  • 4 linking-cube food/sugar molecules
	  • 3 gallon-sized plastic bags to store the linking cubes
	  • 3 organism posters/place mats (tree, squirrel, mountain lion)
	
	PD Resources
	• STeLLA strategies booklet
	• RESPeCT lesson plans binder
		Does Content Representation 1 Match the Main Learning Goal?
		How did you answer these questions from part 1 of **Analysis Guide D1**?
		1. Is the content representation scientifically accurate?
		2. Is it closely matched to the main learning goal?
		3. Does it present science ideas to students in comprehensible ways?
		4. Does it reinforce/introduce any misconceptions?
		5. Does it address common misconceptions?
		6. Does it contain distracting details?
			Display Slide 14. Does Content Representation 1 Match the Main Learning Goal? (10 min)
			
			a. **Whole group:** Discuss participants' responses to the questions in part 1 of Analysis Guide D1. (See ideal responses below.)
			
			b. **Ask:** "How might this photosynthesis content representation be improved? Would you use it with your students?"
			
			Ideal responses for Analysis Guide D1 (part 1):
			• **Question 1:** Although the photosynthesis diagram is scientifically accurate, it could be misleading because of its simplicity. The role of the Sun isn't clear, and the lack of labeling might lead some students to conclude that sunlight is like water and carbon dioxide—another kind of matter that doesn't provide energy for living things.
			• **Question 2:** The diagram closely matches all parts of the main learning goal. It does a nice job of contrasting water and carbon dioxide with food (only food provides energy living things can use). The idea that food production occurs in plants and that plants are producers is conveyed only in the title, not in the diagram itself.
			• **Question 3:** Students might have trouble interpreting some of the diagram. Teachers will likely have many ideas about the difficulties students may experience, as well as suggestions for how the diagram might

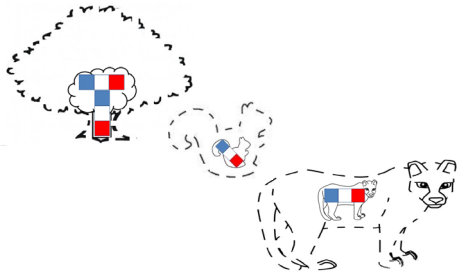
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			be improved. For example, students might not understand the word *produces*. To clarify, the label on the arrow could be modified to read "is changed into." Also, students might not understand that all of this food production is taking place inside a plant leaf. And they might have trouble understanding the distinction between matter that provides energy for living things and matter that doesn't. It's also unclear what the Sun represents. It could appear to students that sunlight is matter that doesn't provide energy for living things. It might help to add a label to the Sun that says "Light Energy." • **Question 4:** The diagram isn't likely to introduce, reinforce, or promote misconceptions. • **Question 5:** The diagram is seeking to address the misconception that water and carbon dioxide are food for plants; however, it could be done more effectively. For example, the label on the left side underneath water and carbon dioxide could say "NOT FOOD." And on the right side, the equation could say "Glucose Molecules," and underneath it could say "FOOD." • **Question 6:** Oxygen is included in this representation to make it scientifically accurate, but this may distract students from the central idea that plants make food. **Take-home message:** Trying to address all six criteria in the analysis guide is a balancing act or trade-off. To make complex science ideas meaningful and comprehensible to students, the content representation needs to be simplified, but simplifications can

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			sometimes be misleading in terms of scientific accuracy. The important thing is for teachers to be aware of such problems so they can be addressed.
		 Content Representation 2: Mixing-Bowl Model of Photosynthesis Read the main learning goal and the description of the content representation in **Analysis Guide D2** (page 2 of handout 7.1). **Main learning goal:** Plants are producers that make their own food by using energy from the Sun to transform matter from the air (carbon dioxide) and matter from the soil (water) into energy-supplying food. **Description of content representation:** mixing-bowl model of photosynthesis	**Display Slide 15.** Content Representation 2: Mixing-Bowl Model of Photosynthesis (5 min) a. Set the context for analyzing another content representation. b. Have participants turn to **Analysis Guide D2** (page 2 of handout 7.1) and read the main learning goal and description of the content representation. c. Demonstrate the mixing-bowl model of photosynthesis from Food Webs lesson 2b. In this activity, students simulate how plants make their own food. **Note:** Distribute handout 7.4 (Mixing-Bowl Model to Illustrate Photosynthesis) for this demonstration.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		Content Representation 2: Mixing-Bowl Model of Photosynthesis 	**Display Slide 16.** Content Representation 2: Mixing-Bowl Model of Photosynthesis (7 min) a. **Individuals:** Have participants work independently on part 1 of Analysis Guide D2. **Note:** If time is short, just do partner work. b. **Pairs:** "Now pair up and discuss your answers to the analysis questions."
		Does Content Representation 2 Match the Main Learning Goal? How did you answer these questions from part 1 of **Analysis Guide D2**? 1. Is the content representation scientifically accurate? 2. Is it closely matched to the main learning goal? 3. Does it present science ideas to students in comprehensible ways? 4. Does it reinforce/introduce any misconceptions? 5. Does it address common misconceptions? 6. Does it contain distracting details?	**Display Slide 17.** Does Content Representation 2 Match the Main Learning Goal? (10 min) a. **Whole group:** Discuss participants' responses to the questions in part 1 of Analysis Guide D2. (See ideal responses below.) b. **Ask:** "How might this mixing-bowl content representation be improved? Would you use it with your students?" **Ideal responses for Analysis Guide D2 (part 1):** • **Question 1:** The mixing-bowl model of photosynthesis is accurate, but as a content representation, it can be misleading. It might suggest that the materials are simply mixed together, but photosynthesis is *not* a mixing process; it's a chemical change in which water and carbon dioxide (the inputs) are transformed into a completely new kind of

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			material (sugar/food molecules). Showing the sugar at the end of the demonstration would emphasize that something new is created. • **Question 2:** The content representation is well matched to the main learning goal. • **Question 3:** The model is a simple representation that students are likely to comprehend. They might need help remembering that the bowl represents a plant leaf, and placing a real plant next to the bowl would emphasize this point. • **Question 4:** By emphasizing that water, carbon dioxide, and sunlight are used to make something new (sugar/food molecules), the model could be helpful in challenging the misconception that these three elements are food for plants. • **Question 5:** The model might introduce a misconception that photosynthesis is magic (i.e., the materials are mixed together, and sugar/food magically appears). • **Question 6:** The model is simple, with no distracting details. **Take-home message:** Trying to address all six criteria in the analysis guide is a balancing act or trade-off. To make complex science ideas meaningful and comprehensible to students, the content representation needs to be simplified, but simplifications can sometimes be misleading in terms of scientific accuracy. The important thing is for teachers to be aware of such problems so they can be addressed.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		Content Representation 3: Linking-Cubes Model of Growth Read the main learning goal and the description of the content representation in **Analysis Guide D3** (page 3 of handout 7.1). **Main learning goal:** Animals consume the Matter originally made by plants (in the form of food molecules). This matter moves from one organism to another in food chains, and each organism uses it to build body structures and to grow bigger. **Description of a content representation:** linking-cubes model of growth showing how organisms in a food chain make and use food	**Display Slide 18.** Content Representation 3: Linking-Cubes Model of Growth (5 min) **Note:** If time is running short, this content representation can be skipped. a. Have participants turn to **Analysis Guide D3** (page 3 of handout 7.1) and read the main learning goal and the description of the content representation. b. Demonstrate the linking-cube activity from Food Webs lesson 3. In this activity, students break apart water and carbon-dioxide linking-cube molecules to create sugar/food linking-cube molecules. The sugar molecules are first used to make the tree grow bigger. Then they're passed on to the squirrel and from the squirrel to the mountain lion, enabling each organism to grow bigger. **Note:** If participants haven't already done this as a content-deepening activity, have them do it interactively instead of watching a demonstration.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		How Do Plants and Animals Grow Bigger? 	**Display Slide 19.** How Do Plants and Animals Grow Bigger? (7 min) a. **Individuals:** Have participants work independently on part 1 of Analysis Guide D3. **Note:** If time is short, just do partner work. b. **Pairs:** "Now pair up and discuss your answers to the analysis questions."
		Does Content Representation 3 Match the Main Learning Goal? How did you answer these questions from part 1 of **Analysis Guide D3**? 1. Is the content representation scientifically accurate? 2. Is it closely matched to the main learning goal? 3. Does it present science ideas to students in comprehensible ways? 4. Does it reinforce/introduce any misconceptions? 5. Does it address common misconceptions? 6. Does it contain distracting details?	**Display Slide 20.** Does Content Representation 3 Match the Main Learning Goal? (10 min) a. **Whole group:** Discuss participants' responses to the questions in part 1 of Analysis Guide D3. (See ideal responses below.) b. **Ask:** "How might this linking-cube content representation be improved? Would you use it with your students?" **Ideal responses for Analysis Guide D3 (part 1):** • **Question 1:** The linking-cube content representation is highly simplified, so many details aren't exactly accurate. However, the basic concept represented in this activity is accurate: Plants use water, carbon dioxide, and sunlight to create food they can use for growth, and other organisms eat and use this food to grow bigger. Following are some

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			of the inaccuracies: • Obviously, molecules are much, much smaller than linking cubes! • The chemical structure of glucose (sugar) molecules is actually $C_6H_{12}O_6$, but glucose is represented in this activity with just one atom of carbon, one atom of hydrogen, and one atom of oxygen. • The process of photosynthesis is much more complicated than the simplified version represented here. • The growth of organisms is much more complicated than simply piling on more and more glucose molecules. • **Question 2:** There is a close match to the main learning goal. • **Question 3:** Students are likely to find this representation comprehensible but would need to go through it more than once to understand it fully. They don't always pick up on the idea that food molecules are becoming part of the organisms' bodies, and that's why the organisms are growing bigger. • **Question 4:** Without a discussion of ways this model has been simplified, it could introduce a misconception about the size of molecules. Participants may come up with other interesting ways this representation might introduce or reinforce misconceptions. • **Question 5:** This representation is one way to challenge the misconception that water, carbon dioxide, and sunlight are food for plants. Breaking down the water and carbon-dioxide molecules and rearranging them to form food molecules should help

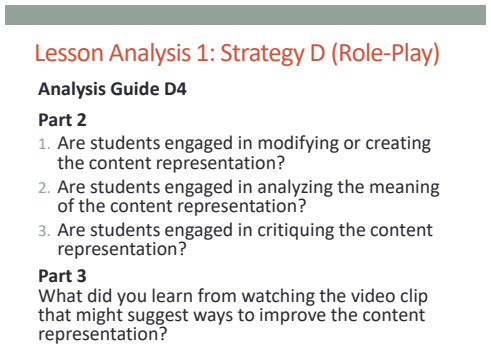
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			students begin to understand the notion of a chemical change taking place to produce food. The representation is also designed to challenge the misconception that plants and animals "have" some molecules (like red blood cells in your body) and to physically emphasize the point that plants and animals are completely *made up of* molecules. Growth occurs because plants and animals are made up of more molecules. • **Question 6:** Participants are likely to conclude that there are no distracting details in this content representation. **Take-home message:** Trying to address all six criteria in the analysis guide is a balancing act or trade-off. To make complex science ideas meaningful and comprehensible to students, the content representation needs to be simplified, but simplifications can sometimes be misleading in terms of scientific accuracy. The important thing is for teachers to be aware of such problems so they can be addressed.
10:10–10:20 10 min	**BREAK**		

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

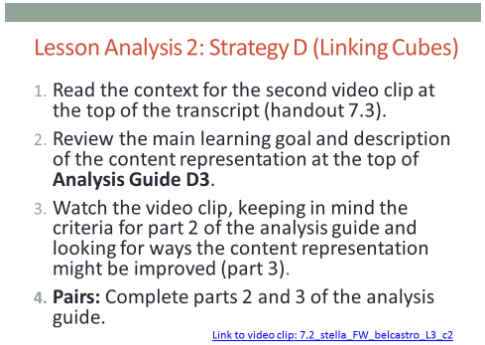
10:20–12:00
100 min
 	
Lesson Analysis: SCSL Strategy D
 	
Slides 21–26
	Purpose
	• Develop participants' ability to analyze content representations to determine how well engaged students are in their use.
	• Use lesson analysis of classroom videos to better understand STeLLA strategy D.
	• Deepen participants' science-content knowledge of the Sun's effect on climate through lesson analysis.
	
	Content
	• Six criteria are used in analyzing and selecting a content representation that is well matched to the main learning goal.
	• Three criteria are used in analyzing how well teachers engage students in using content representations.
	• The following Food Webs science ideas should be addressed in these analyses:
	  • Plants are producers that make their own food by using energy from the Sun to transform matter from the air (carbon dioxide) and the soil (water) into energy-supplying food.
	  • Matter that originates from producers (in the form of food molecules) moves from
		Lesson Analysis: Focus Question 2
		
		How can we engage students in using content representations in meaningful ways?
			Display Slide 21. Lesson Analysis: Focus Question 2 (Less than 1 min)
			
			a. **Transition slide:** "Next we'll watch two video clips of strategy D in use in a Food Webs lesson. In addition to completing part 1 of Analysis Guide D4, we'll focus on parts 2 and 3: *How well engaged are students in using the content representation? And what suggestions do you have for improving the content representation and its use with students?"*

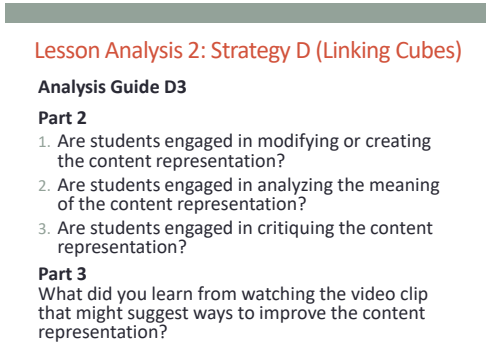
		Lesson Analysis 1: Strategy D (Role-Play) 1. Read the context for the first video clip at the top of the transcript (handout 7.2). 2. Review the main learning goal and description of the content representation at the top of **Analysis Guide D4**. 3. Watch the video clip, keeping in mind the criteria for strategy D (part 1 of the analysis guide). 4. Work with a partner to complete part 1 of the analysis guide. 5. Share your responses with the group. Link to video clip: 7.1_stella_FW_belcastro_L3_c1	**Display Slide 22.** Lesson Analysis 1: Strategy D (Role-Play) (25 min) a. Orient participants to **Analysis Guide D4** and the transcript for video clip 1 (handout 7.2 in PD binder). b. Have participants read the main learning goal and description of the content representation at the top of the analysis guide. **Note:** The teacher in this clip is reviewing the main learning goal from previous lessons. c. Show the video clip. d. **Pairs:** Have participants pair up and complete part 1 of the analysis guide. e. **Whole group:** Discuss participants' responses to the questions in part 1 of the

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	one organism to another in food chains, and each organism uses this matter to build body structures and grow bigger. **What Participants Do** • Use Analysis Guide D to analyze student engagement with a content representation (role-play) for the first video clip and determine how well it matches the main learning goal. • Use the analysis guide to analyze student engagement with a content representation (linking-cube activity) in the second video clip and determine how well it matches the main learning goal. • Identify key ideas participants have learned about strategy D and the science content from the lesson analysis work. **Videos** • Video Clip 7.1, Amy Belcastro classroom (beginning of lesson) • Video Clip 7.2, Amy Belcastro classroom (end of lesson) **Handouts in PD Binder** • 7.1 Analysis Guide D • 7.2 Transcript for Video Clip 7.1 • 7.3 Transcript for Video Clip 7.2 **PD Resources**		guide. (See ideal responses below.) **Ideal responses for Analysis Guide D4 (part 1):** • **Question 1:** This role-play has some of the same problems as the mixing-bowl model. It's accurate but so highly simplified that students might think of the process of plants making food as magic. The linking cubes do a better job of challenging the "magic" misconception by exploring what is happening at a molecular level. • **Question 2:** There is a close match between this activity and the main learning goal. • **Question 3:** The role-play is highly comprehensible to students, which is the beauty of this representation. • **Question 4:** Whether misconceptions are challenged or reinforced depends on how the teacher leads the role-play. There are opportunities to emphasize that water, carbon dioxide, and sunlight by themselves are *not* food for plants. In this clip, the idea of a chemical change is mentioned (segments 01:59.3; 02:14.1) but not emphasized. Some students may still be thinking that plants get their food from water, carbon dioxide, and sunlight, and by making it. That is, like humans, plants have lots of different kinds of food. • **Question 5:** Same response as point 4. • **Question 6:** There are no distracting details in this content representation.

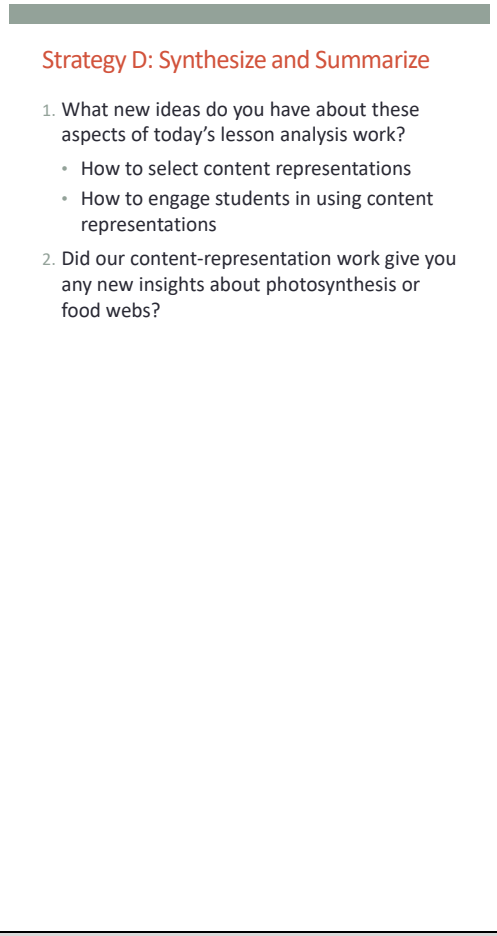
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	• STeLLA strategies booklet • RESPeCT lesson plans binder • SCSL Z-fold summary chart (front pocket of PD binder) **Resources in Lesson Plans Binder** *Resources section:* • Content background document		**Display Slide 23.** Lesson Analysis 1: Strategy D (Role-Play) (25 min) a. "Now we're going to turn our attention to part 2 of strategy D, which engages students in using content representations. We'll also consider ways the content representation could be improved." b. **Individuals:** "Study the video transcript again and think about parts 2 and 3 of **Analysis Guide D4**. Be ready to share evidence that supports your conclusions." c. **Pairs:** "Compare your conclusions about student engagement with the role-play representation." d. **Whole group:** Review participants' responses to parts 2 and 3 of the analysis guide. Challenge participants to support their answers with evidence from the video transcript. e. If it didn't already come up in the discussion, ask participants, "How might the teacher have engaged these students in analyzing or critiquing the representation?" **Ideal responses for Analysis Guide D4 (part 2):** • **Questions 1 and 2:** Students are modestly involved in helping create the role-play and analyze its meaning. The teacher asks questions during the role-play to engage students in helping create and make sense

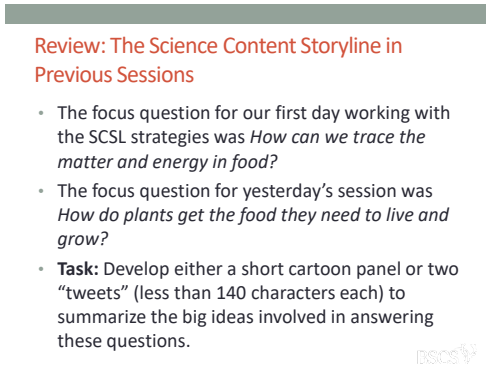
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			of the representation (see video segments 00:35.8; 00:45.9; 01:08.1; 01:50.0; 02:10.9; 02:45.4; 02:50.2). Not many students participate in this discussion, and most of their responses are quite brief. But there is significant student involvement in segments 02:14.1–02:31.6 (Water and carbon dioxide are mixing together to make something different: food). Another significant instance of student involvement occurs during segments 02:49.4–03:06.3 (Plants also need sunlight to make the energy). • **Question 3:** In segment 05:31.8, a student notices a discrepancy between the role-play representation of plants and the video of plant growth that the teacher showed. The teacher takes this opportunity to point out the limitations of models (05:53.5–06:04.7). **Ideal responses for Analysis Guide D4 (part 3):** • Participants should come up with ways to get students more actively involved in deriving meaning from this role-play. In addition, they might suggest ideas that could be emphasized in the role-play, such as the idea that the "mixing" process in the leaves is transforming matter with no energy for living things (water and carbon dioxide) into new matter that contains energy living things can use (food).

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 24.** Lesson Analysis 2: Strategy D (Linking Cubes) (25 min) a. "Next, we'll return to the linking-cube activity from Food Webs lesson 3, but this time we'll see it in action in a classroom. For this analysis, we'll focus only on parts 2 and 3 of Analysis Guide D3: *How well engaged are students in using the content representation? And what suggestions do you have for improving the content representation and its use with students?"* b. Orient participants to **Analysis Guide D3** and the transcript for the second video clip (handout 7.3 in PD binder). c. Have participants review the main learning goal and description of the content representation at the top of the analysis guide. d. "For this analysis, we're going to look at a new classroom video and examine how students are (or are not) engaged in using the linking-cube content representation." e. Show the video clip. f. **Pairs:** Have participants pair up and complete parts 2 and 3 of the analysis guide.

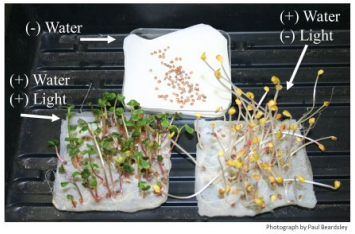
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 25.** Lesson Analysis 2: Strategy D (Linking Cubes) (15 min) a. **Whole group:** Discuss participants' responses to parts 2 and 3 of **Analysis Guide D3**. Challenge participants to support their answers with evidence from the video transcript. b. If it didn't already come up in the discussion, ask participants, "How might the teacher have engaged these students in analyzing or critiquing the representation?" **Ideal responses for Analysis Guide D3 (part 2):** • **Question 1:** Students in this video clip are definitely engaged in manipulating the linking cubes, breaking down the water and carbon-dioxide "molecules" and rearranging the "atoms" to form sugar molecules. They're arranging these food molecules to show the tree growing bigger and food moving to the squirrel and then to the mountain lion, enabling these organisms to grow bigger. However, although students are busy manipulating the linking cubes, they aren't truly helping create the content representation; they're simply following the teacher's directions. • **Question 2:** The teacher asks questions to get students thinking about the meaning of the content representation, but students are struggling. It's challenging to get them thinking about the ideas when they're so focused on manipulating the cubes. The

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			teacher tries to get students thinking about the food molecules being used to build up the organisms—to match the learning goal about how living things grow bigger. She has some success with one student (segments 04:10.8–04:19.5) when she asks, "And where's the food going to go?" A student replies that it's going to "grow out the tree" (04:16.1), and "It's going to blossom and grow like the apple trees do" (04:19.5). Right on target! But later the teacher asks a different student the same question, and this student replies that the food will go "into dirt" (05:07.6). The teacher follows up with this student, emphasizing that the food is going to make the tree grow "bigger and bigger" (05:17.1). • **Question 3:** Students don't critique the content representation in this video clip. **Ideal response for Analysis Guide D3 (part 3):** • The content representation itself seems strong in a variety of ways; the problem is getting students to engage in meaningful ways with it. Participants should come up with a variety of ways to improve student engagement with the content representation. For example, students could be asked to stop and do a thinking activity after the first step when they broke apart the water and carbon-dioxide molecules and made food molecules. They could draw and label what they did or answer part of the focus question: *What do we know about how plants grow bigger?* They could stop again and think after the squirrel step and then again after the mountain lion step.

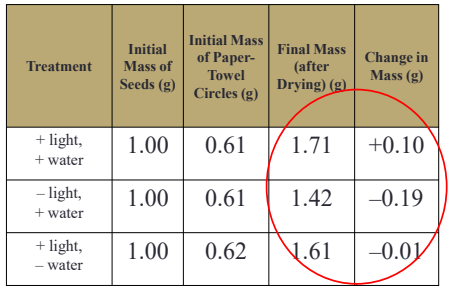
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 26.** Strategy D: Synthesize and Summarize (10 min) a. **Individuals (5 min):** Have participants work on the slide questions. Encourage them to use their resources (e.g., the strategies booklet, their Z-fold summary charts, the content background document, notes they've taken). b. **Whole group (5 min):** Have participants share their new ideas for each question in a round-robin format, if time allows. Otherwise, have a couple of volunteers share their ideas for each question.
12:00–12:45 45 min	**LUNCH**		

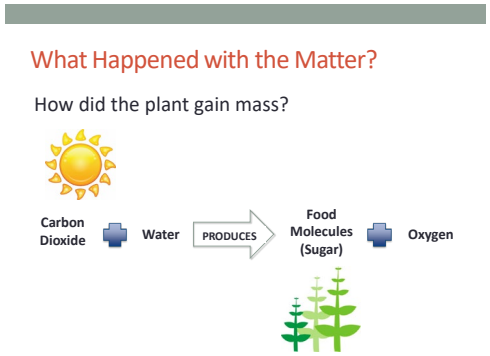
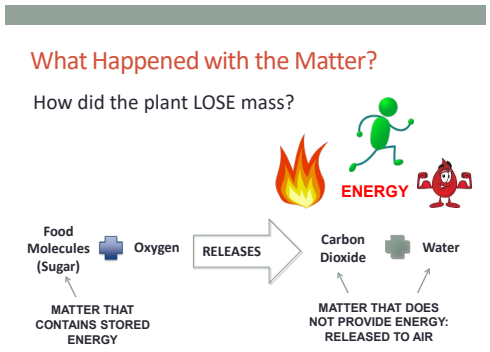
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
12:45–3:15 150 min (Includes 10-min break) **Content Deepening: Food Webs** Slides 27–69	**Purpose** • Deepen participants' understandings of the science content that is part of the Food Webs unit. **Content** • The feeding level an organism occupies in a food web is its trophic level, which includes producers, primary consumers (herbivores), secondary consumers (small predators that are carnivores or omnivores) and top-level consumers (large predators that are carnivores or omnivores). • Food molecules undergo a series of reactions in the process of cellular respiration and eventually react with oxygen molecules in living organisms to release the energy needed for life processes (growth, movement, warmth, and repair). • During cellular respiration, carbon dioxide and water are produced. **What Participants Do** • Use all the concepts from the content deepening activities to refine and improve a model of matter cycling in food chains.		**Display Slide 27.** Content Deepening: Food Webs **Note:** Throughout this content deepening phase, refer as needed to the Food Webs Content Background Document and Common Student Ideas about Food Chains and Food Webs. **PD leader talk:** "Now let's begin our content deepening work on food webs." **Timing note:** To keep things moving so you don't run out of time during this phase, adhere as closely as possible to the time you've allotted for each slide. If you're running short on time, you may need to abridge or skip some of the group discussion.
			**Display Slide 28.** Review: The Science Content Storyline in Previous Sessions **PD leader move:** To remind participants of the science content storyline in previous sessions, ask them to complete one of the tasks on the slide. **PD leader talk:** "As you work on these tasks, be creative and demonstrate what you've learned in different ways. If you need ideas, you can look through your notebooks."

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

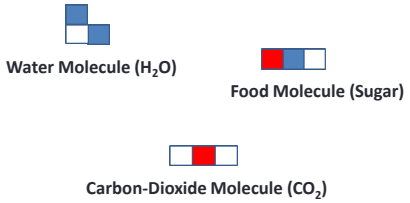
	• Become familiar with the science content and logistics for one of the central activities in the lesson set.
	
	Handouts in PD Binder
	• 7.5 Matter in a Simple Food Chain (from Food Webs lesson 5a)
	
	Handouts in Lesson Plans Binder
	• 5.2 Rotting Is a Good Thing! (from Food Webs lesson 5b)
	
	Supplies
	• Materials for linking-cube activity from Food Webs lesson 3 (supplies per set):
	  • 10 linking-cube water molecules
	  • 20 linking-cube carbon-dioxide molecules
	  • 4 linking-cube food/sugar molecules
	  • 3 gallon-sized plastic bags to store the linking cubes
	  • 3 organism posters/place mats (tree, squirrel, mountain lion)
	• Materials for linking-cube activity from Food Webs lesson 4:
	  • Laminated tree, squirrel, and mountain lion posters/mats (from lesson 3b)
	  • Plastic bags containing 16 linking-cube carbon-dioxide
		Today's Content Deepening Focus Question
		What happens to matter as it moves from organism to organism in a food chain?
		 
		
			Display Slide 29. Today's Content Deepening Focus Question
			
			PD leader move: Read the focus question on the slide; then have participants copy it into their science notebooks and draw a box around it.
			
			PD leader talk: "In the previous session, we started thinking about what happens to matter in a food chain. Let's review what we've learned so far."
			
			PD leader move: Ask one or two participants to summarize what they've learned so far about how matter moves from organism to organism in a food chain.
			
			PD leader move: Emphasize the following science ideas:
			• In producers (plants), water and carbon dioxide combine to form sugars.
			• Plants use these sugars to grow.
			• A squirrel eats the plant and uses its matter and energy to grow.
			• A mountain lion eats the squirrel and uses its matter and energy to grow.
			
			PD leader talk: "The plants on this slide are radish seedlings grown under three different conditions. The plant at the top had light but no water. The plant on the bottom left had light and water, and the plant on the bottom right had water but no light."
			
			PD leader talk: "We'll use this experiment to help us consider in more detail what happens

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	molecules (2 white and 1 red cubes per molecule) and 8 linking-cube water molecules (2 blue and 1 white cubes per molecule); total linking cubes needed: 16 red, 16 blue, 40 white • 4 small bowls labeled: Water, CO_2, Oxygen, Wastes **PD Resources** • Science notebooks • RESPeCT lesson plans binder **Resources in Lesson Plans Binder** *Resources section:* • Content background document • Common Student Ideas		to matter in producers."
	Purpose • Demonstrate using a prediction to elicit student ideas about the role of photosynthesis and cellular respiration in affecting the movement of matter in producers.	Experimenting with Mass Which of the following treatments will increase mass? Treatment / Initial Mass of Seeds (g) / Initial Mass of Paper-Towel Circles (g) / Final Mass (after Drying) (g) / Change in Mass (g) 1. + light, + water — 1.00 — 0.61 2. – light, + water — 1.00 — 0.61 3. + light, – water — 1.00 — 0.62 	**Display Slide 30.** Experimenting with Mass **PD leader talk:** "At the beginning of this experiment, researchers measured the mass of the seeds and the paper towels holding the seeds before the seeds received different treatments. Then after two weeks, the plants and paper towels were dried to remove all the water." **PD leader move:** Ask participants to predict which treatment(s) will result in an increase of mass. **PD leader move:** Have participants share

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			their predictions with an elbow partner.
	Purpose • Provide data that are likely to surprise many participants, making the experience more memorable.	The Results!  Treatment / Initial Mass of Seeds (g) / Initial Mass of Paper-Towel Circles (g) / Final Mass (after Drying) (g) / Change in Mass (g) + light, + water: 1.00 / 0.61 / 1.71 / +0.10 – light, + water: 1.00 / 0.61 / 1.42 / –0.19 + light, – water: 1.00 / 0.62 / 1.61 / –0.01	**Display Slide 31.** The Results! **PD leader talk:** "As you can see from the slide, the plant grown with both light and water *gained* mass, but the plant grown in the dark actually *lost* mass." **PD leader move:** Ask participants to compare the results of the experiment with their original predictions.
	Purpose • Review and document participants' current thinking about biomass and carbon in plants grown in light and dark conditions.	Document Your Ideas 1. Describe what is happening with the biomass and carbon of the plant grown in the dark? 2. Describe what is happening with the biomass and carbon of the plant grown in the light?	**Display Slide 32.** Document Your Ideas **PD leader talk:** "In your notebooks, write your ideas for answering the questions on the slide. We'll review your responses as a group during the following activities."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Purpose • Review the process of photosynthesis and what it has to do with the cycling of matter.		**Display Slide 33.** What Happened with the Matter? **PD leader move:** Summarize what happened to the matter in the plant that had both light and water.
	Purpose • Introduce the idea that cellular respiration (which organisms use to get the energy they need to live) results in the loss of matter (carbon dioxide and water).		**Display Slide 34.** What Happened with the Matter? **PD leader move:** Next, summarize what happened to the matter in the plant that had water but no light. Point out that this process, called *cellular respiration*, occurs in all living plants and animals. **PD leader talk:** "The main point of this diagram is that an individual plant or animal can lose mass from its body by burning food and releasing carbon dioxide and water."

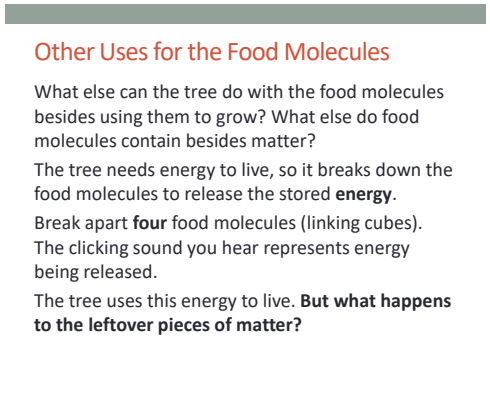
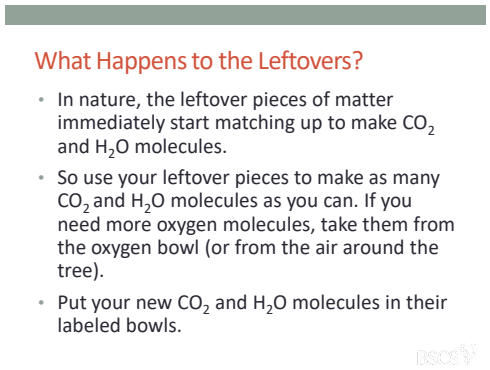
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Purpose • Ask participants a question that will create some cognitive dissonance, and reflect on the misconceptions in some of the responses.	Where Did the Mass Go? Your friend decides to take advantage of the wonderful exercise opportunities around Cal Poly and loses 25 pounds. Where did most of the fat/mass go? a. The fat was converted into heat. b. The mass left her/his system as urine. c. The mass left her/his system as feces. d. The mass left her/his system as carbon dioxide and water. e. None of these	**Display Slide 35.** Where Did the Mass Go? **PD leader talk:** "To see how well you understand the science ideas we've been discussing, use what you've learned so far to answer the question on the slide." **PD leader move:** Ask participants to identify the common misconceptions for each incorrect answer. They should identify the following misconceptions: a. Matter is converted into energy. b. All the lost mass is water. c. Undigested food is how our bodies lose mass. d. Correct answer **PD leader move:** Remind participants that matter is lost as CO_2 through cellular respiration.
	Purpose • Interpret data to draw out major science concepts.	A Challenge Question Was the plant grown in the light also performing cellular respiration? Treatment / Initial Mass of Seeds (g) / Initial Mass of Paper-Towel Circles (g) / Final Mass (after Drying) (g) / Change in Mass (g) + light, + water / 1.00 / 0.61 / 1.71 / +0.10 – light, + water / 1.00 / 0.61 / 1.42 / –0.19 + light, – water / 1.00 / 0.62 / 1.61 / –0.01	**Display Slide 36.** A Challenge Question **PD leader talk:** "So here's a challenge question to consider: *Was the plant grown in the light also engaging in cellular respiration?*" **PD leader move:** Discuss this question as a group and elicit participants' ideas. **PD leader move:** Point out that the plant in the light was performing *both* photosynthesis and cellular respiration, but it was performing

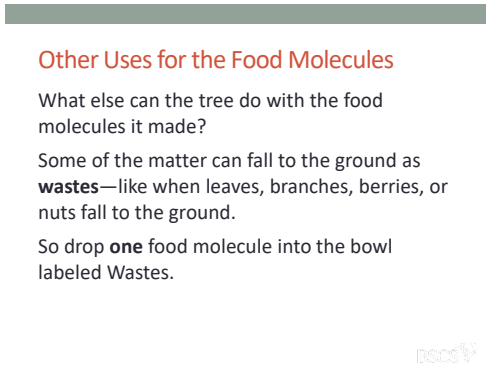
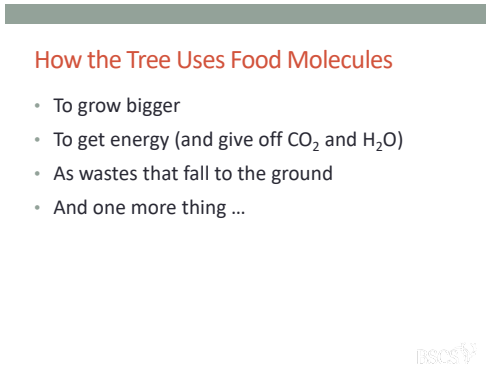
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			photosynthesis at a faster rate.
	Purpose • Reorient participants to the content deepening focus question and set up the model that will show how matter moves through a food chain.	Our Content Deepening Focus Question **Focus question:** *What happens to matter as it moves from organism to organism in a food chain?* To help us answer this question, let's build a physical model! Pair up with a partner and gather these supplies: ◦ Food-chain organism "place mats" (laminated posters). ◦ Baggies containing 16 linking-cube CO_2 molecules (each molecule = 2 white cubes and 1 red cube) and 8 linking-cube water molecules (each molecule = 2 blue cubes and 1 white cube) (Total cubes: 16 red, 16 blue, 40 white) ◦ 4 small bowls labeled Water, CO_2, Oxygen, Wastes	**Display Slide 37.** Our Content Deepening Focus Question **Timing note:** Allow 40 minutes for this activity (slides 38–60). **PD leader move:** Ask participants to pair up and collect the items they'll need for this activity from Food Webs lesson 3. **PD leader talk:** "Make sure to give yourselves plenty of space for the place mats, waste bowls, linking cubes, and your notebooks."
		Building Organisms: Three Kinds of Matter  Water Molecule (H_2O) Food Molecule (Sugar) Carbon-Dioxide Molecule (CO_2)	**Display Slide 38.** Building Organisms: Three Kinds of Matter **PD leader move:** Remind participants of the three different types of molecules that will be used at the beginning of the activity. **PD leader talk:** "You may want to make a key for these molecules in your notebooks. Remember that the blue linking cubes are hydrogen, the white ones are oxygen, and the red ones are carbon."
	10-MINUTE BREAK		

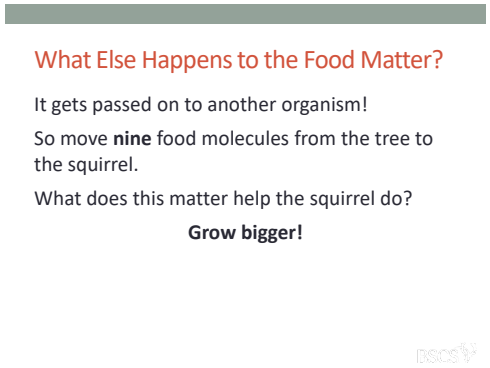
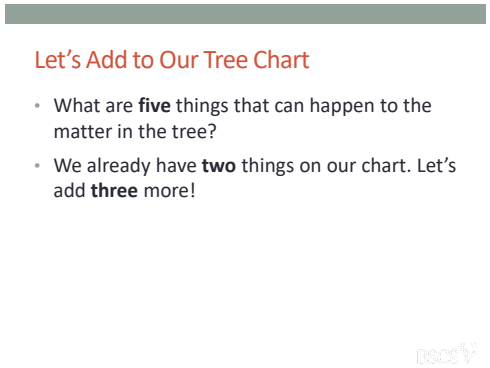
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Purpose • Help participants find relevant content-related sections in the lesson plans.	Lesson 4 Science Content Storyline To prepare for this activity, read the science content storyline on the opening page of lesson 4 in your lesson plans binder.	**Display Slide 39.** Lesson 4 Science Content Storyline **PD leader move:** Give participants 1 or 2 minutes to read the science content storyline on the overview page for lesson 4. **PD leader talk:** "Make sure to refer back to this science content storyline as we work through the activity."
	Purpose • Create a content representation showing how matter moves from organism to organism in a food chain.	Let's Create a Content Representation! During this food-chain simulation from lesson 4, you'll create a diagram in your notebooks that summarizes how matter moves from organism to organism in a food chain (tree, squirrel, mountain lion, decomposer).	**Display Slide 40.** Let's Create a Content Representation! **PD leader talk:** "Your main task in this activity is to create a content representation in your notebooks showing how matter moves from organism to organism in a food chain and back into the environment."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Purpose • Help participants learn the science content while conducting the main activity in lesson 4 (one of the most challenging activities in the lesson sequence).	What Happens to the Matter? What do you think happens to the molecules (matter) as they move from organism to organism in a food chain? Let's find out! • First, count how many pieces of matter you're starting with. (Each linking cube represents a piece of matter, so you should begin with 72 pieces of matter: 16 red, 16 blue, and 40 white linking cubes.) • Throughout the activity, make sure to keep track of how many pieces of matter you have.	**Display Slide 41.** What Happens to the Matter? **Note:** The content for this activity comes from lesson 4. **PD leader move:** To help orient participants to the activity, lead them through the information on the slide. Make sure participants have all the necessary materials.
		What Happens to Matter in the Tree? 1. 2. 3. 4. 5. Draw this chart in your notebooks. Then write and draw in boxes 1 and 2 to show **two** things that happen to matter in the tree. 	**Display Slide 42.** What Happens to Matter in the Tree? **PD leader move:** Ask participants to complete the task on the slide. **Note:** The first two boxes should say "Make food" and "Use food to grow."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		Show the Tree Making Food and Growing Use linking cubes to show the tree making food and growing: • Use up all of your carbon-dioxide and water molecules to make food molecules in the tree. • Put leftover oxygen "atoms" in the oxygen bowl (or in the air around the tree). • Show how the tree grows bigger with all these food molecules. 	**Display Slide 43.** Show the Tree Making Food and Growing **PD leader talk:** "You'll be working with a partner to carry out each step in this simulation." **PD leader move:** Use the PowerPoint slides to guide participants through each step (the way they'll guide their students). **PD leader talk:** "Students won't need to learn all the details about the chemical reactions represented in this simulation, but you should gain some familiarity with them. Here are the most important points to remember: 1. Energy-supplying food matter is moving from one organism to another in this simulation. 2. Each organism • uses food matter to grow bigger; • breaks down some of its food molecules to release the energy it needs to live and grow, creating carbon dioxide and water in the process; • leaves behind some food matter as wastes; and • can be consumed by another organism. 3. Despite all these (chemical) changes and the movement of matter from one organism to another, no matter is ever lost or destroyed. Matter constantly moves around and is rearranged, but it

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			never disappears." **PD leader move:** Encourage participants to jot down this information in their science notebooks.
			**Display Slide 44.** Other Uses for the Food Molecules **PD leader move:** Walk participants through the steps on the slide.
			**Display Slide 45.** What Happens to the Leftovers? **PD leader move:** Walk participants through the steps on the slide.

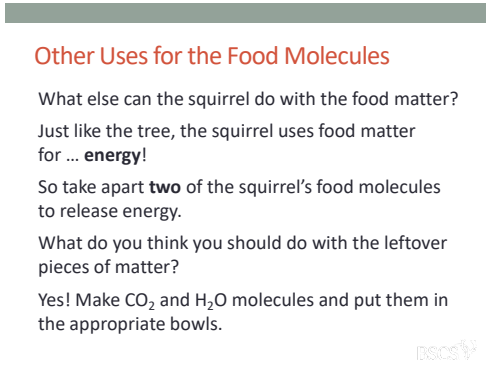
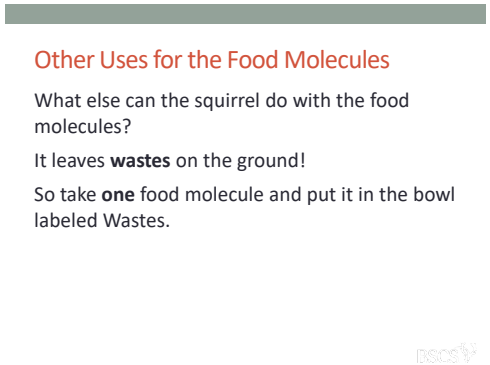
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 46.** Other Uses for the Food Molecules **PD leader move:** Walk participants through the steps on the slide.
			**Display Slide 47.** How the Tree Uses Food Molecules **PD leader move:** Read through the bullet points on the slide.

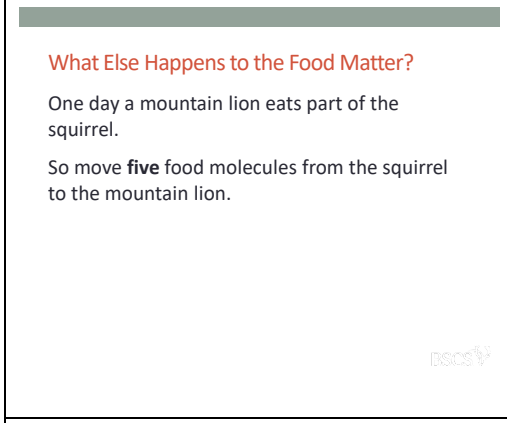
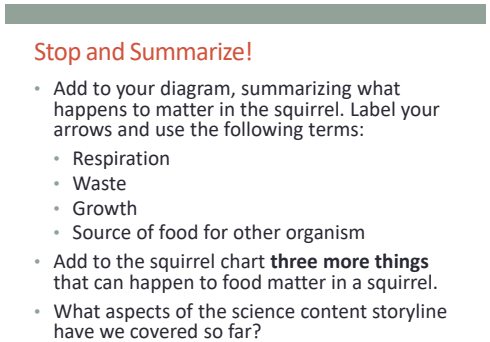
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 48.** What Else Happens to the Food Matter? **PD leader move:** Walk participants through the steps on the slide.
			**Display Slide 49.** Let's Add to Our Tree Chart **PD leader talk:** "So what are five things that can happen to the matter from the tree?" **PD leader move:** Participants should come up with the following five things the tree does with matter: 1. Makes new food from carbon dioxide and water 2. Uses the matter for growth 3. Uses the matter for energy 4. Gives off matter as waste 5. Becomes a source of food for another organism

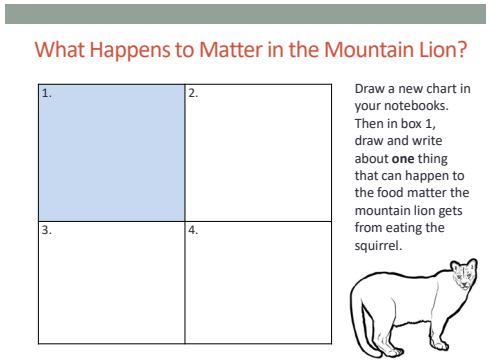
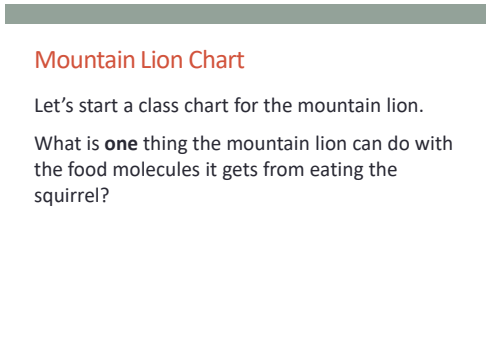
PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process

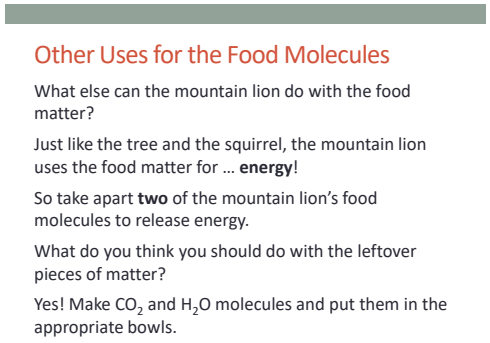
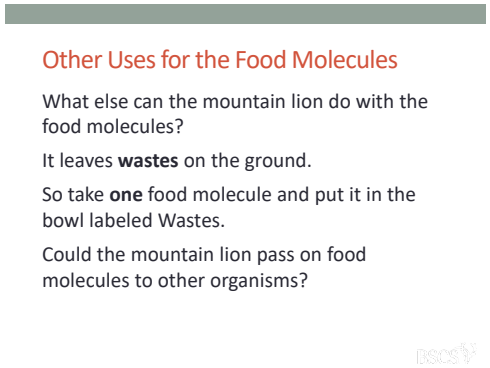
	Purpose
	• Reinforce important notebook skills and how to create and modify content representations and models as a lesson proceeds.
		Stop and Summarize!
		• Create a content representation that summarizes what happens to matter in the tree. Label your arrows and use the following terms in your diagram:
		  • Photosynthesis
		  • Respiration
		  • Waste
		  • Growth
		  • Source of food for another organism
		• What aspects of the science content storyline have we covered so far?
			Display Slide 50. Stop and Summarize!
			
			PD leader talk: "Now I'd like you to create a content representation showing what happens to matter in the tree. Use two full blank pages in your science notebooks and make sure to leave space to add the other organisms to your food chain. Also use different colors to label wastes, respiration, and other items on your drawings."
			
			PD leader move: Examine participants' drawings to assess whether the arrows and terms are in the correct locations and the arrows have been labeled.
			
			PD leader move: When participants have finished their diagrams, refer them back to the science content storyline in lesson 4. Ask them to think about the aspects that have been covered thus far.

		What Happens to Matter in the Squirrel? 1. 2. 3. 4. Draw a new chart in your notebooks. Then in box 1, draw and write about **one** thing that can happen to the food matter the squirrel takes from the tree. 	**Display Slide 51.** What Happens to Matter in the Squirrel? **PD leader move:** Ask participants to complete the tasks on the slide.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 52.** Other Uses for the Food Molecules **PD leader move:** Walk participants through the steps on the slide.
			**Display Slide 53.** Other Uses for the Food Molecules **PD leader move:** Walk participants through the steps on the slide.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 54.** What Else Happens to the Food Matter? **PD leader move:** Walk participants through the steps on the slide.
			**Display Slide 55.** Stop and Summarize! **PD leader talk:** "Add to your diagrams using the same colors to label your arrows and drawings." **PD leader move:** When participants have finished their diagrams, have them add to their squirrel charts three more things that can happen to food matter in a squirrel. Then refer them back to the science content storyline in lesson 4. Ask them to think about the aspects that have been covered thus far.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 56.** What Happens to Matter in the Mountain Lion? **PD leader move:** Have participants complete the tasks on the slide.
			**Display Slide 57.** Mountain Lion Chart **PD leader move:** "Let's create a new chart for the mountain lion and list one thing it can do with the food matter from the squirrel."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 58.** Other Uses for the Food Molecules **PD leader move:** Walk participants through the steps on the slide.
			**Display Slide 59.** Other Uses for the Food Molecules **PD leader move:** Walk participants through the steps on the slide.

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

		Stop and Summarize!
		• Add to your diagram, summarizing what happens to matter in the mountain lion. Label your arrows and use the following terms:
		  • Respiration
		  • Waste
		  • Growth
		  • Source of food for other organism
		• Add to the mountain lion chart **three more things** that can happen to food matter in a mountain lion.
		• What aspects of the science content storyline have we covered by now?
			Display Slide 60. Stop and Summarize!
			
			PD leader talk: "Now add to your diagrams again using the same colors to label your arrows and drawings."
			
			PD leader move: When participants have finished their diagrams, refer them back to the science content storyline in lesson 4. Ask them to think about the aspects that have been covered thus far.

	Purpose • Introduce participants to Food Webs lesson 5 in which decomposers are discussed.	Lesson 5 Focus Question The organisms in our ecosystem model left behind a good deal of matter as wastes. Guess where we're headed next! Here's a clue: Turn to the first page of lesson 5 and read the focus question.	**Display Slide 61.** Lesson 5 Focus Question **PD leader talk:** "Next, we're going to talk about the wastes our organisms left behind! The focus question for this Food Webs lesson is *What happens to the matter that makes up wastes and dead organisms?*"

<table>
<tr><th>PD Model:
Time/Phase</th><th>Purpose, Content, and
What Participants Do</th><th>Slides</th><th>Process</th></tr>
<tr><td rowspan="2"></td><td>Purpose
• Link to participants' work with decomposers earlier in the PD program.</td><td>What Helps Decomposers Grow?
• In a previous session, we encountered decomposers when we explored what happens to the mass of fresh strawberries compared to rotting strawberries in a jar.
• At the beginning of the experiment, we asked, "What will happen to the mass of the strawberry jar after the strawberries decompose compared to the mass before decomposition?"
• Where does the matter come from that helps decomposers grow?
 
Photo courtesy of Cal Poly Pomona</td><td>Display Slide 62. What Helps Decomposers Grow?

PD leader move: Read the first point and the first question on the slide.

PD leader talk: "What major principle are we using to answer this question?"

PD leader move: Confirm that the principle is conservation of mass. Then ask the group to rephrase it in kid-friendly language.

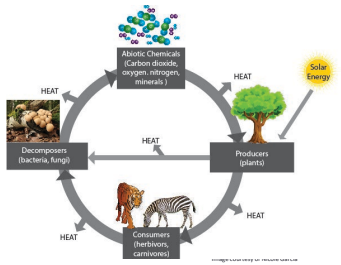
PD leader move: Ask the second question on the slide and have participants pair up to discuss it.

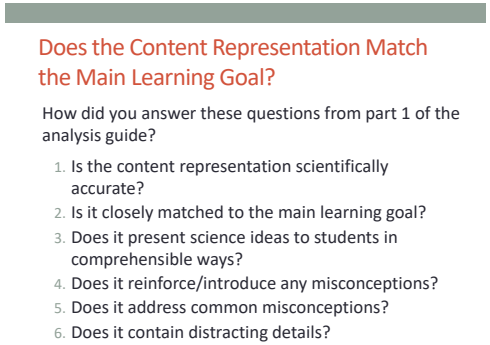
PD leader talk: "Let's hear your ideas about where the matter comes from that helps decomposers grow."</td></tr>
<tr><td>Purpose
• Extend the model of matter moving through food chains to include decomposers.
• Highlight a writing strategy used in the lessons.</td><td>The Role of Decomposers in Food Chains
Return to the food-chain model you created at the beginning of the session and add decomposers to your diagram. Then add as many details as you can to explain what is happening to the matter in this food chain. Be sure to label your arrows.
Word bank to draw from:
<table><tr><td>Decomposers</td><td>Minerals</td></tr><tr><td>Recycle</td><td>Matter</td></tr><tr><td>Food</td><td>Carbon dioxide</td></tr><tr><td>Water</td><td>Growth</td></tr><tr><td>Wastes</td><td>Energy</td></tr></table></td><td>Display Slide 63. The Role of Decomposers in Food Chains

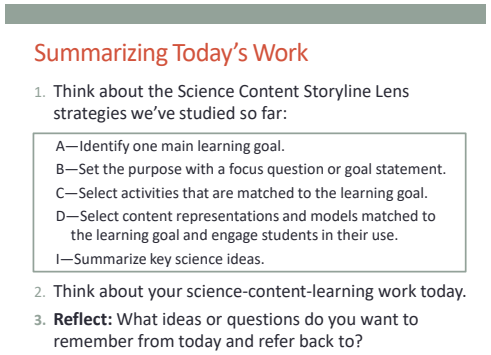
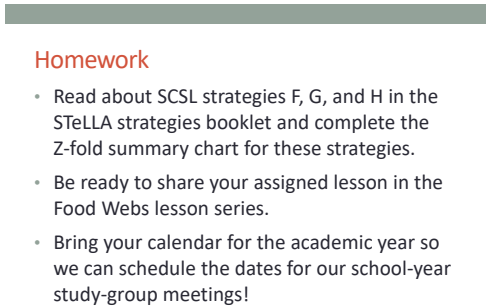
PD leader move: Ask participants to add decomposers to their food-chain diagrams from earlier and include as many details as they can about what happens to the matter. Note that this is similar to the task students complete in lesson 5.</td></tr>
</table>

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Purpose • Help participants become familiar with one of the readings in the lesson.	More about Decomposers • Read Rotting Is a Good Thing! (handout 5.2 in your lesson plans binders). • Then go back through the reading independently and answer the Stop and Think questions in your notebooks.	**Display Slide 64.** More about Decomposers **PD leader move:** Have participants locate Food Webs lesson handout 5.2 (Rotting Is a Good Thing!) in their lesson plans binders and read the essay individually, in pairs, or as a group. **PD leader talk:** "Now go back through the reading independently and answer the Stop and Think questions in your notebooks."
	Purpose • Reinforce the use of evidence from the reading to support claims (overlap of science practice and Common Core State Standard English Language Arts practice).	What Causes Things to Rot? • In lesson 5, students read the handout Rotting Is a Good Thing! after examining decomposing strawberries. Then they refer back to the reading to answer these questions: 1. How do the strawberries decompose? 2. Why did the mass of the strawberry jar stay the same? • What strong evidence can you find in the reading to support your answers to these questions?	**Display Slide 65.** What Causes Things to Rot? **PD leader move:** Read through the slide and ask participants the questions. Then direct them to the relevant pages in lesson 5b to see if their answers align with the answers in the lesson materials (see activity follow-up). **PD leader talk:** "Now read the science content storyline for lesson 5 on the overview page of the lesson plan." **PD leader talk:** "Does anyone have any questions about the ideas in this storyline?"

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
	Purpose • Synthesize and summarize key content.	How Do Organisms Get the Matter They Need? • The focus question for lesson 5 is *What happens to matter as it moves from organism to organism in a food chain?* • Add words and arrows to the diagram on handout 7.5—Matter in a Simple Food Chain—to show how each organism gets the matter it needs. • Also add to the diagram any major groups of organisms that may be missing! • Write a brief summary describing how this diagram can be used to answer the focus question.	**Display Slide 66.** How Do Organisms Get the Matter They Need? **PD leader move:** Distribute PD handout 7.5 (Matter in a Simple Food Chain) from Food Webs lesson 5a. **PD leader talk:** "How do you think each organism in the food chain gets the matter it needs to live and grow? Answer this question by adding words and arrows to the diagram on the handout. Make sure to label your arrows." **PD leader move:** Have participants complete the other tasks on the slide. **PD leader talk:** "Your final task is to write a brief summary describing how this diagram can be used to answer the focus question." **PD leader move:** Collect participants' responses to gain insight into any questions they still have about this focus question.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
		Content Representation: Ecosystem Model of Matter and Energy Copy the following information on a blank copy of Analysis Guide D (last page of handout 7.1). **Main learning goal:** • Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. • In the process of cellular respiration, food molecules and oxygen molecules in living organisms react to release the energy needed for life processes (such as growth, movement, warmth, and repair). • The process of photosynthesis converts light energy to stored chemical energy in food molecules. **Description of content representation:** summary diagram of matter and energy flow in an ecosystem	**Display Slide 67.** Content Representation: Ecosystem Model of Matter and Energy **Note:** If time is running short, work as a group on part 1 of Analysis Guide D and skip the next slide. **PD leader talk:** "Locate the blank copy of Analysis Guide D on page 5 of handout 7.1. Then choose one of the main learning goals on the slide and record it at the top of your handout, and copy the description of the content representation shown at the bottom of the slide."
		Ecosystem Model 	**Display Slide 68.** Ecosystem Model **PD leader talk:** "Closely examine this content representation of an ecosystem and answer the questions in part 1 of the analysis guide."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 69.** Does the Content Representation Match the Main Learning Goal? **PD leader move:** Go over participants' responses to the questions in part 1 of the analysis guide. **Ideal responses:** • **Question 1:** This model is somewhat accurate. The problem is that it would be very easy for novices to conflate matter and energy. • **Question 2:** Yes, the representation closely matches the main learning goal. • **Question 3:** The model could cause comprehension problems. • **Question 4:** Misconceptions could be reinforced if students conflate matter and energy. • **Question 5:** The model doesn't address possible misconceptions. • **Question 6:** Colors representing matter and energy aren't consistent (sometimes heat is black, and sometimes white), which could confuse or distract students.

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
3:15–3:30 15 min **Wrap-Up: Summary, Homework, and Reflections** Slides 70–72	**Purpose** • Summarize and reflect on key ideas about SCSL strategies A, B, C, D, and I and the Food Webs science content, lesson plans, and lesson analysis work. **What Participants Do** • Write about and share key ideas from SCSL strategies A, B, C, D, and I. • Write about and share key ideas about today's content deepening work. • Copy down the homework assignment for day 8. • Write reflections on today's learning. **Handouts in PD Binder** • 7.6 Daily Reflections—Day 7 **Supplies** • Science notebooks		**Display Slide 70.** Summarizing Today's Work (6 min) a. **Individuals (4 min):** Ask participants to think about the first two tasks on the slide and respond to the reflection question in their notebooks. b. **Whole group (2 min):** Ask for volunteers to share an idea or question from their responses to the reflection question.
			**Display Slide 71.** Homework (3 min) a. Review the homework assignment and have participants write it in their notebooks. b. Make sure participants understand the assignment. c. "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."

PD Model: Time/Phase	Purpose, Content, and What Participants Do	Slides	Process
			**Display Slide 72.** Reflections on Today's Session (6 min) a. Allow **at least 5 minutes** for participants to think about today's session and write their reflections and feedback on the Daily Reflections sheet (handout 7.6 in PD program binder).