

## PD Leader Master

### 5th-Grade Guide to Belcastro Video Clips for Day 6

#### Analysis Guide C, Part 1—Identify and Analyze Science Ideas in the Activity (Four Video Clips)

**Focus question:** How do plants get the food they need to live and grow?

**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.

**Note to PD leaders:** Participants may make different arguments about whether the science ideas in these video clips are well matched to the main learning goal. Because the teacher ran out of time before getting to the idea of plants *making* their own food, not all of the science ideas that emerged from activities in this lesson are well matched to the *intended* main learning goal. Some of them challenge students’ misconceptions about how plants get their food (such as the misconception that plants get their food by taking it in from the soil, water, the air [carbon dioxide], or sunlight). This cognitively prepares students for understanding (in the following lesson) how plants *transform* water, carbon dioxide, and sunlight into energy-supplying food. In that sense, the science ideas and the scientific definition of *food* are closely matched to the main learning goal, although the match is only partial. However, it is perfectly reasonable to argue that some of the ideas from these activities are not well matched to the intended main learning goal.

Time Code	Science Ideas in Video Clip 3	Matched to the Main Learning Goal?
00:06.5	Food is matter (building materials) that contains energy living things can use to live and grow, to heal wounds, and to keep all their parts working.	Close but partial match. This idea defines the key word <i>food</i> in the main learning goal.
01:54.0	Water isn’t food because it doesn’t have any Calories.	Close but partial match (or not matched). This idea emphasizes that water, by itself, is not food for plants, correcting a common student misconception. It sets up the main learning goal but doesn’t directly address it.

Time Code	Science Ideas in Video Clip 4	Matched to the Main Learning Goal?
<b>Note:</b> In this clip, most of the ideas expressed are student ideas and arguments about whether soil is food for plants. The teacher doesn’t indicate whether any of the ideas are <i>science</i> ideas.		
03:29.8– 03:42.9	Plant food doesn’t have Calories, so it isn’t food.	Close but partial match (or not matched). Addressing a common misconception, this idea clarifies that plant food doesn’t provide energy for plants, so it isn’t food for plants.
04:25.5	Food has to have Calories and mass.	Close but partial match. This idea defines the key word <i>food</i> in the main

		learning goal.
04:25.5– 04:41.5	Plant food in the soil has mass, but it doesn't have Calories, so it's not a food.	Close but partial match (or not matched). Addressing a common misconception, this idea clarifies that plant food doesn't provide energy (Calories) for plants, so it isn't food for plants.

Time Code	Science Ideas in Video Clip 5	Matched to the Main Learning Goal?
00:27.4	Sunlight is not matter.	Close but partial match (or not matched)
00:35.6	The scientific definition says that sunlight needs to have both energy and matter to be a food.	Close but partial match
01:44.2	Food is matter—building materials—that contains energy that living things can use to live and grow.	Close but partial match
02:34.0– 02:39.4	Food is matter that contains energy.	Close but partial match
04:44.5– 04:56.3	Food has to be matter that contains energy.	Close but partial match
04:58.5; 05:02.1	Sunlight does have energy, but it doesn't have matter.	Close but partial match (or not matched)
05:27.5	The Sun provides energy. This energy has no mass.	Close but partial match (or not matched)

Time Code	Science Ideas in Video Clip 6	Matched to the Main Learning Goal?
01:15.3	Sunlight and soil are not the plant's food.	Close but partial match (or not matched)
01:28.1	Water and carbon dioxide aren't the plant's food.	Close but partial match (or not matched)

### Analysis Guide C, Part 2, and PowerPoint Discussion Questions

#### Were the activities well matched to the learning goal? Provide evidence to support your response.

The activities in this lesson were building up to the main learning goal, but the learning goal itself was never addressed because the teacher ran out of time. The activities were designed to challenge students' initial misconceptions and establish that water, carbon dioxide, soil, and sunlight are *not* food for plants. As seen in the video clips, this set students up to wonder, *Then what IS food for plants?*

- Analysis of the Van Helmont experiment data was designed to show that the food matter plants need to live and grow did *not* come from the soil. There is evidence that students came to this conclusion (clip 4, segments 05:23.3–07:29.6). And Kyle summed up by concluding that something else must be food for the plants (07:29.6). In segments 06:57.2–07:29.6 (video clip 4), he said, “Since the tree’s gaining, like, over 160 pounds ... and that’s a lot, but the soil lost, like,

two ounces, ... I think that's saying that the tree didn't get any, like, didn't get much stuff from the soil because it was in a pot, and it [the soil] ... only lost two ounces. So I don't think that soil helped it grow. I think it was something else that did."

- Emmy came to the same conclusion that soil, sunlight, water, and carbon dioxide are not food for plants, which prompted her to ask, "Then what *is* food for plants?"
  - Video clip 5, segment 03:15.5: "If soil and sunlight isn't the food, then what is the food for plants?"
  - Video clip 6, segment 01:15.3: "If sunlight and soil isn't the plant's food, then what is it?"
  - Video clip 6, segment 01:28.1: "[If] water ... and carbon dioxide aren't the ... plant's food, then what is?"

**If there are weak or partial matches (or no matches), suggest ways the activity (or activities) could be modified to more closely match the main learning goal.** Because the teacher ran out of time, the intended learning goal wasn't addressed in this lesson. Consequently, the activities didn't closely match the main learning goal. However, the activities did successfully challenge students' misconceptions that plants get their food by taking it in from the soil, the air (carbon dioxide), the water, or the Sun. Thus, they did a good job of setting students up to make sense of the idea that plants make their own food by using (transforming) sunlight, water, and carbon dioxide. The activities and ideas in this lesson clearly helped students move toward the intended main learning goal even though they didn't specifically address it.

Instead of changing the activities to match the main learning goal for this lesson, a good solution would be to change the main learning goal. In fact, most students (with the exception of some vocal dissenters!) walked away from the lesson with this main learning goal: *Water, carbon dioxide, soil, and sunlight are not food for plants because they aren't matter that contains energy plants can use to live and grow.* These important understandings support students in developing the idea that plants make their own food.

The weak match between the activities and the main learning goal in this Food Webs lesson was later resolved by dividing the original lesson into a two-part lesson. The first part of the lesson addresses common student misconceptions, as seen in the four classroom video clips. The focus question in the revised plan was *What evidence do we have that water, carbon dioxide, soil, and sunlight are or are not food for plants?* And the main learning goal was *Water, carbon dioxide, soil, and sunlight are not food for plants because they are not matter that contains energy plants can use to live and grow.* The second part of the lesson addressed the focus question, *How do plants get the food they need to live and grow?* Activities in the revised lesson closely matched the 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. (**Note:** The focus questions and main learning goals in the revised plans differ from the current lesson plans.)

### **What kept students focused on the revised learning goal?**

1. The teacher asked *challenge questions*, pushing students for evidence to support or challenge whether soil or sunlight is food for plants:
  - Video clip 4, segments 00:16.2, 01:01.1, 01:12.2, 02:34.7, 03:47.5, 04:04.4
  - Video clip 5, segments 00:07.9, 03:33.0, 04:28.8
2. The teacher kept students focused on the *particular variable* under discussion and the *data and evidence* relevant to that variable. (**This is a good use of STeLLA strategy 4: Engage students in analyzing and interpreting data and observations.**)

- In video clip 4, the teacher kept students focused on the data from the Van Helmont experiment (segments 02:48.0, 05:02.5, 05:13.2, 05:42.2, 05:49.8, 05:59.5, 06:05.3).
  - In video clip 5, the teacher kept students focused on sunlight. In segments 03:26.8–03:29.9, she spotted the shift in the discussion to water and brought students back to sunlight. At 04:17.6 she again brought the discussion back to sunlight when a student started talking about water.
3. The teacher kept students focused on the scientific definition of *food*.
    - Video clip 5, segment 04:44.5: “We’re going to go through it [the scientific definition] word by word. Food has to be what?”
  4. At the end of the lesson, the teacher engaged students in *synthesizing* what they had concluded about all four variables (water, carbon dioxide, soil, and sunlight). She used this to set up how students will answer the focus question in the next lesson. At the beginning of video clip 6, she asked students to indicate their conclusions about the materials by showing thumbs-up (all four are food for plants), thumbs-down (none are food for plants), or thumbs-sideways (some are food; some aren’t). Most students signaled thumbs-down. The teacher then left students with a controversy to be resolved next time: If all four materials are *not* food for plants, then what is? (segments 01:22.7–01:48.9).

#### **What distracted students from the revised learning goal?**

- In video clip 5, Harry and Blake might have distracted students from the intended conclusion that sunlight is not food for plants. They argued passionately that since the Sun provides energy that helps plants live and grow, it is food for plants. They weren’t convinced that food for plants must be matter that contains energy. This misconception that the definition of food for plants is different from the definition of food for animals is actually quite common for students.
- What Harry and Blake didn’t understand is that plants cannot use *light energy* to live and grow. They can use only *food energy* or Calories (chemical energy stored in molecules). This idea is crucial to the definition of *food* and needs to be emphasized when explaining how plants make their own food. Plants can *transform* light energy (which is not food for plants) into food energy (chemical energy stored in the bonds of glucose and other organic molecules).

**This analysis is a good content deepening opportunity  
for PD participants.**