PD Leader Master
5th-Grade Guide to Video Clips for Day 3

Strategies for Day-3 Video Clips

1. Video clip 1 focuses on strategy 4: Engage students in analyzing and interpreting data and observations.
2. Video clip 2 focuses on strategy 5: Engage students in constructing explanations and arguments.

Video clip 1: Belcastro classroom—small group observing and analyzing drops of water on the outside of a glass of water with ice, but not on a glass of room-temperature water (strategy 4)

Identify Strategy 4

The teacher **calls attention** to the key observations that water is forming on the outside of a glass of water with ice, but not on the outside of a glass of room-temperature water. She is **clarifying** these key observations and **identifying** what needs to be explained. She is also **highlighting** a pattern in the observations (the difference between the two glasses).

Evidence:
00:01.3–00:09.3
00:35.0
00:57.8–01:00.4
01:13.8

Students make **key observations**:

00:12.8 "There's water on the outside of the glass."

Students are trying to **make sense** of their observations:

00:11.2–00:46.8	In this overlapping talk, students are focused on the ice playing an important role in the water-changes system.
01:04.4	Alyssa makes a connection to water forming on cold soda cans.
01:19.8–01:44.2	A student suggests that maybe some sort of reaction is taking place between the ice and the air.

The teacher concludes by **highlighting** another pattern to be explained: There is water vapor all around both glasses (02:28.9).

Identify Teacher Questioning Strategies

It's appropriate for the teacher to ask **challenge questions** at this point, since she is trying to move student thinking forward toward a scientific understanding/explanation of condensation.

The teacher asks **challenge questions** at these points in the video clip:

0:00:13.4	T	Why?
0:00:18.1	T	What does the ice have to do with it [the water on the glass]?
0:00:43.0	T	How would the ice make that [condensation] happen?

The teacher also makes these **observations**:

0:00:57.8; 0:01:00.4	T	But the ice is on the inside of the glass.… And the water's on the outside.

02:24.4–end of video clip	T	So I want you to think about … now there's … water vapor around this [room-temperature] glass and around this [ice-water] glass. But for some reason, we're only seeing liquid water, not water vapor … on the outside of this one [the ice-water glass]. And vapor plays a really important role. [Is the teacher challenging students or leading them?]

It's appropriate for the teacher to ask **probe questions** at this point as well. To ask good challenge questions, the teacher needs to know what the students are thinking.

The teacher asks **probe questions** at this segment of the clip:

0:00:35.0	T	So there's ice, but ice is solid water. You're telling me there's liquid water on the outside [of the glass]?

Analyze Student Thinking

Analysis Questions

1. What student thinking is revealed in the video clip by engaging students in analysis and interpretation (strategy 4)?
2. Were any opportunities missed for engaging students in analyzing and interpreting data and observations?

Note: Encourage participants to come up with a claim, evidence, and reasoning for the first analysis question. For the second analysis question, have them consider alternative interpretations or strategies the teacher could have used in the video.

Possible claim: Students are focusing on the ice itself rather than the cooling effect the ice is having on the air around the glass.

Evidence:

00.14.5	Because there's no ice.
00:15.3	That [glass] has the ice cubes in it.
00:19.5	The ice is frozen water.
00:20.0	It's frozen.
00:21.3	It's melting.
00:44.0	'Cause the solid ice is melting.
01:31.2	It just makes, like, kind of a reaction between the ice and the air, so it makes it kind of have that effect with the water.

Reasoning: In their attempts at analysis, students are focused on the ice. They correctly recognize that the water is forming only on the outside of the glass with ice in it. But their ideas focus on what is happening to the ice itself (e.g., it's melting; it's frozen; it reacts with the air) rather than the effect of the ice on the air around the glass. To grasp what is happening in condensation, they need to understand two things about the air around the ice-water glass: (1) It's cooling (losing heat energy), and (2) there is water vapor in the air around the glass.

Alternative interpretation: Two students might be thinking about the air temperature around the glass. At 01:19.8, one student notes that the air surrounding the ice-water glass is warmer and causes a reaction between the ice water and the air. She is thinking about the air warming the ice cubes, and not about the air losing heat energy to the ice. And at 02:07.4, Gunnar mentions "vapor." Is he thinking about water vapor around the glass? A probe question would have been very helpful here:

"Say more about what you mean by 'vapor.' What does that have to do with the water on the outside of the glass?"

Video clip 2: Anderson classroom—small group working on explaining the water-changes system (strategy 5)

Identify Strategy 5

00:23.8 – 00:40.1 Carlos **gives an explanation** that energy changes are causing water-state changes in the system. He **supports** his explanation with science ideas: Adding heat energy causes water to change to a gaseous state; losing heat energy causes water to change to a liquid state. His **reasoning is logical** and based on his **observations** of the system, although he doesn't explicitly mention his observations.

01:21.8 – 02:00.4 This girl **agrees** with Carlos (argumentation) that the water is in a gaseous state in the tubing and turns to liquid water when it cools and drips into the test tube.

02:51.0 – 03:05.4 This student uses **logical reasoning** to deduce that there is more heat in the aquarium tubing than in the test tube and uses **evidence from observations** that steam is clouding the aquarium tubing. In contrast, the test tube just has liquid water. The student also uses **science ideas** about molecules in the liquid state forming together and sliding past each other to support her explanation. **Note:** She seems to have a misconception that steam is gaseous water vapor, but this is something to address in the analysis of student thinking, not here when we are only identifying students engaged in trying to construct explanations.

Identify Teacher Questioning

It's appropriate for the teacher to ask **challenge questions** at this point as he tries to move student thinking forward toward a scientific understanding/explanation of condensation.

The teacher asks **challenge questions** at these points in the video clip:

0:00:02.2 T So talk to me about that focus question [How can ideas about water molecules help us explain evaporation and condensation in a system?]. What does happen to the molecules as water evaporates and condenses?

0:00:17.0 T Can you use the … the diagram in front of you to explain what you mean by that, Carlos?

0:02:01.0 T OK, so it's cooler here. So explain to me using— Kelsey used the word *cooling*. Explain to me what's happening with the molecules as [the water is] changing those states.

0:02:28.9 T OK. So what's happening with the molecules? What are the molecules doing?

0:02:37.7 T Can you be specific about what state you're talking about? When are they [the molecules] doing that?

0:02:42.3 T OK, so in your diagram, where— Explain what the motion of the molecules is doing at a particular spot.

0:03:23.5 T So Kaya, what is the movement of the molecules like in the [aquarium tubing]?

0:04:01.9 T In the aquarium tubing, are [the molecules] only losing energy because they're moving away from the hot plate, or is there another reason that they're losing energy in the aquarium tubing?

It's also appropriate for the teacher to ask **probe questions** at this point. To ask good challenge questions, he needs to know what students are thinking.

The teacher asks **probe questions** at these segments of the clip:

0:01:55.8 T OK, so you said it's cooler in the— You do … do you mean the tubing or the test tube, where it's cooler?

0:02:20.2 T We … I heard you guys say … a couple of you say it [the water] was changing state over here because it's losing energy. Correct?

Identify Strategy 4

00:48.2–01:24.3 The teacher is trying to make sure students observed that there was condensation in the aquarium tubing, not just in the test tube. He is ensuring they aren't missing key observations. He makes this move because students were talking only about water changing back to the liquid state in the test tube.

Analyze Student Thinking

Analysis Questions

1. What student thinking is revealed by engaging students in constructing explanations of the water-changes system?
2. Were there any missed opportunities to support students in constructing explanations and arguments?

Note: Encourage participants to come up with a claim, evidence, and reasoning for the first analysis question. For the second analysis question, have them consider alternative interpretations or strategies the teacher could have used in the video.

Claim 1: Carlos has a good understanding of the relationship between energy changes and changes of state in the system, but he isn't using ideas about molecules.

Evidence: 00:23.8–00:40.1

Reasoning: Carlos accurately describes how adding heat energy causes a change from liquid to gas, and how losing heat energy causes a change from gas to liquid. But he never mentions anything about what is happening at the molecular level.

Claim 2: The teacher **challenges** students to use the idea of molecules in their explanations.

Evidence:

00:23.8–00:40.1	Carlos never mentions molecules in his explanation.
02:28.9	The teacher asks, "So what's happening with the molecules?"
02:42.3; 03:23.5; 03:32.6	The teacher asks again about molecules at these points.
02:33.4; 03:05.45; 03:41.2	After this, several students talk about the molecules.

Claim 3: Students aren't using science ideas about condensation to explain their observations of liquid water in the aquarium tubing. They focus only on liquid water forming in the test tube. The teacher attempts to get them to include their observations of liquid water in the aquarium tubing in their explanations but doesn't succeed.

Evidence:

00:40.1	Carlos talks about liquid water forming in the test tube.
00:48.2	The teacher pushes students to consider where else they saw liquid water.
01:09.4	The teacher highlights students' observation of liquid water in the aquarium tubing.
01:21.8	The teacher again calls students' attention to observing liquid water in the aquarium tubing.
01:32.9–02:00.4	A student supports Carlos's conclusion that there is water vapor (gas) in the aquarium tubing, and it doesn't cool and form liquid water until it gets to the test tube.
02:51.0–03:05.4	A student acknowledges liquid water in the aquarium tubing but still talks about liquid water forming in the test tube.
04:01.9	No one has mentioned cooling and condensation occurring in the aquarium tubing, so the teacher leaves students with a question that might get them thinking about the cooler air that is around the aquarium tubing.

Claim 4: One student might have a misconception that the "steam" in the aquarium tubing is water vapor.

Evidence:

02:51.0–03:05.4	This student says there is more heat in the aquarium tubing than in the test tube. She talks about steam clouding the aquarium tubing but focuses on water changing into liquid water in the test tube.

Reasoning: This student's explanation focuses on liquid water forming in the test tube (not in the aquarium tubing). But she also said there was steam and cloudiness in the aquarium tubing. It seems as if she's thinking that since there is more heat in the tubing than in the test tube, the change to the liquid state occurs in the test tube. This leads me to the conclusion that she thinks the steam or cloudiness is water vapor, not liquid.

Alternative interpretation: I'm not sure what the student means by "water droplets" (02:57.3). Does she mean in the aquarium tubing? Does this suggest that she *does* understand that steam is liquid-water drops?