Observation and Inference Using the Inquiry Activity “The Burning Candle”

Prep Time: 10 minutes
Class Time: 20 minutes (Note: If combined with Lesson 1 Part B, both can be completed in one class period.)

Word Wall Words: observation, inference

Overview
In this demo, the teacher uses a seemingly innocent “candle” to practice observation and inference, then delivers a discrepant event to cause students to re-examine their theories about the situation. This demo is also a great example for the Nature of Science and for showing that there is more than one possible explanation for observations, that science is tentative, and that theories can change as new evidence is gathered.

NGSSS
SC.4.N.1.6
SC.5.N.1.6

Learning Goals
The student will be able to:

1. Understand that scientific knowledge is based on observation and inference.
2. Understand that an OBSERVATION is recognizing and noting a fact to gather information about the world using our five senses, and an INFERENCES is a possible explanation or guess about an observation.

Materials
- String cheese
- Almond sliver
- Skinny coffee stirrer type straw
- Lighter
- Candle holder
Background
Excerpt from Randy Bell’s Book (2008):

“If your students are like mine, this straightforward concept will likely be difficult for them to understand and accept. Most students hold the oversimplified view that scientific knowledge is solely based upon the accumulation of careful observations. For them, the mantra of the scientist is much like that of Sergeant Joe Friday on the old television show Dragnet: “Just the facts, Ma’am.” In this view, the reliance on careful observation coupled with the avoidance of subjective thought and speculation distinguishes science from other disciplines. In actuality, the practice of science is much more complex (and interesting) than simply making careful observations” (p.36).

Procedure:

• Begin with a discussion on the definition of observation. Have students define observation. Common responses include:
  “Looking at something”
  “Using any of your five senses to collect information”
  “Making measurements”

  These comments are accurate and present a different perspective of the way the term observation is used in science. Remind students that observing in science can mean using any of your five senses.

• Set up the candle beforehand. To set up, insert straw/stirrer into the “candle” the long way to reduce its jiggling. Put one almond sliver in one end to resemble a wick. You might want to model each of these additionally with an X-Acto knife for realism. Burn the almond sliver and blow it out so it looks like it has burned before, and so that it lights easier the second time.
• In front of the class, dim the lights (or not) and tell the students you’d like them to make observations about a very special piece of equipment.
• Present the unlit “candle” but don’t call it by name. Have students observe on paper or out loud.
• Light the candle and ask them to continue observing.
• After about 20 seconds it might start to sputter so you’ll have to cut the observing short.
• Teachable Moment: Tell them that you’re going to do something and they should continue taking observations.
• Dramatically bite the top off the candle, lit almond and all, chew and swallow.
• Ask them to continue making observations.
• Discussion: Were some of their observations actually inferences? Were any of them not surprised?
• The goal of the segment is for the students to understand the meaning of inference. Acceptable definitions would be something like the following:
  “To reach a conclusion based on evidence”
  “Using observations to reach a logical conclusion”
  “An observation is what you see, feel, hear, taste, or smell. An inference is what you think.”
Alternative Activity: Crazy Ketchup

Procedure:

• Set up the “ketchup bottle” prior to class by unscrewing the lid of the bottle and placing the red yarn inside. Then, take the lid and one of the ends of the yarn, and pull it through the spout of the lid. Tie a small knot on both ends of the yarn to prevent it from slipping back into the bottle. Pull the rest of the string into the bottle, where the small red knot is barely protruding from the spout (students might construe this to be the little glob of ketchup stuck to the spout).

![Diagram of ketchup bottle with red yarn](image)

• Before starting the activity, have the students define ‘observation’. Common responses include:
  “Looking at something”
  “Using any of your five senses to collect information”
  “Making measurements”

These comments are accurate and present a different perspective of the way the term observation is used in science. Remind students that observing in science can mean using any of your five senses.

• The teacher presents the bottle (be careful to avoid saying ‘ketchup bottle’) and encourages students to make observations.

• After students’ observations have been exhausted, teacher points the bottle toward the class and squeezes hard. The red yarn will fly out of the bottle, looking exactly like a spurt of ketchup.

• After students have recovered from the ‘shock’ of the discrepant event, teacher guides the class in defining ‘inference.’
• Students identify the inferences in their original list of ‘observations.’ Teacher helps students realize that many of their ‘observations’ were actually inferences, reflecting their incorrect assumption that there was ketchup in the bottle.
• Students discuss how observations and inferences are used in everyday situations.
• Students discuss how observations and inferences are used in science.
• Compare the definitions of ‘inference’ and ‘observation.’ Remind students that observation is:
  “Using your five senses to collect information about natural phenomena.”
• If students do not have a clear grasp on the definition of ‘inference,’ then a more deductive approach can be used by offering the formal definition, like the following:
  “To reach a conclusion based on evidence.”
  “Using observations to reach a logical conclusion.”
  “An observation is what you see, feel, taste, hear or smell. An inference is what you think.”

Assessment

• Reflection on Burning Candle Activity Worksheet
• Reflection on ‘Crazy Ketchup’ Activity Worksheet

Exit Ticket

• Define observation.
• Give examples of inference.
• True or False: Scientific knowledge is based on observation and inference.
Reflection on Burning Candle Activity

Name ___________________________________________ Date __________

1. Define observation.
   ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________

2. Define inference.
   ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________

3. List below some of your class’s observations and inferences about the “candle” you saw in class.

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<thead>
<tr>
<th>Observations</th>
<th>Inferences</th>
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4. What was an observation that you made at the beginning that turned out to be an inference?
   ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________

5. Describe an example of how scientists use observations and inferences to understand some aspect of the natural world.
   ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________
Reflection on ‘Crazy Ketchup’ Activity

Name ___________________________________________ Date _____________

1. Define observation.
   ______________________________________________________________________
   ______________________________________________________________________
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2. Define inference.
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3. List below some of your class’s observations and inferences about the bottle you saw in class.

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