BSCS Pathway Session: Engaging Students in Explanations and Argumentation

Practices 6 and 7

April Gardner
Connie Hvidsten

NSTA • Chicago, IL
13 March 2015
Welcome!

• What is your role as an educator?

• What interested you in this session?
BSCS Mission
To transform science teaching and learning through research and development that strengthens learning environments and inspires a global community of scientifically literate citizens.
Goals of this session

• Experience a strategy for helping students develop a scientific explanation (SEP 6)
• Evaluate explanations to experience the process of scientific argumentation (SEP 7)
Participate from two different perspectives

Learner perspective (learner hat)

Teacher perspective (teacher hat)
Put on your learner hats!
Brrr!

• Place a piece of ice in the palm of your hand. How does it feel?
• Why does your hand feel cold when you’re holding an ice cube?
• Write down your ideas about why your hand feels cold.
Black Blocks

1. Notice the black blocks in the middle of the table. Do not move them or pick them up at any time!
2. Touch the blocks and write down your observations.
3. Question to investigate: Which block will melt an ice cube the fastest and why? Write down your prediction.
4. Share your predictions with those at your table.
5. Explain your reasoning for your prediction.

You do not have to agree with everyone in your group. This is an individual prediction.
Black Blocks and Ice

1. Test your predictions by placing one ice cube in the center of each block.
2. Make a T chart. Label the column on the left side “Observations.” Label the column on the right side “Ideas.”
3. Record your observations on the T chart.
4. Discuss what happened and why with your group. How did your predictions compare with your observations?
5. Record your initial ideas on the T chart.
Science Ideas for Black Blocks and Ice

• What are some science ideas that you think might be related to the phenomenon you observed with the black blocks and ice?

• A Model for Matter
  – BB Model
  – Computer Model
BB Model

1. Look at the petri dish of BBs on your table—don’t touch them at this time!
2. Predict how the BBs in the dish will move when you shake the dish.
   • Will they all move at the same speed?
   • How will they move when they collide?
3. What do the BBs represent in this model of matter?
BB Model

1. Shake the petri dish slowly. Record & discuss your observations:
   • Are all the BBs moving at the same speed?
   • What is supplying the energy for the BBs to move?
   • What happens when the BBs collide?
2. Shake the petri dish more vigorously. Record & discuss your observations again.
3. If the BBs in our model represent the particles in matter, what does the shaking represent? What does the speed of the movement of the BBs represent?
BB Model

• Discuss the following questions with your group:
  – What might happen to particles moving slowly if they collided with particles moving very fast?
  – Think about the phenomenon you observed. In ice you cannot see the particles moving. How might you tell if the particles are moving fast or slow?

• Add any new ideas to your T chart.
Computer Model

• The model will show what happens when objects of different temperatures are in contact with each other.
• Watch carefully and record your observations of what happens to the matter on either side of the
  1. thick long bar
  2. sponge
• Add any new ideas to your T chart.
What are the characteristics of a science explanation?
Science Explanations

• Three key characteristics of science explanations:
  – Include a claim that answers the question
  – Are supported by evidence and science ideas
  – Include reasoning that links evidence and science ideas with the claim

• The Explanation Tool is a way to help you organize evidence and ideas for your explanation.
Science Explanations

• **Question:** The question your scientific explanation is intended to answer

• **Evidence:** Data that help answer the question

• **Science ideas:** Concepts that help answer the question

• **Claim:** Statement that answers your question and is supported by evidence and science ideas

• **Reasoning:** One or more sentences that link your claim, evidence, and science ideas to justify your claim
Scientific Argumentation

• Engaging in argument from evidence is a process used by scientists to reach common understanding and agreement about explanations for phenomena.

• Scientists use argument to critically and respectfully listen to, compare, and evaluate the evidence and reasoning in explanations.
Engaging in Argumentation

1. Take a stack of sticky notes and move to another group’s explanation, as directed by April & Connie.
2. Examine and provide 2 to 4 pieces of feedback on this group’s explanation:
   – Does each piece of evidence support the claim?
   – Does any of the evidence contradict the claim?
   – What evidence is missing that would strengthen the claim?
   – Is there a better explanation that accounts for the evidence?
3. Write your feedback on sticky notes and add these to the chart.
Engaging in Argumentation

1. Go back to your explanation and read the feedback from your reviewing group.
2. Then, meet with each other and engage in a respectful discussion about the relative strengths and limitations of your explanations. Base your arguments on
   • the strength of the supporting evidence & concepts and
   • the logic of the reasoning.
3. Consider how (or whether) your explanation could be revised to make it stronger.
Ideas from Brrr!

• Find your ideas that answered the question: *Why does your hand feel cold when you’re holding an ice cube?*

• Based on your experiences with the black blocks, the BB model, and the computer model,
  – which of your initial ideas are consistent with the science ideas in this lesson?
  – which of your initial ideas are inconsistent with these ideas?
  – did any of your ideas change? If so, what helped them change?
Thank You

To download this presentation, visit www.bscs.org/sessions