Scaffolding Claims Evidence and Reasoning in the Middle School Classroom

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Purpose

• Use the Claims, Evidence and Reasoning (C-E-R) framework to support scientific explanations in the classroom

• Support students of all levels by providing scaffolds to increase their awareness and abilities to make inferences, support them with evidence and data

• Support the Science Literacy Common Core by making claims and supporting them with evidence
Agenda

• Review the Claims, Evidence and Reasoning framework.
• Examine and evaluate prepared, scaffolded labs for 6th grade students utilized in an “Intro to Science” unit.
• Create a scaffolded lab from an existing activity.
What is Claims, Evidence and Reasoning? (C-E-R?)

- C-E-R is a framework used to enhance students abilities to speak and write scientific explanations.
  - Claims are inferences, “a conclusion to a question or problem”
  - Evidence is “scientific data that supports the claim”
  - Reasoning is “a justification that links the evidence to the claim”

  from *McNeill and Krajeck, 2012*
Student Example: What effect does pollution have on plant growth?

Claim: Plant growth is inhibited by the presence of pollution in its water.

Evidence: Plants grew on average 3.4cm less when watered with polluted water than with rain water.

Reasoning: Because of the chemicals in the polluted water, the water does not effectively allow sunlight to get to the plant’s chloroplasts which enable the plant to make food. This means the plants can’t grow as rapidly.
What is the relationship between luminosity and temperature in main sequence stars?

http://www.le.ac.uk/ph/faulkes/web/stars/r_st_evolution.html
Use at Mariana Bracetti Academy

• 6-12 Urban Philadelphia School
• Claims, Evidence and Reasoning is introduced for the first time to 6\textsuperscript{th} grade
• Taught in Unit 1- What is Science?
• Uses multiple choice format and cooperative learning strategies to support students in making claims, citing evidence and stating their reasoning.
Selecting the Claim

From “Pendulum Lab” with the question, “How does the height the pendulum is dropped from change the number of swings of the pendulum?

CLAIM (Circle ONE of the following which answers the question.)

A. The pendulum swings more when the string is longer.
B. Our pendulum was better than other groups because we worked hard to get it all right.
C. The height the pendulum is dropped from did not affect the number of times it swung in 30 seconds.
Selecting the Evidence

From “Pendulum Lab” with the question, “How does the height the pendulum is dropped from change the number of swings of the pendulum?

EVIDENCE (Circle TWO of the following facts from the data that support your claim.)

A. We built several pendulums in class and they were all different numbers of swings.
B. In each of the trials, the pendulum swung between 24 and 25 times.
C. The pendulum was made with string, washers and ring stands, and that affected the number of swings.
D. The pendulum swung the same in each of the trials for each length.
E. This was really fun to do because we got to count the number of swings and it was easy to do.
Selecting the Reasoning

From “Pendulum Lab” with the question, “How does the height the pendulum is dropped from change the number of swings of the pendulum?

REASONING (Circle ONE of the following, looking for a scientific fact that explains your claim and evidence.)

A. Even though we tried really hard to get the lab right, we made errors in our lab and that made the swings the same. If we did this again and fixed the errors, we would see a different number of swings for each length because that is what should have happened.

B. The length of the string did not affect the number of swings because we did not change the weight of the washer, which is what controlled the number of swings.

C. Gravity caused this.
Selecting the Reasoning

From “Penny Lab” with the question, “How does soap change the how many drops of water fit on a penny?”

REASONING (Circle ONE of the following that give a science fact to back up your claim and evidence.)

A. More drops fit on the head of the penny when there was no soap in the water. This happened because water is special and able to sit on the head of the penny, but this isn’t what we thought would happen so we were wrong.

B. The soap washed away the glue, so it wasn’t sticky any more.

C. The surface tension of the water was broken by the soap’s molecules.
Selecting the Reasoning

From “Disappearing Act Lab” with the question, “How does temperature change how fast Alka-Seltzer dissolves in water?

Select one REASON from those listed below that explains your claim and evidence.

A. The heat is melting the Alka-Seltzer.
B. The water molecules move faster when they are hot, and can break down the Alka-Seltzer faster.
C. When we added heat to the Alka-Seltzer, the Alka-Seltzer dissolved faster than when the water was cold or at room temperature.
Putting it into action

• Task: To take a basic density lab and modify it to be scaffolded to support students in introductions to the Claims, Evidence and Reasoning Framework. Teachers will create a board meeting presentation to share out their work at the end.

• Question: When I change an object’s density, how does it change how an object floats?
Changing an object density can change how object floats by changing the mass and volume.

2. What EVIDENCE, in your data, supports your claim?

Block A supports my claim because the block is heavy which it can change my density of the block of the mass and volume. 

- use actual data & numbers

3. What REASON explains your claim and evidence?

My reason is that is an object has a low density it will float and if it has a high density then it will sink.
Conclusion

1. What CLAIM can you make about our question, “When I change an object’s density, how does it change how an object floats?”

   When the density increases, if it will sink. If it decreases it will float.

2. What EVIDENCE, in your data, supports your claim?

   The less buoyancy acted on, it will make it sink. The more buoyancy acted on, it will make it float.

3. What REASON explains your claim and evidence?

   Buoyancy is what makes things float.
1. What CLAIM can you make about our question, “When I change an object’s density, how does it change how an object floats?”

The weight can change and it will sink, but if it’s light then it might float.

2. What EVIDENCE, in your data, supports your claim?

Because when you put a heavier block, it would sink, and if you put a light block, it will float. So the less density, the more chances of floating.

3. What REASON explains your claim and evidence?

The article I read was for density and it said the lower the density, the more likely for an object to float.
1. What CLAIM can you make about our question, "When I change an objects density, how does it change how an object floats?"

When there is less density it will float and more density it will sink.

2. What EVIDENCE, in your data, supports your claim?

When we put an cube like the gold one in water it had a high density so it sank unlike the wood cube that had a low density floated.

3. What REASON explains your claim and evidence?

The reason is that say if you have a cube that has a density of 9g/cm³ and the water is 1.00g/cm³ The cube would float because it has a lower density than the water.
In conclusion, if the density of the object is larger, then the object will sink or not float, because the buoyancy of the water is not large enough for the object to float. In the data table it shows that since the water level in each of the experiments objects were from 115-120 mL the objects were all sink to the bottom of the graduated cylinder. I believe this because of buoyancy. Buoyancy is a downwards force that is against other forces such as gravity in this experiment.
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<th>Block ID</th>
<th>Qualitative Observations</th>
<th>Mass</th>
<th>Volume</th>
<th>Density</th>
<th>Float or Sink?</th>
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Sharing Our Work
Citations
