Argumentation in every K-12 Classroom

https://tinyurl.com/yyur6mud

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#MSTA19
“…this practice entails making and supporting claims, evaluating one another’s ideas, and working toward reconciling those differences.”

Berland, McNeill, Pelletier, & Krajcik (2017)
Assumptions

- Science is done in communities of knowledge-seekers.
- Knowledge-seekers use multiple science and engineering practices.
- Argumentation occurs in concert with all the other practices....not just explanation.

Diagram from page 14 in this chapter of this book:

nextgenstorylines.org
Thirty Percent of North American Bird Species Face Decline Across Seasons

Two new studies strike similar conclusions on continental bird populations during winter and spring.

By Erica Cirino
May 28, 2016

Citizen science programs like the Christmas Bird Count are helping scientists track declines in North American species. Photo:
How many different species are represented in the sample?

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="A" /></td>
<td><img src="image2.png" alt="B" /></td>
<td><img src="image3.png" alt="C" /></td>
<td><img src="image4.png" alt="D" /></td>
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<td>F</td>
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<td><img src="image7.png" alt="G" /></td>
<td><img src="image8.png" alt="H" /></td>
<td><img src="image9.png" alt="I" /></td>
<td><img src="image10.png" alt="J" /></td>
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<tr>
<td><strong>Question:</strong> How many different species are represented?</td>
<td></td>
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<tr>
<td><strong>Claim:</strong></td>
<td></td>
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<tr>
<td><strong>Evidence:</strong></td>
<td><strong>Reasoning / Justification:</strong></td>
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</table>
Argumentation Opportunity 1:

• What *evidence* do we need to answer this *question*?
• What *investigations* might produce the evidence we need?

How many *different species* are represented in the sample?
Argumentation Opportunity 2:

- What is my group’s **claim** about the number of species?
- What other **claims** did we consider but reject?

How many **different species** are represented in the sample?
Argumentation Opportunity 3:

- What **evidence** supports my group’s claim?
- How are we **analyzing and interpreting** the data?

How many **different species** are represented in the sample?
Argumentation Opportunity 4:

- Do we agree or disagree with **claims** made by others?
- What **questions** do we have about other claims?
- What **questions** do we have about other **evidence**?

How many **different species** are represented in the sample?
Claim – Evidence – Reasoning isn’t just for Explanations!

- Argumentation does include claim, evidence, and reasoning.
- A Claim can be any idea worth supporting.

Diagram from page 14 in this chapter of this book:

nextgenstorylines.org
### Science and Engineering Practices

**Engaging in Argument from Evidence:** Argumentation is the process by which evidence-based conclusions and solutions are reached. In science and engineering, reasoning and argument based on evidence are essential to identifying the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation to listen to, compare, and evaluate competing ideas and methods based on merits. Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to evaluate claims.

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<tr>
<td>Engaging in argument from evidence in K–2 builds on prior experiences and perspectives that account for natural and designed worlds.</td>
<td>Engaging in argument from evidence in 3–5 builds on K–2 experiences and perspectives that account for natural and designed worlds.</td>
<td>Engaging in argument from evidence in 6–8 builds on 3–5 experiences and perspectives that account for natural and designed worlds.</td>
<td>Engaging in argument from evidence in 9–12 builds on 6–8 experiences and perspectives that account for natural and designed worlds.</td>
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<td>• Identify arguments that are supported by evidence.</td>
<td>• Distinguish between explanations that account for natural and designed worlds.</td>
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<td>• Compare and critique two claims on the same topic and analyze whether they have similar or different evidence or interpretations of facts.</td>
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<td>• Respectfully provide and receive critiques of peers about their explanations, procedures, models, and questions by citing relevant evidence and posing specific questions.</td>
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<td>• Construct an argument with evidence to support a claim.</td>
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<td>• Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence.</td>
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Based on Appendix F of the Next Generation Science Standards © 2013 Achieve, Inc. on behalf of the 26 NGSS Lead States.
Argumentation Connects the Practices

<table>
<thead>
<tr>
<th>Investigating Practices</th>
<th>Sensemaking Practices</th>
<th>Critiquing Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Asking questions</td>
<td>2. Developing and using models</td>
<td>7. Engaging in argument from evidence</td>
</tr>
<tr>
<td>3. Planning and carrying out investigations</td>
<td>4. Analyzing and interpreting data</td>
<td>8. Obtaining, evaluating, and communication information</td>
</tr>
<tr>
<td>5. Using mathematical and computational thinking</td>
<td>6. Constructing explanations</td>
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Science Practices
Argumentation Connects to Speaking, Listening, Reading and Writing (ELA)

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<th>Investigating Practices</th>
<th>Sensemaking Practices</th>
<th>Critiquing Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural World</td>
<td>Data</td>
<td>Explanations and/or Models</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Science Practices</th>
<th>Math</th>
<th>Science</th>
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<tr>
<td>1. Asking questions</td>
<td>M1: Make sense of problems and persevere in solving them</td>
<td>S1: Ask questions and define problems</td>
</tr>
<tr>
<td>2. Developing and using models</td>
<td>M2: Reason abstractly &amp; quantitatively</td>
<td>S2: Develop &amp; use models</td>
</tr>
<tr>
<td>3. Planning and carrying out investigations</td>
<td>M6: Attend to precision</td>
<td>S3: Plan &amp; carry out investigations</td>
</tr>
<tr>
<td>4. Analyzing and interpreting data</td>
<td>M7: Look for &amp; make use of structure</td>
<td>S4: Analyze &amp; interpret data</td>
</tr>
<tr>
<td>5. Using mathematical and computational thinking</td>
<td>M8: Look for &amp; make use of &lt;br&gt;regularity in repeated reasoning</td>
<td>S6: Construct explanations &amp; design solutions</td>
</tr>
<tr>
<td>6. Constructing &lt;br&gt;explanations</td>
<td>E6: Use technology &amp; digital media strategically &amp; capably</td>
<td>E1: Demonstrate independence in reading complex texts, and writing and speaking about them</td>
</tr>
<tr>
<td>7. Engaging in argument from evidence</td>
<td>M3 &amp; E4: Construct viable arguments and critique reasoning of others</td>
<td>E7: Come to understand other perspectives and cultures through reading, listening, and collaborations</td>
</tr>
<tr>
<td>8. Obtaining, evaluating, and communicating information</td>
<td>S7: Engage in argument from evidence</td>
<td>E3: Obtain, synthesize, and report findings clearly and effectively in response to task and purpose</td>
</tr>
</tbody>
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Commonalities Among the Practices in Science, Mathematics, and English Language Arts

Based on work by Tina Chuek el.stanford.edu
Supporting Argumentation requires TALK MOVES by teacher and students.
Argumentation, Knowledge-Building, and Equity

- All ideas are valuable, tentative, and subject to revision.
- The best ideas in a community emerge through scientific argumentation.
- People deserve multiple, varied pathways to engage in scientific argumentation.
- Norms and expectations must be explicitly and repeatedly valued and discussed.
- Teaching scientific argumentation can affect the larger culture/community.
How Michigan tried to discredit Flint pediatrician's lead warnings

Posted by Tom Perkins on Tue, Jun 26, 2018 at 2:36 pm

Hanna Hanna-Attisha first became aware of the possibility that lead was poisoning Flint's children while she had a glass of wine with old friends in her home. One of her friends, a former Environmental Protection Agency water technician, had asked her if she was aware that lead appeared to be poisoning children in Flint? Had just changed its water source and was likely no longer using filters, said the friend, and kids were getting sick, the friend told Hanna-Attisha.

Following months, Hanna-Attisha investigated and discovered that children were indeed being poisoned by lead in the water. She found evidence of lead concentrations in children's bloodstreams increased after the switch to new water sources, while nationally the number of children with lead in their blood was decreasing.

Lake Erie's algae bloom is growing again after paralyzing Toledo water system

Michigan's environmental watchdog

CUT THE DRIVE GIVE NOW

WHAT A BEAUTIFUL HOLIDAY

What a beautiful holiday.

How climate change is impacting Michigan's farming future

MICHEIGAN ARTS FLINT

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Resources for Argumentation

  • http://www.argumentationtoolkit.org/intro.html
  • https://www.teachingchannel.org/video/scientific-argumentation-nsf
  • https://www.sciencepracticesleadership.com/diagram.html

• For the Birds:
  • https://www.allaboutbirds.org
  • Classifying Birds in the U.S. Activity from Scientific Argumentation in Biology: 30 Classroom Activities (NSTA 2012)