Argumentation as a Scientific Practice

Amy Trauth-Nare
Professional Development Center for Educators
anare@udel.edu

www.udel.edu
PD Goals

**Student Role**
- Observe long term trends through graphical representations
- **Use multiple lines of evidence** (data, informative text) to generate a **scientific**
- Engage in **scientific argumentation** using the CER framework

**Teacher Role**
- Participate in a scientific investigation **aligned with NGSS and CCSS**
- Examine the role of **scientific practices** in teaching disciplinary core ideas and crosscutting concepts
Why have penguin populations changed in the last 50 years?

• Read over the information on your Specialist Fact Sheet
• Interpret the trend(s) in your graph
• Wait for your instructor to give you the next steps....

Specialist Fact Sheet

Each Home Group contains five different specialists:

1. **Ornithologist**: A scientist who studies birds. Uses visual surveys (from ship or on land), diet analysis, bird banding, and satellite tracking to collect data on penguins.

2. **Oceanographer**: A scientist who studies the ocean. Uses satellite imagery, underwater sensors, and manual measurements of sea-ice thickness to collect data on sea-ice conditions and ocean temperature.

3. **Meteorologist**: A scientist who studies the weather. Uses automatic weather stations and visual observations of the skies to collect data on precipitation, temperature, and cloud cover.

4. **Marine Ecologist**: A scientist who studies relationships between organisms and their ocean environment. Uses visual surveys, diet analysis, and satellite tracking to collect data on a variety of organisms, including penguins.

5. **Fisheries Biologist**: A scientist who studies fish and their prey. Collects data on krill during research vessel cruises.
Construct an argument using CER framework

Why have penguin populations changed in the last 50 years?

• **Claim**

  *In the last 50 years, Adelie penguin populations have *(increased/decreased/not changed)* and Chin strap penguins have...*because*...(list factors influencing population size)....

• **Evidence**

  Explain the data trends that support your claim

• **Reasoning (Justification)**

  Connect your evidence to scientific (ecology) concepts, principles, theories
Figure 1. A Framework That Can Be Used to Illustrate the Components of a Scientific Argument and Some Criteria That Can and Should Be Used to Evaluate the Merits of a Scientific Argument

A Scientific Argument

The Claim
A conjecture, conclusion, explanation, generalizable principle or some other answer to a research question

Supports…
Fits with…

The Evidence
Data (measurements and observations) or findings from other studies that have been collected, analyzed, and then interpreted by the researchers

Explains
Supported by…

A Justification of the Evidence
A statement that explains the importance and the relevance of the evidence by linking it to a specific concept, principle, or underlying assumption

The quality of an argument is evaluated by using …

Empirical Criteria
The claim fits with the available evidence.
The amount of evidence is sufficient.
The evidence used is relevant.
The method used to collect the data was appropriate.

Theoretical Criteria
The claim is sufficient.
The claim is useful in some way.
The claim is consistent with accepted theories or laws.

Analytical Criteria
The method used to analyze data was appropriate.
The interpretation of the data is sound.

The generation and evaluation of arguments reflect discipline-based norms that include …

important models, theories, and laws in the discipline;
accepted methods for inquiry within the discipline;
standards of evidence within the discipline; and
the ways scientists within the discipline share ideas.

NGSS Connections: Activity 1

Disciplinary Core Idea
HS-LS2 Ecosystems: Interactions, Energy and Dynamics

Performance Expectation:
HS-LS2-6. Evaluate the claims, evidence and reasoning that the complex interactions in an ecosystem ...changing conditions may result in a new ecosystem.

Scientific Practices
• Analyze and interpret data
• Construct explanations
• Engage in argument from evidence
• Obtain, evaluate and communicate information

Crosscutting Concepts
• Patterns
• Stability and Change
DCI – ESS1.C The History of Planet Earth

Performance Expectation MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

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Connection to CCSS-ELA and Math

English Language Arts
CCSS.ELA-Literacy.RST.9-10.7: Translate quantitative or technical information expressed in words in a test into visual form (e.g., a table or chart) and translate information expressed visually or mathematically into words.

CCSS.ELA.Literacy.WHST.9-10.1: Write arguments focused on discipline-specific content.

Mathematics
CCSS.Math.Practice.MP3: Construct viable arguments and critique the reasoning of others.

CCSS.Math.Content.HSS.IC.B3-6: Make inferences and justify conclusions from sample surveys, experiments and observational studies.
Reflection on PD

1. From your perspective as a teacher and learner, how did you experience the activities?
2. What did I do to support your learning?
3. Why do you think I did what I did? (facilitation style, questions, activities)
4. What did I do to prepare to facilitate your learning?
5. What does this experience mean for your practice?
Our next steps…

1. What do you see as the greatest needs in your classroom? The school? The district?
2. What questions do you have around the roll-out of the NGSS?
3. What topics would you like covered in future PD?