

# Content–Embedded Inquiry

## Preparing Science Teachers for the New Standards

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# 3 Dimensions

1. Practices: Not the Scientific Method

2. Cross Cutting Concepts:

- a. Patterns, similarity, and diversity
- b. Cause and effect
- c. Scale, proportion and quantity
- d. Systems and system models
- e. Energy and matter
- f. Structure and function
- g. Stability and change

3. Disciplinary Core Ideas =  
Content



# 8 Science Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics, information and computer technology, and computational thinking
6. **Constructing explanations (for science) and designing solutions (for engineering)**
7. **Engaging in argument from evidence**
8. **Obtaining, evaluating, and communicating information**

(NRC, 2011)

# Basic Argument Structure

- ▶ The Research Question: Should a virus be classified as a living thing?
- ▶ Your Claim: Answer to the research question
- ▶ Your evidence: Data that has been analyzed and interpreted
- ▶ Your justification of the evidence: Why is the data you chose important and relevant; connection to science content

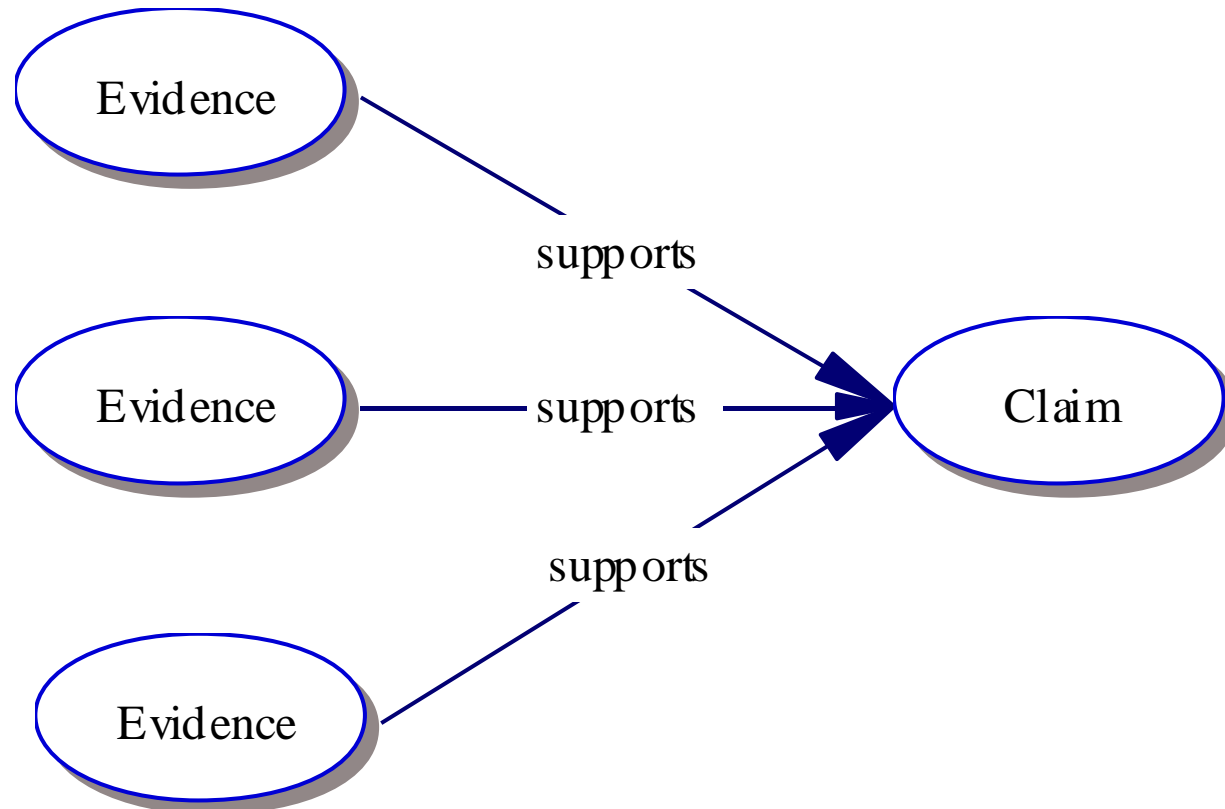
(Sampson & Schleigh, 2013)

- ▶ Evidence, which may be composed of data and interpretations, support claims.



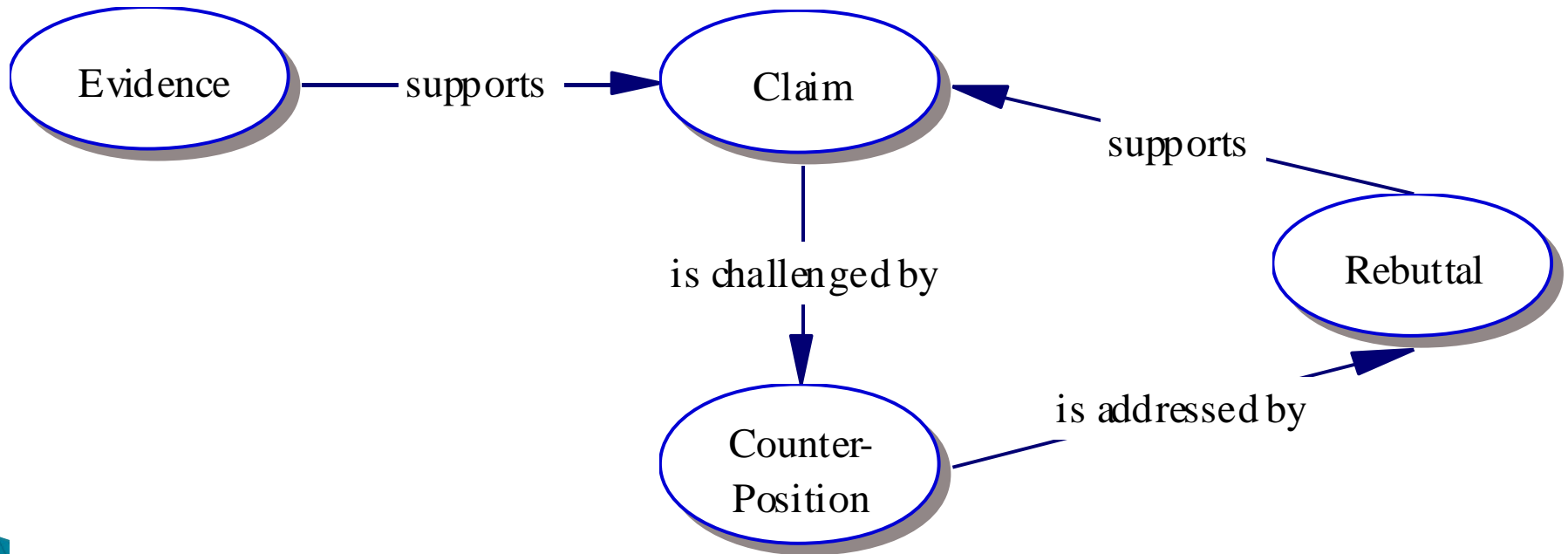
Arguments can be expanded and thereby improved by considering **MULTIPLE LINES OF EVIDENCE** or MULTIPLE PERSPECTIVES.

- ▶ Multiple lines of evidence:



Arguments can be expanded and thereby improved by considering MULTIPLE LINES OF EVIDENCE or **MULTIPLE PERSPECTIVES**.

▶ Multiple Perspectives:



# Should a Virus be Classified as Living?

## Stage 1: Generate a Tentative Argument

- In groups of ~3, write your argument on your white board (template on p. 124)
- Use data in Table 10.1 (pages 125–126)
- You have 10 minutes!

## Stage 2: Argumentation Session

- 1 person stays to present their group's white board argument while others move to hear another group's argument

## Stage 3: The Reflective Discussion

- Students go back to their original groups and make adjustments to argument, Teacher helps students reflect on content learning through a whole class discussion

## Stage 4: Final Written Argument

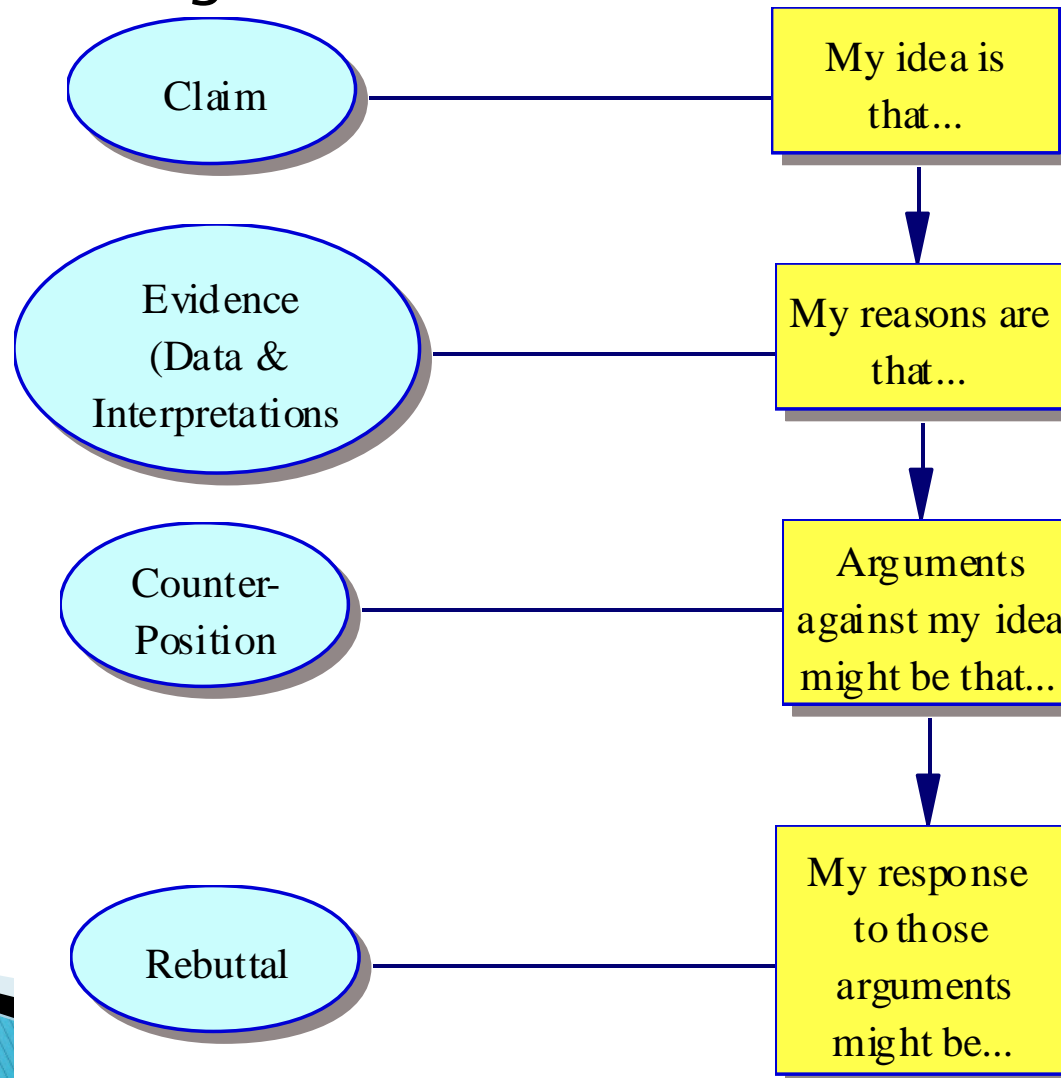
- Students individually write a final argument, rubric in handouts

(Sampson & Schleigh, 2013)



# Writing Frames

- ▶ One strategy to help form high quality arguments is to use writing frames which highlights the aspects of argumentation that we've discussed.



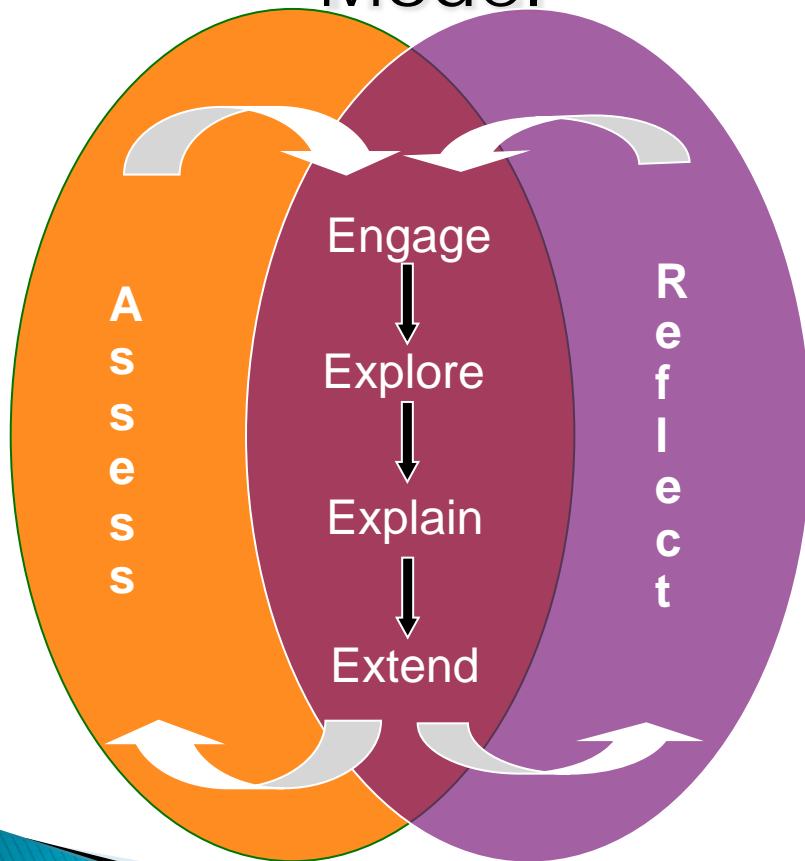
(Osborne, Erduran, Simon, & Monk, 2001)

# Examples from Draft of New SC Science Standards

- ▶ 7<sup>th</sup> grade: **Construct and present arguments supported by empirical evidence and scientific reasoning** for multiple explanations for how changes to physical or biological components of an ecosystem result in changes to the populations in the ecosystem.
- ▶ 8<sup>th</sup> grade: **Use arguments supported by scientific evidence** and social and economic rationale to evaluate plans for maintaining biodiversity and ecosystem services.\*

# Overview of 4E x 2 Model

## 4E x 2 Instructional Model



**Engage** focuses on motivation and prior content knowledge

**Explore** focuses on process of learning—Doing science & math

**Explain** unites process & content

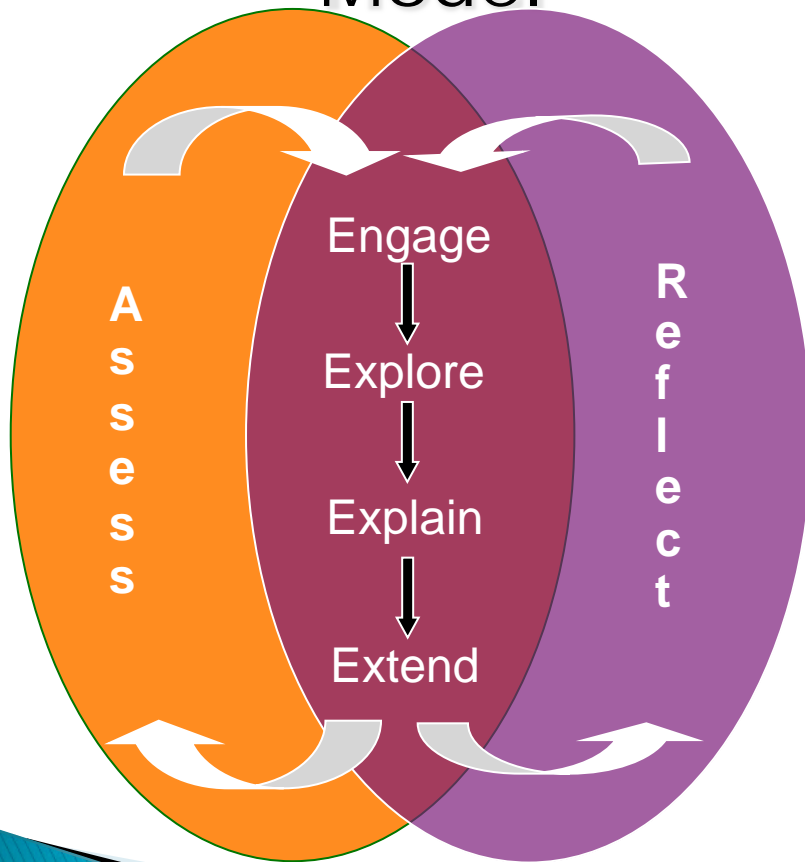
**Extend** deepens conceptual understanding

**Reflective Practice** at each stage encourages thoughtful teaching that addresses student needs

**Assessing** at each stage emphasizes formative learning

# Most Critical Aspect of Model

## 4E x 2 Instructional Model



Opportunities must be provided for students to EXPLORE before EXPLAIN occurs.

# Questions?

- ▶ Other ways/models we can use to embed content with inquiry?
- ▶ New directions for professional development?

# Contact Information

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This material is based upon the work supported by the National Science Foundation under Grant #DRL-0952160 and a grant from the South Carolina Commission on Higher Education under the auspices of the EIA Teacher Education Centers of Excellence Grant Program.