Beyond "Right and Wrong" Answers: Reimagining Biology Learning Through Model-Based Inquiry

Sarah E. Sarchet

NGSS 8 Science Practices

1. **Asking Questions and Defining Problems:** Identifying what is unknown, and formulating testable questions for scientific investigations.
2. **Developing and Using Models:** Creating and revising models (diagrams, physical replicas, simulations) to represent, explain, and predict phenomena.
3. **Planning and Carrying Out Investigations:** Designing and conducting systematic, fair tests to gather data, identifying variables and controls.
4. **Analyzing and Interpreting Data:** Making sense of data, using tables, graphs, and statistical analysis to uncover patterns and relationships.
5. **Using Mathematics and Computational Thinking:** Applying mathematical concepts, formulas, and digital tools to analyze data.
6. **Constructing Explanations and Designing Solutions:** Developing evidence-based scientific explanations for phenomena.
7. **Engaging in Argument from Evidence:** Critiquing and defending ideas, using evidence to convince peers of the best explanation.
8. **Obtaining, Evaluating, and Communicating Information:** Critically reading, synthesizing, and communicating information (graphs, presentations, reports).

Comparison of Learning Styles

Content-Centered Learning	Model-Based Inquiry Learning
The Nature of Science (Science is…)	
Fixed knowledge to be learned	Asking **questions**, testing **ideas**, and revising **explanations**.
Unconnected to students' identities and experiences.	Connected to **students' identities**, **communities**, and **lived experiences**.

Comparison of Learning Styles - Continued

Content-Centered Learning	Model-Based Inquiry Learning
View of Knowledge (What counts as knowledge)	
Fixed and complete.	**Revisable** and constructed through evidence and dialogue.
One correct explanation.	**Multiple** evidence-based **explanations** are explored and refined.
Mistakes are errors to correct.	Misconceptions are **learning resources**.
Class Topics	
Disconnected abstract ideas.	**Anchored to** puzzling **phenomena** and **meaningful to students'** lives.
Class Activities	
Labs reinforce known facts.	Labs **investigate student**-generated **questions**.
Lectures transmit canonical science knowledge.	**Student sensemaking** is centered; brief lectures clarify and support.
Demonstration of Learning	
Correct answers	**Evidence-based explanations** and revised models
Modality: English and writing are often privileged	Modalities: **ASL**, models, **diagrams**, **spatial reasoning**, collaborative work
Memorization and recall	Models, **explanations**, **reasoning**, **argumentation**, revision
Roles	
Centers instructor's authority.	Centers **student agency** and shared **sensemaking**.
Students accept what the instructor teaches.	Students **question, investigate,** and **refine** ideas through inquiry.