Abstraction in Modeling through Synthesis (AiMS):
Research on the Utility of Abstraction as a Guiding Principle for Learning about the Nature of Models

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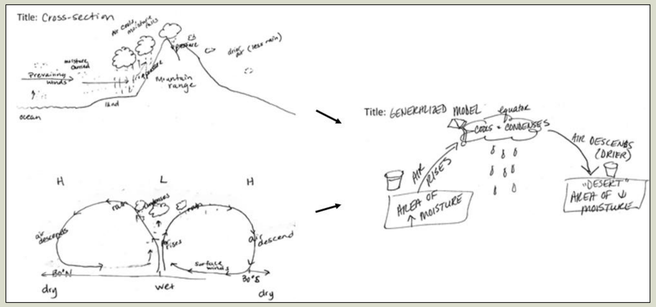
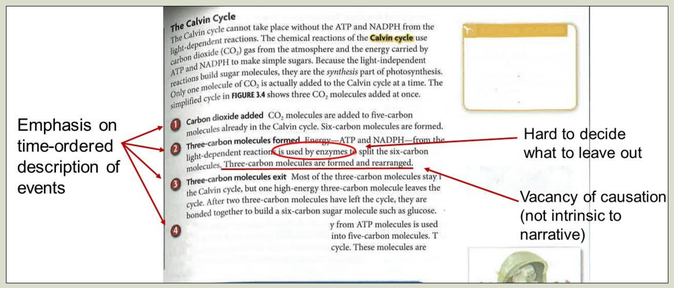
Models are organized units of representations that **abstract** the structure of their referents (Capps & Shemwell, in press; Nersessian, 2008)

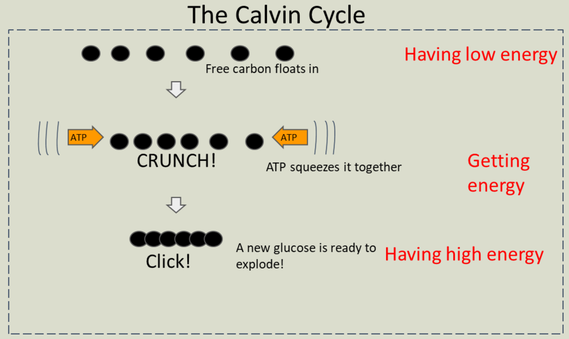
Teaching that models are abstractions:

- Helps students learn the true nature of models
  - Defines what students should learn that models are
  - Helps keep modeling authentic



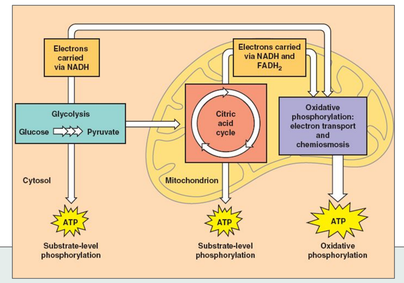
- Brings structure to science narratives

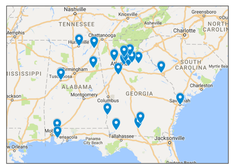




Structuring science narratives (through modeling):

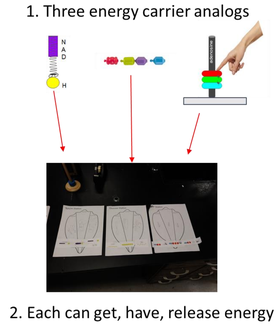
- Provides a centralized interpretative framework
  - Aids comprehension
  - Potentially transferable
- Accommodates non-narrative concepts
- Constrains against superfluous information





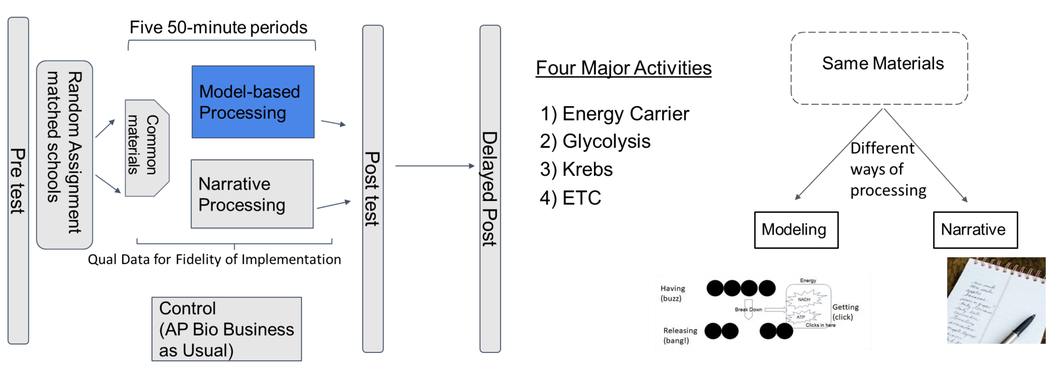
Project Goals:

1. Understand the value of AiMS for learning the nature of models
   a) Stronger evidence of AiMS impact on student learning
   b) More complete conception of AiMS instruction; impact
   c) Demands and affordances for teaching AiMS
   d) How teaching/learning with AiMS differs across contexts
   e) A conception of AiMS for broader audience
2. Develop knowledge of how AiMS can bring structure to science narratives
   a) Teacher benefits
   b) Learner benefits



Research on Learning:

- Does synthesis help students learn the abstract nature of models?
- Does model-based instruction help learners bring structure to the narrative?
  - Knowledge of underlying structure of the domain
    - Better comprehension
    - Longer retention
    - Transfer



https://coe.uga.edu/research/labs/aims-modeling-in-biology-project

Model-based Processing

- Build a General Energy Model (GEM)
- Instantiate GEM on Glycolysis Narrative
- Modify GEM to fit Glycolysis and Krebs
- Extend GEM to Explain ETC

Representation

Narrative Processing

- Make an argument for where each carrier fits in CR Narrative
- Sequence Glycolysis Narrative
- Extend the Narrative to Krebs + Argumentation Activity
- ETC play-by-play

Fidelity of Implementation

Purpose: Increase sensitivity of quantitative study

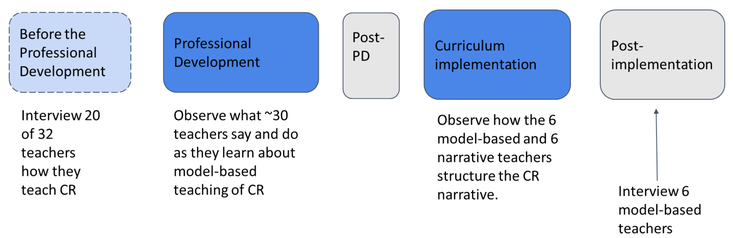
- Measure adherence to defined key elements of instruction
- Correlate adherence with test scores within treatment group
- Check strength of association: adherence with condition differences

Research on Teaching:

Purpose: Learn how teachers can develop the capacity to bring structure to science narratives

Analyze data (e.g., interviews, video of PD, and enactment video) for

- Degree to which prior instruction is driven by narrative
- Desire for structuring the narrative
- Receptiveness to structuring the narrative
- Capability to structure the narrative; variations in structuring



Project Timeline:

Summer 2017	Fall 2017	Spring 2018	Summer 2018	Fall 2018	Spring 2019-Spring 2020
Select content domain	IRB approval Assemble instructional team Develop instructional module	Pilot instructional modules Recruit 30 teachers Interview teachers	Run PD institute Develop instruments Gear up for fall research	Run the research study	Data analysis Prepare research manuscripts Prepare new AiMS module in new content area

AWARD No. 1720996