



# Session 3: Student Ideas as Assets to Science Learning

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# Session Goals

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1. To connect the four tenets of Catholic Social Teaching to an asset-based approach to student ideas.
1. To explore the use of drawn conceptual models as a strategy across grade levels and content areas for how students' ideas can be used as resources to understand core science ideas.

# Ideas as Assets: Key Assumptions

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**ELEVATING THE  
DIGNITY *of the*  
INDIVIDUAL**



**PROMOTING *the*  
COMMON GOOD**



**ACTING WITH  
RIGHTS *and*  
RESPONSIBILITIES**



**EMPOWERING  
*the* MARGINALIZED  
AND VULNERABLE**

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Students' ideas matter and kids at every age can engage in complex causal reasoning (e.g. Lehrer & Schauble, 2004)



On average, interaction is cognitively more effective than passive or constructive environments (e.g. Chi, 2009)

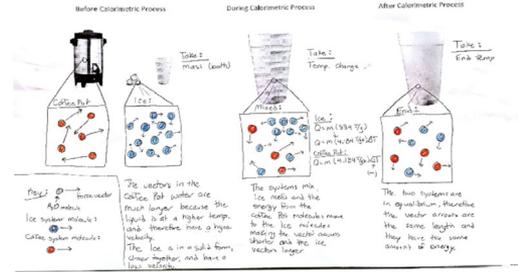
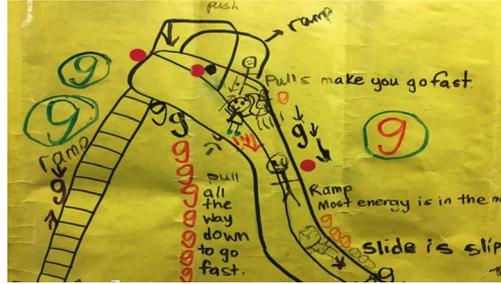


The environment must  
cultivate ownership of and  
active participation in learning  
(Chan et al., 2014)



Norms and structures must recognize multiple ways of knowing and talking as valid and useful (e.g. Moll et al., 1992)

# Student Ideas as Assets: Model-based Reasoning



## Model-Based Experience



Productive Talk

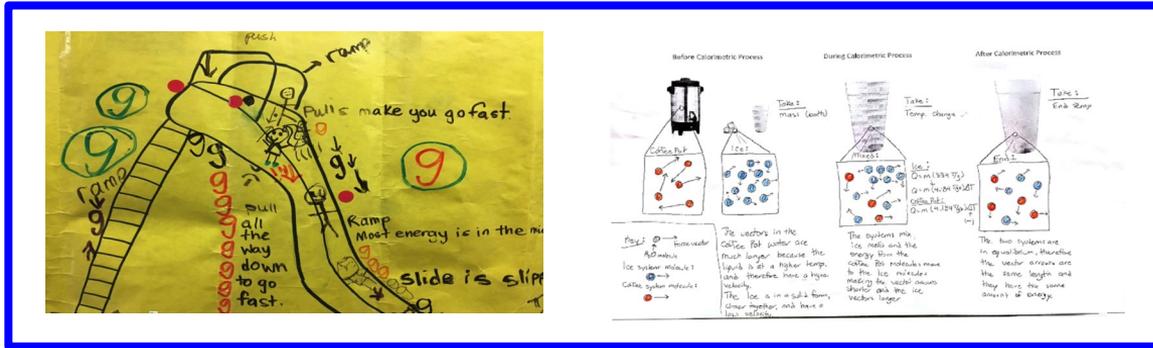


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# Student Ideas as Assets: Model-based Reasoning



## Model-Based Experience



Productive Talk



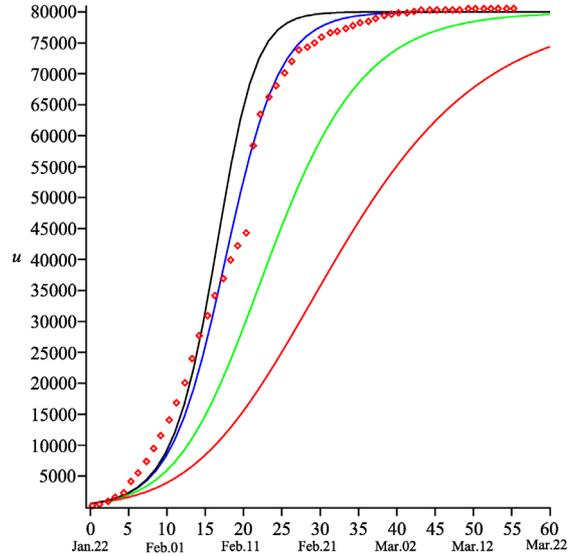
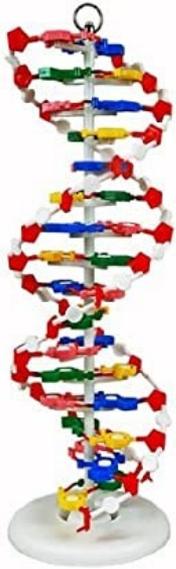
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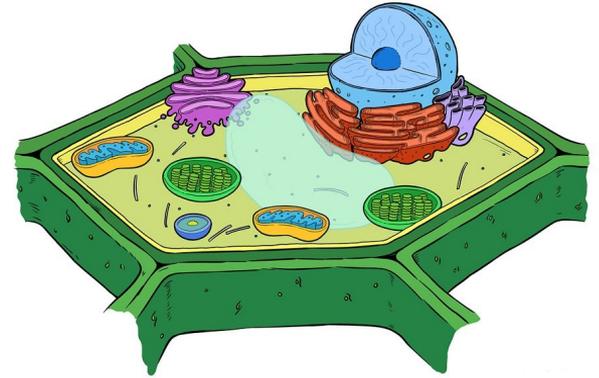
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# What is a model?

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**If a school were a cell...**

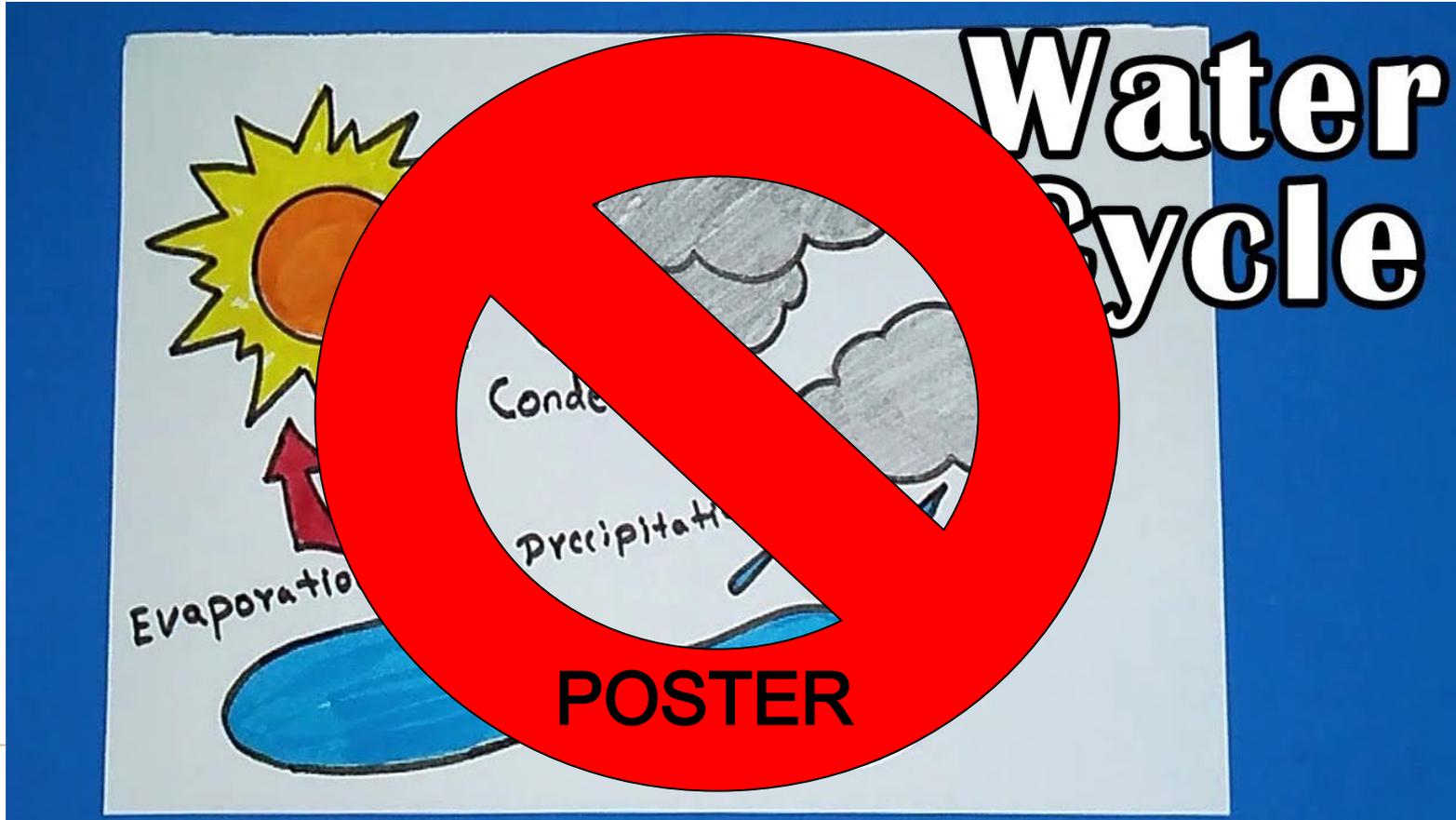


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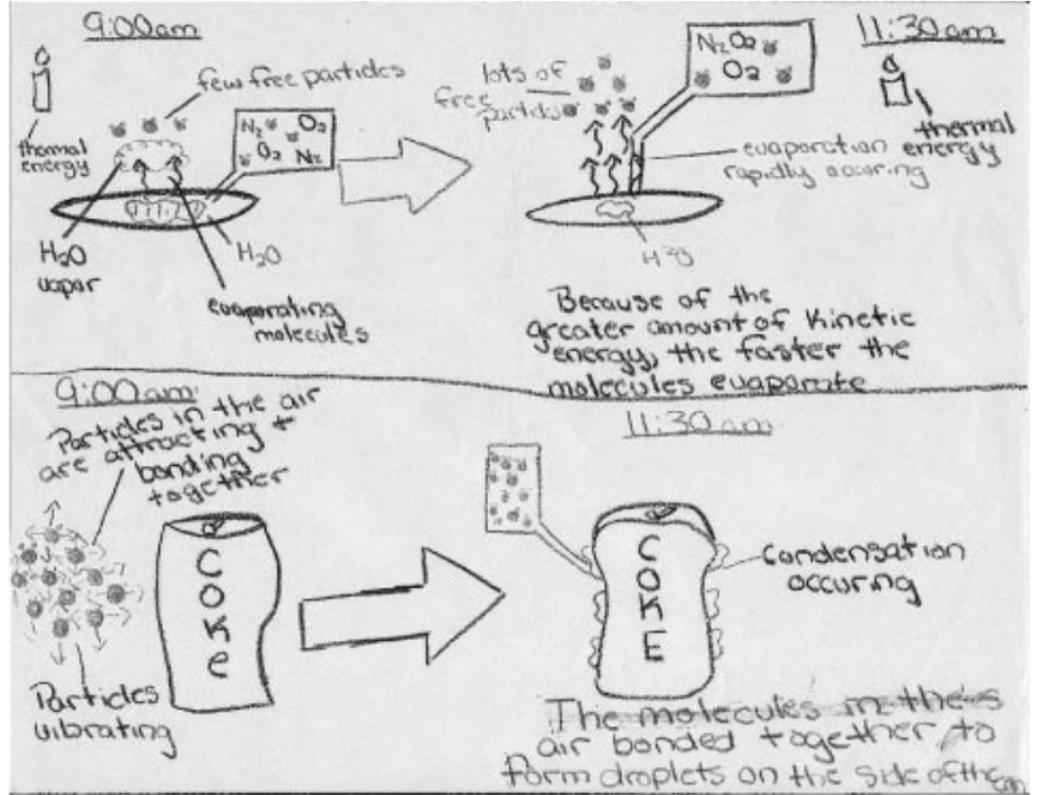
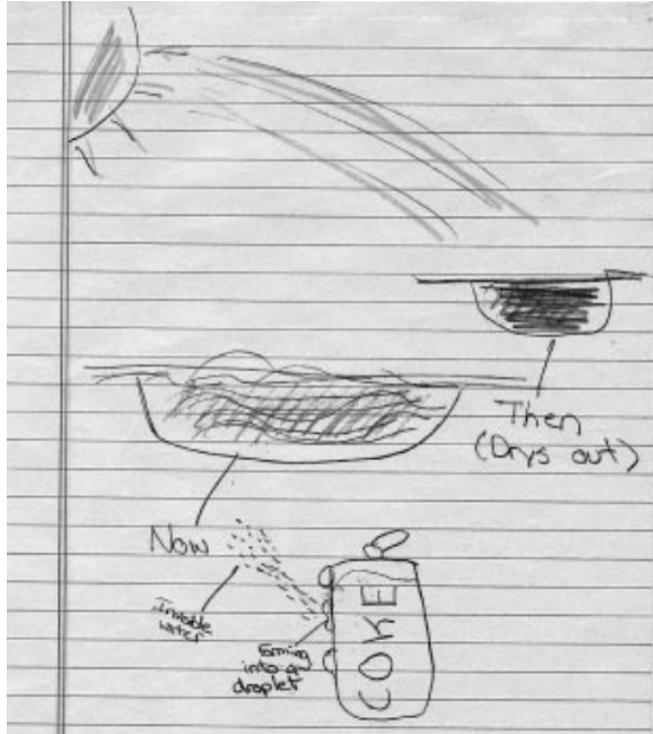
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# Drawn Conceptual Models



# Drawn Conceptual Models



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(Schwarz et al., 2009)

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5th Grade Student

# Mini-Model Experience 1st Watch

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Beginning a new unit:

Watch a short clip about a man riding a bicycle.

**First watch** : Only write down things that you observe.

“I notice...”

“I observe...”

“I hear...”



# Mini-Model Experience 2nd Watch

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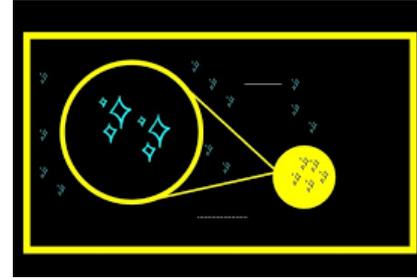
Individually draw a model that:

- Reflects your observations
- Begins to explain how Daniel rides a bike without seeing.

# Tips for Rich Models

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- Show the observable AND the unobservable using whatever symbols necessary
  - Imagine having “microscope eyes”



- Think about boundary conditions where interactions take place
- Before-During-After structure is helpful

BEFORE	DURING	AFTER



# Small Group Discussion Breakout

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1. Share your models
2. Begin to develop an INITIAL consensus model
  - a. Okay to have conflicting ideas on the same model that might have to be tested
3. If you are tech savvy and comfortable, please take a photo of your consensus model and place it in the slide with your group number.

# Where were these tenets embedded in the experience?

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# Model-Based Reasoning Sequence

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1. **START** the experience with having students reason about an anchoring event.
  - a. Youth can draw on prior knowledge and experiences
  - b. Non-canonical thinking can lead to productive canonical understanding

# Selecting Anchoring Events

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1. Ensure the event focuses on the core science idea in the lesson or unit goal.
1. Seek contextualized (and relevant) events.
1. Event is sufficiently complex and related to a causal story.

# Quick Fire Challenge

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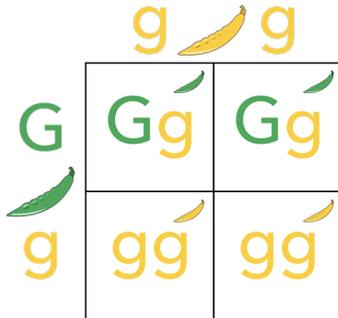
## 1. Waves and Sound

Goal: SWBAT apply the structure of sound waves to how it affects its surroundings.



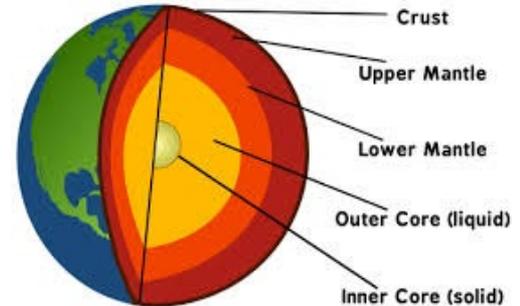
## 2. Genetics

Goal: SWBAT connect genetic factors and processes to probabilistic, observable outcomes.



## 3. Layers of the Earth

Goal: SWBAT explain how features of inner earth affect its surface.



Anchor Event 1: Physics/Physical Science: Unit Topic: Sound & Waves

Unit Concept: The transfer of energy by waves

Unit Goal: SWBAT apply the structure of sound waves to how it affects its surroundings.



Anchor Event 3: Life Science/Biology: Unit Topic: Genetics

Unit Concept: How do we become who we are?

Unit Goal: SWBAT connect genetic factors and processes to probabilistic, observable outcomes.



Anchor Event 2: Earth Science Unit Topic: The Formation of the Lithosphere

Unit Concept: The hidden forces of Earth

Unit Goal: SWBAT explain how features of inner earth affect its surface.



# Model-Based Reasoning Sequence

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1. **START** the experience with having students reason about an anchoring event.
2. Individuals - Start with observations
3. Small Groups - Create a consensus model that can be revised over time
  - a. Before-During-After structure is very helpful

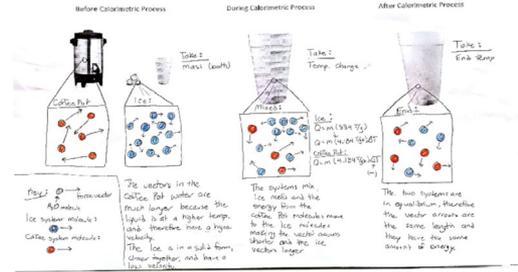
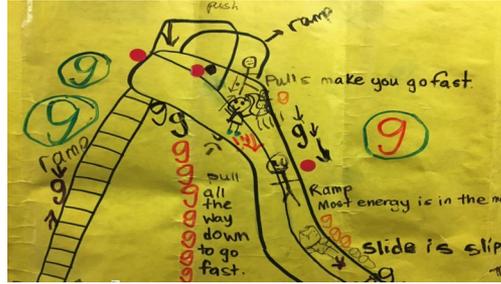
BEFORE	DURING	AFTER

# Model-Based Reasoning Sequence

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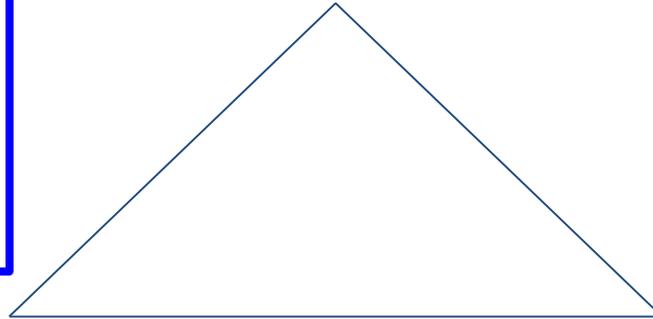
1. **START** the experience with having students reason about an anchoring event.
2. Individuals - Start with observations
3. Small Groups - Create a consensus model that can be revised over time
  - a. Before-During-After structure is very helpful
4. **Share ideas publicly and work with those ideas**
  - a. Name models and refer to them
5. Connect ensuing readings and investigations to models
6. Final Models require a “Gotta Have” checklist that push for explanation and not just description of the event

# Student Ideas as Assets: Model-based Reasoning



Productive Talk

## Model-Based Experience



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# Peer Review with Sentence Stems

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Could you say  
more about..?

What evidence  
supports..?

I agree with  
\_\_\_\_ because  
\_\_\_\_\_.

I see your  
point, but....

What I see  
you saying  
is...

# Fostering Productive Talk

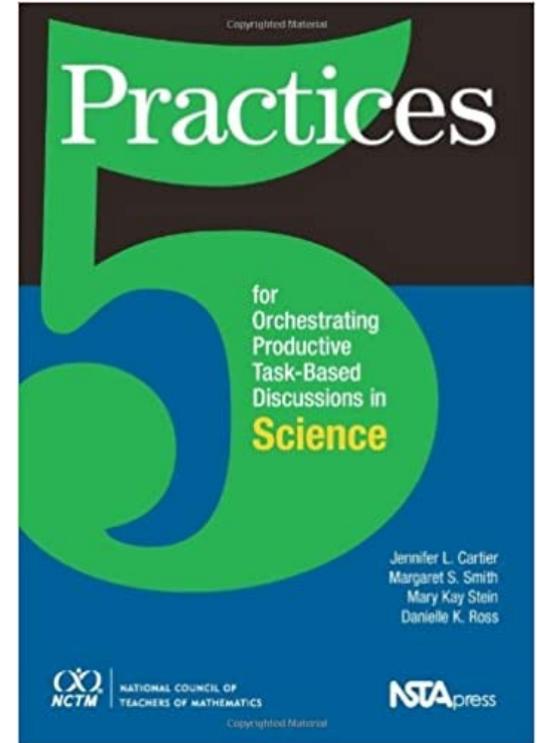
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Talk Science / The Inquiry Project

<https://inquiryproject.terc.edu/index.html>

Cartier, Smith, Stein, Ross (2013). *Five practices for orchestrating productive talk-based discussions in science.*

NSTA Press.

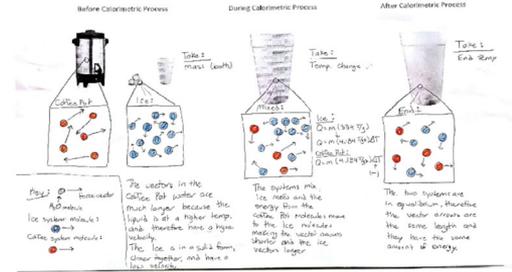
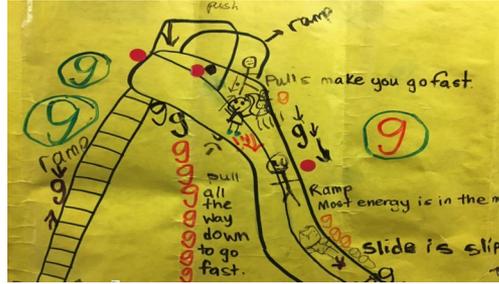


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# Student Ideas as Assets: Model-based Reasoning



## Model-Based Experience



Productive Talk



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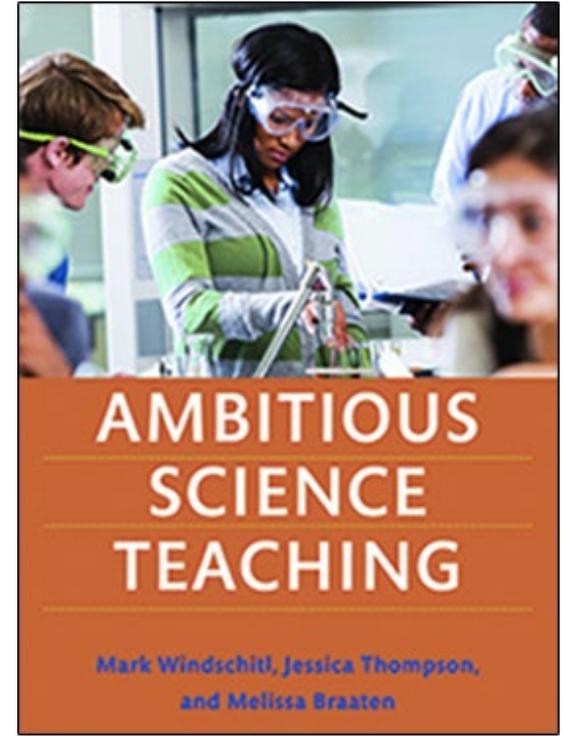
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Ambitious Science Teaching  
Website

<https://ambitiousscienceteaching.org/>

Windschitl, Thompson, and Braaten  
(2018). *Ambitious Science Teaching*.  
Harvard Education Press.



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# Evaluation Selection

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1. Make sure you select:
  - a. Student Ideas as Assets to Science Learning (Matt Kloser)
  
1. Option to be part of a contact list

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Please join us for Session 4!  
March 25th @ 7:30 PM ET

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