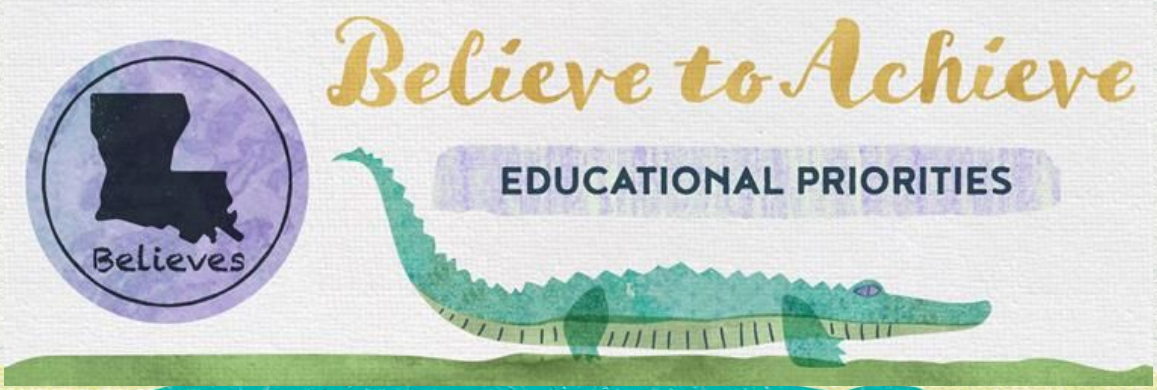

Believes
#LATeacherLeaders
TL
SUMMIT 2022
MAKING A COMEBACK!

Modeling and Constructing Explanations

Session Context

This session is designed to address two of Louisiana's Believe to Achieve Educational Priorities:

- Remove barriers and create equitable, inclusive learning experiences for all children
- Provide the highest quality teaching and learning environment



Session Goals

- Explore the relationship between the practices of Developing and Using Models and Constructing Explanations from the Louisiana Student Standards for Science.
- Examine how the shifts in writing and drawing for sensemaking support students in building the knowledge and skills called for by LSSS.
- Analyze samples of student work to plan student supports in writing and drawing for sensemaking.

Connections Between Developing and Using Models and Constructing Explanations

"Modeling and forming explanations are two critical ways that scientists build knowledge and then test, critique, and revise that knowledge. They are tools that scientists use to help them make sense of the world."

Models are a type of explanation. Scientists construct explanations for many different reasons. Explanations are not descriptions and they are not answers to questions. They offer a plausible account that speaks to the "why" and/or "how" of a phenomenon.

Learning in Places Collaborative. (2020). Framework: Modeling and Forming Explanations. Bothell, Seattle, WA & Evanston, IL: Learning in Places.

Practices Build Agency

The Framework for K-12 Science Education emphasizes the need for students to "learn science in large part through their active involvement in the practices of science" (pg. 283). When educators effectively support and encourage engagement with the practices, they provide an entry point for science learning and build agency for all students.

National Research Council. 2012. A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press.https://doi.org/10.17226/13165.

Shifts in Writing and Drawing for Sensemaking

Shifts In Writing and Drawing for Sensemaking

"There have been significant shifts in some fundamental understandings in the way that human beings learn. Increasingly, the emphasis is on learning with understanding rather than memorization. While knowing facts is important, useable knowledge is better"

Learning in Places Collaborative (2021). Culture and Learning. Learning in Places website http://learninginplaces.org/wp-content/uploads/2019/05/IET_01_CultureLearningResearchBrief-Issue1.pdf

Shifts in Writing and Drawing for Sensemaking

Less of a Focus on	More of a Focus on
Writing/Drawing only for students to show what they know	Writing/drawing for students to figure things out - building understandings of phenomena and science ideas
Writing/drawing for recall, fact recitation, copying down notes or images, or procedure writing	Writing/drawing to make sense of investigations, readings, and experiences; to synthesize learning; to communicate to others
Decontextualized science vocabulary work	Using science vocabulary when students need it and building off of their resources and language repertoires
Privileging final form only - reports, written arguments, final modes, etc.	Prioritizing multiple and varied forms of writing/drawing across the unit
Writing/drawing for a “general” single audience (i.e. teacher)	Writing/drawing for different audiences (myself, others) for difference pieces with different purposes
single, disconnectioned writing/drawing tasks	Writing/drawing as a continuing practice

Lesson 1 Droughts and Floods Unit 7.6

1	25 min	**INTRODUCE TWO STORIES ABOUT FLOODS AND DROUGHTS** Record and share noticings and wonderings from two news clips—a drought in Porterville, CA, and flooding in Vicksburg, MS. Discuss what it might be like to live in one of those communities.	A-H	The Town Without Water video, Floods Hit
2	15 min	**IDENTIFY PATTERNS IN HEADLINES ABOUT FLOODS AND DROUGHTS IN SMALL GROUPS** Examine and organize headlines from communities across the US related to floods and droughts.	I-K	
3	5 min	**ASSIGN HOME LEARNING** Assign students to talk to members of their families or communities to gather water stories.	L	
4	7 min	**SHARE OUR WATER STORIES** Add our water stories to the stories explored on day 1.	M	
5	8 min	**DISCUSS PATTERNS IN HEADLINES ABOUT FLOODS AND DROUGHTS AS A CLASS** Identify similarities and differences between the drought- and flood-related headlines.	N	T-chart of drought/flood headline patterns
6	5 min	**IDENTIFY WHAT WE NEED TO INCLUDE IN OUR MODELS** Identify what we need to include in our models to explain how increasing temperatures could lead to increased floods and droughts and what is causing the temperatures to rise.	O-R	
7	15 min	**DEVELOP AN INITIAL MODEL AND COMPARE WITH A PARTNER** Develop an initial model to answer the questions, "How can increased temperatures lead to both droughts AND floods?" and "What is causing the temperatures to increase?"	S-T	
8	10 min	**BEGIN TO DEVELOP AN INITIAL CONSENSUS MODEL** Gather in a Scientists Circle and facilitate a Consensus Discussion among students to develop the initial class consensus model.	U-V	chart paper, markers

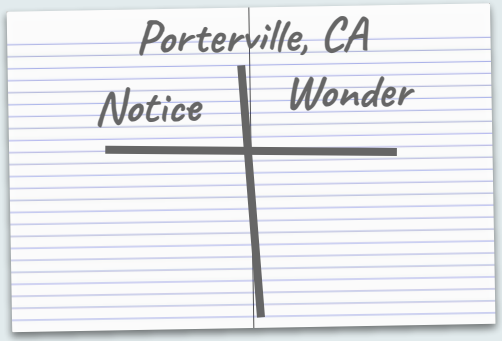
End of day 2

We will look at the OpenSciEd Droughts and Floods unit including a few activities that occur prior to students creating their initial models. While examining these activities, think about ways in which this demonstrates the shifts in writing and drawing for sensemaking.

Case 1: Porterville, California

Students view clips of a couple of cases related to droughts and floods and record noticings and wonderings. The first case is about drought in Porterville, CA.

A Town without Water video



➔ Be prepared to share your thinking with the whole class.

Case 2: Vicksburg, Mississippi

The second clip describes a flood scenario in Vicksburg, MS.

VOA. Rights Reserved.

Floods Hit US Small Towns along Mighty Mississippi

Porterville, CA		Vicksburg, MS	
Notice	Wonder	Notice	Wonder

➔ Be prepared to share your thinking with the whole class.

Water Across the United States

Each marker on the map corresponds to a place that reported a drought or flood in the last few years.

Students examine this map that shows locations that have had droughts and floods in just the past few years. **Brown** markers represent a location that experienced a drought, while **green** marks a location of a flood.

Identify Patterns in Headlines

With your group

1. Individually read the headlines assigned to your group.
2. Discuss and group similar headlines together. (It may be helpful to highlight similar words.)
3. Add a label for the patterns you are seeing and record on a sticky note.

Post Patterns from the Headlines

Share patterns noticed in the headlines.

- Add the patterns that you recorded on sticky notes to the class T-chart.

Patterns you noticed across drought-related headlines	Patterns you noticed across flood-related headlines

Share Your Water Stories

The next day, students revisit the two scenarios and create a continuum with too much water on one side and too little on the other. They share the water stories they were asked to gather for home learning, add them to the class chart, and connect them to patterns they noticed in headlines in the previous lesson.

With your class

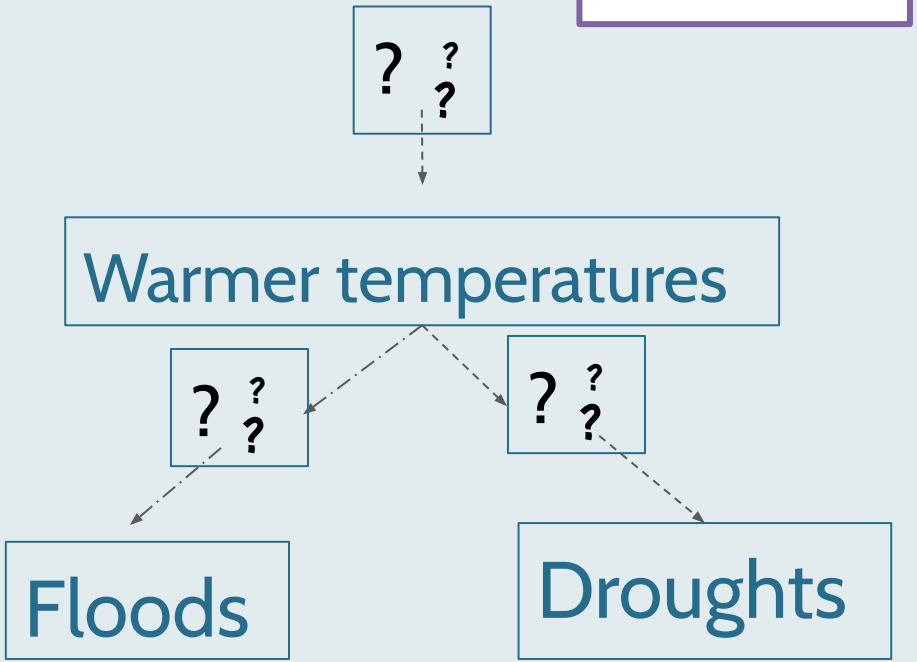
- Has our community experienced anything like this?
- Have you or your family lived in or traveled to a community that experienced anything like this?
- Has a member of your family or community experienced anything like this?

How can we explain this "new normal"?

We set the purpose of the model, to answer the questions on the slide.

How can increased temperatures lead to both droughts AND floods?

What is causing the temperatures to increase?

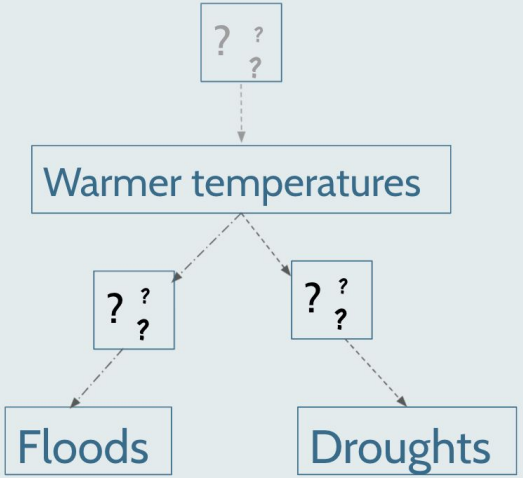


What should our model include?

We identify components that should be included in the models and create a class record.

Turn and Talk

- What things (components) might we include to explain how a drought or flood happens?

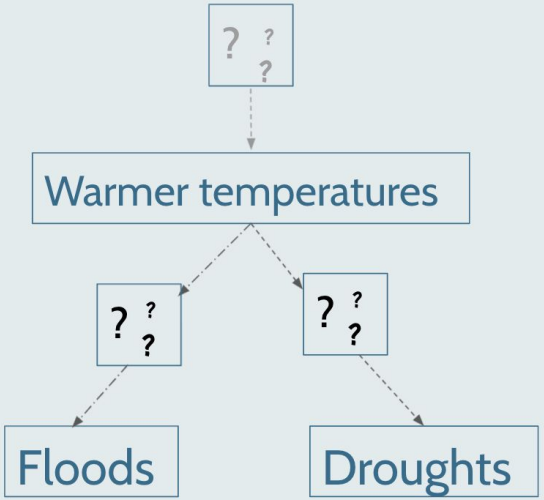


What should our model include?

Students turn and talk about the prompt on the slide then share ideas and add them to a class record.

Turn and Talk

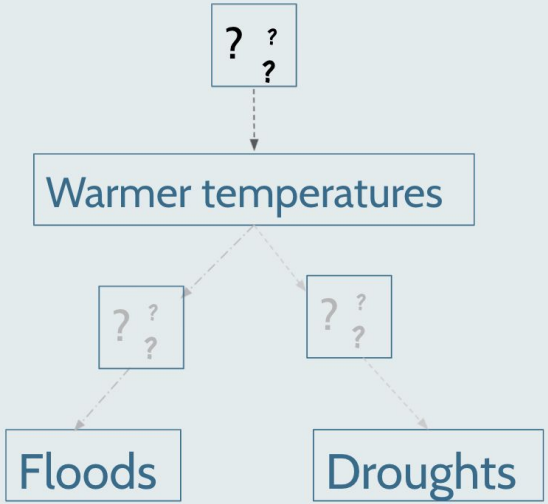
- How can water move from place to place? What are some processes we might want to include in our models?



What should our model include?

What is causing the temperatures to increase?

- Remember to explain **how** your idea **causes** the warmer temperatures.

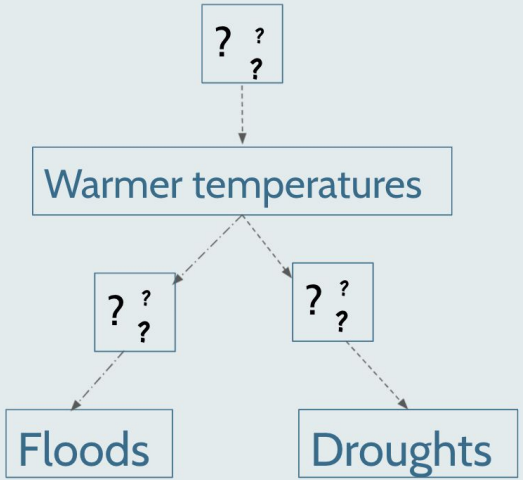


Developing an Initial Model

Teachers are encouraged to keep the slide with the questions and image for the model and the class list of things to include (components, processes) visible while students develop initial models.

Individually develop an initial model to explain:

- What is causing the temperatures to increase?
- How can increased temperatures lead to both droughts AND floods?



➔ Record questions that come to mind as you are constructing your model.

Where did you notice examples that illustrate the shifts in writing and drawing for sensemaking in the lesson?

Generating initial models at the very beginning of a unit using whatever initial ideas they have to begin making sense of a new phenomenon.

Modeling to make sense of experiences (drought and flood scenarios) including their own water stories.

Include whatever language they currently have to explain and include symbols/images if desired. Multiple opportunities to engage in discussion prior to modeling.

Create models for themselves with the purpose of showing initial ideas and explanations.

Shifts in Writing and Drawing for Sensemaking

More of a Focus on
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Writing/drawing to make sense of investigations, readings, and experiences; to synthesize learning; to communicate to others
Using science vocabulary when students need it and building off of their resources and language repertoires
Prioritizing multiple and varied forms of writing/drawing across the unit
Writing/drawing for different audiences (myself, others) for difference pieces with different purposes
Writing/drawing as a continuing practice

Using Student Models and Explanations to Inform Instruction

Step 4: Student Work Analysis **Time Estimate: 40 minutes**

Question: How do you use three-dimensional assessments to evaluate students' understanding?

Purpose: Team members establish norms for evaluating student work, analyze student work to formatively assess students' understanding, and from that analysis determine the implications for instructional practice and effectiveness.

Student Work Analysis Protocol

- Step 1: Identify criteria for analyzing student work using the performance expectation(s) and task
- Step 2: Identify exemplar student responses.
- Step 3: Analyze student work.
- Step 4: Identify and discuss trends.
- Step 5: Plan for future instruction.

Choose a formative assessment	Annotation Discussion questions
Analyze Student Work	Where do you see evidence of students using the Science and Engineering Practices?
	Where are students applying content knowledge?
	How are students connecting ideas using crosscutting concepts?
	What are patterns and trends in what students know and can do?
Plan for Future Instruction	Based on this student work analysis, what are the implications for future instruction?
	What is the plan for responding to students' needs for just in time support and enrichment?

We will examine some sample student models. The questions we will reflect on and the resource we will examine support Step 4 of the Planning Guide for Science Instruction.

Questions to Consider

What are the components of a good model?

What parts of the system should be represented?

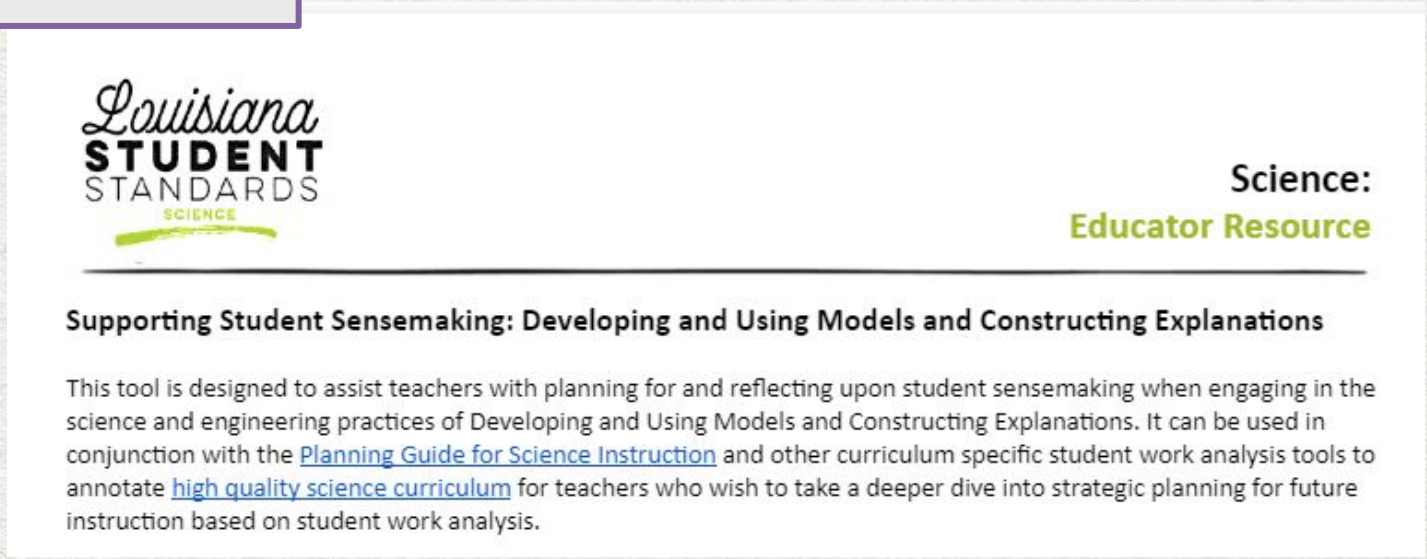
Components and ideas that may have come up in class discussions appear below:

- Some source of heat (sun), water in different forms (e.g. rain, puddles, rivers), clouds, wind (this may not come up until later)
- Ways water moves: dries up or evaporation, condensation, rain or precipitation, wind

Page 2 of the resource linked below has suggestions for supporting the practices of modeling and constructing explanations. Read through the first column labeled “initial supports.

Supports for Modeling

What supports were already included in the lesson? What additional supports might be useful for students who get “stuck”?



Louisiana STUDENT STANDARDS SCIENCE

Science:
Educator Resource

Supporting Student Sensemaking: Developing and Using Models and Constructing Explanations

This tool is designed to assist teachers with planning for and reflecting upon student sensemaking when engaging in the science and engineering practices of Developing and Using Models and Constructing Explanations. It can be used in conjunction with the Planning Guide for Science Instruction and other curriculum specific student work analysis tools to annotate high quality science curriculum for teachers who wish to take a deeper dive into strategic planning for future instruction based on student work analysis.

A couple of examples of supports already in the lesson:

Turn and Talk & class discussions

Instructional Strategies for Supporting Students in Writing and Drawing
Initial Student Supports
Talk out loud: Have students say out loud their ideas before writing and drawing (either to themselves or others).
Sentence Stems/Image Starters: Provide sentence stems or image starters to help students start writing and drawing.
Select from options. Provide different options (e.g. different claims, different ways to draw part of a model) and ask students to select the best option to use in their writing or drawing.
Graphic Organizer: Use a graphic organizer or template to help students organize their ideas to inform their writing or drawing.
Work together: Have students work together to plan and to engage in writing or drawing (e.g. small group model).

Graphic organizer and co-created list of components made visible during modeling

Examples of additional support for a student who is "stuck":

Turn questions we are trying to answer into sentence stems to add to the model.

Call attention to the list of components and ask students to choose from the list for what goes in each spot with question marks.

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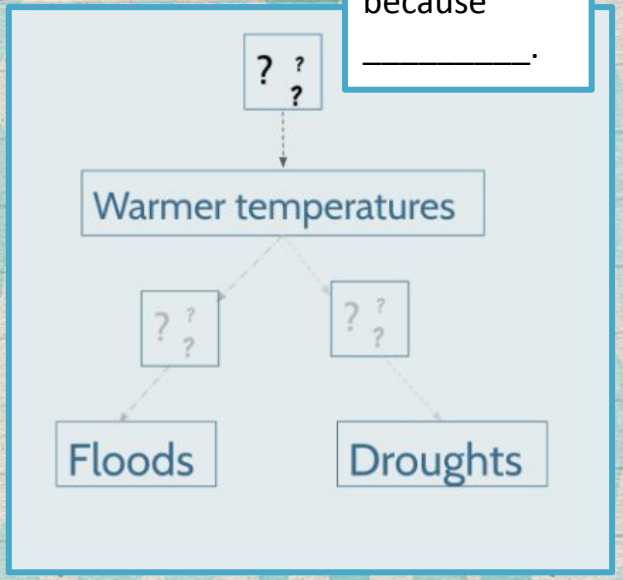
Graphic Organizer: Use a graphic organizer or template to help students organize their ideas to inform their writing or drawing.
Work together: Have students work together to plan and to engage in writing or drawing (e.g. small group model).

____ causes warmer temperatures because _____.

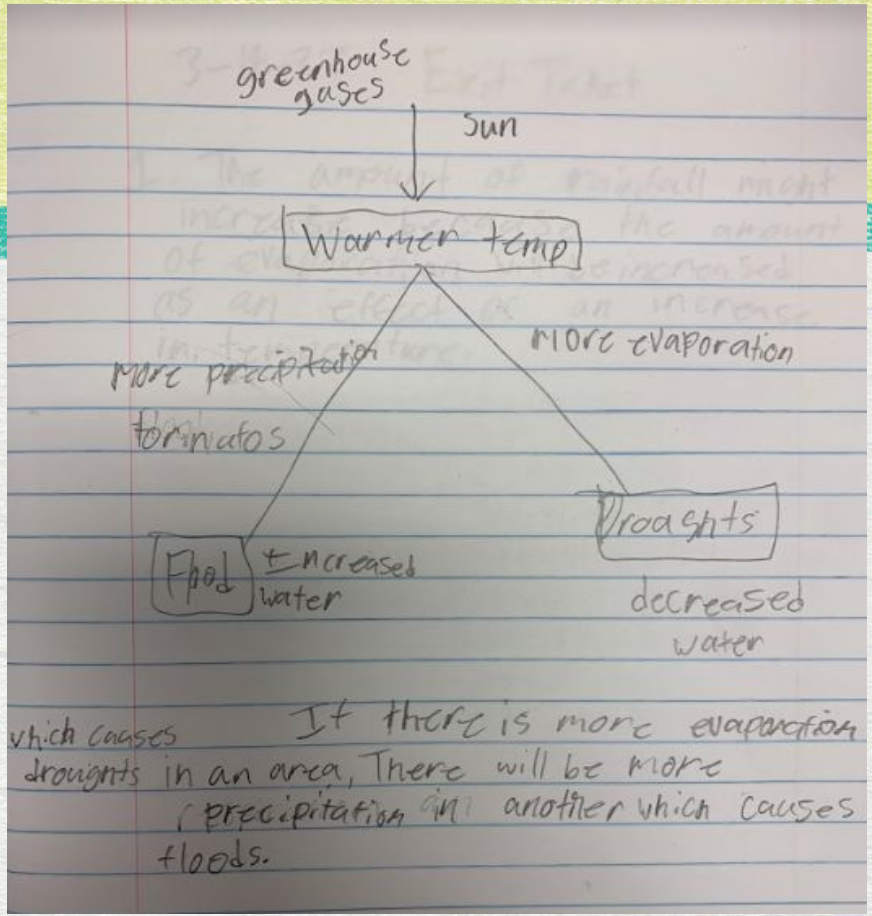


Examine the student samples on the next few slides and reflect on the questions that appear on each slide.

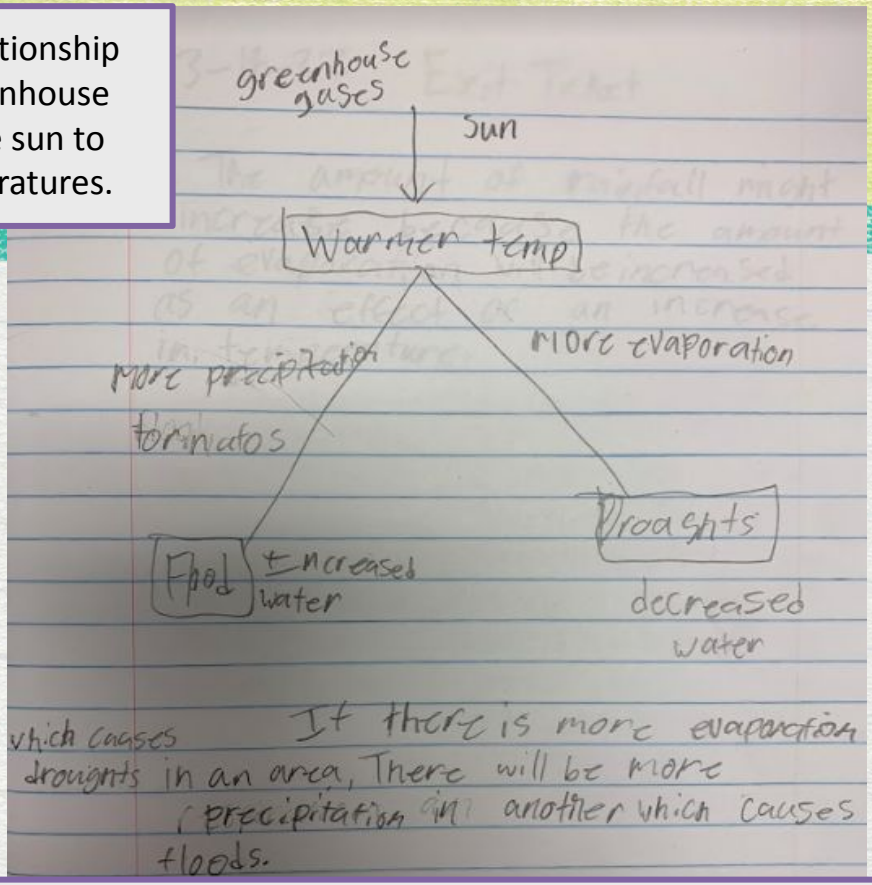
Keep in mind that this is a first attempt to make sense of this phenomenon. We will continue to revise this model both individually and as a class can plan for many opportunities to strengthen this practice as we progress throughout the unit.

What can this tell us about student sensemaking around the phenomenon?

What are next steps for supporting the practice of modeling?



Identifies a relationship between “greenhouse gases” and the sun to warmer temperatures.



What can this tell us about student sensemaking around the phenomenon?

What are next steps for supporting the practice of modeling?

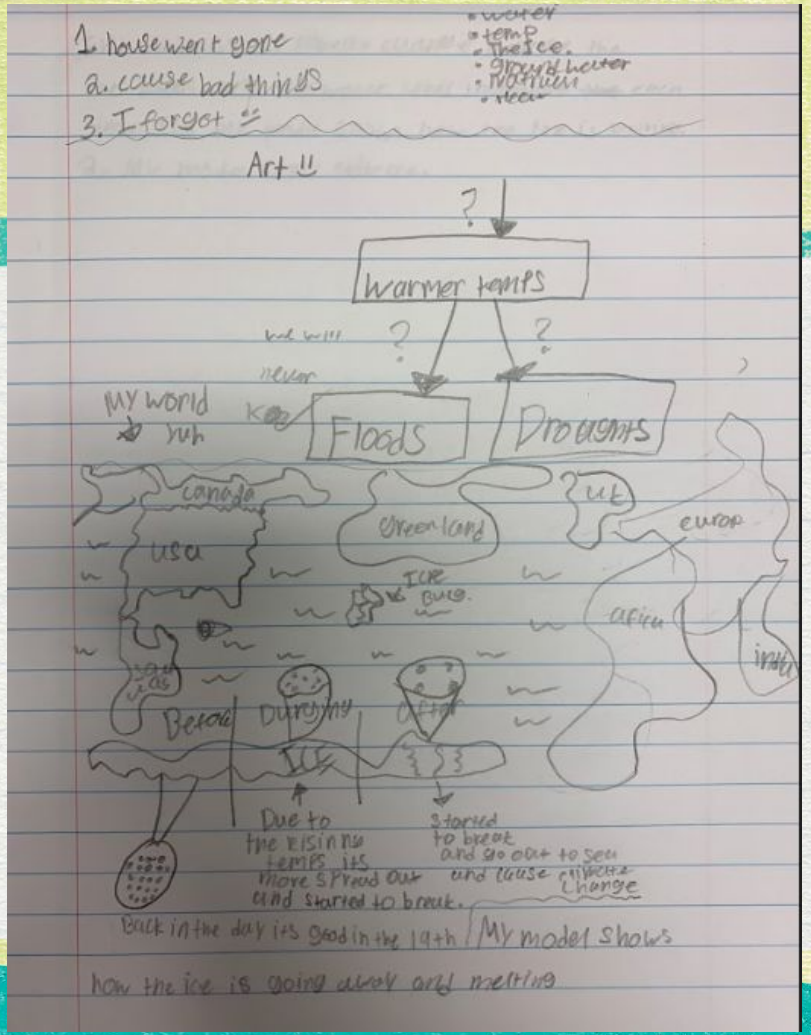
Needs support with representing the relationships between mechanisms and components clearly.

Ideas for strengthening this skill include feedback from peer/teacher and evaluating with criteria as we iterate on the models later in the unit.

Identifies a relationship between evaporation and precipitation. Indicates some causal relationship between these processes and droughts/floods.

What can this tell us about student sensemaking around the phenomenon?

What are next steps for supporting the practice of modeling?



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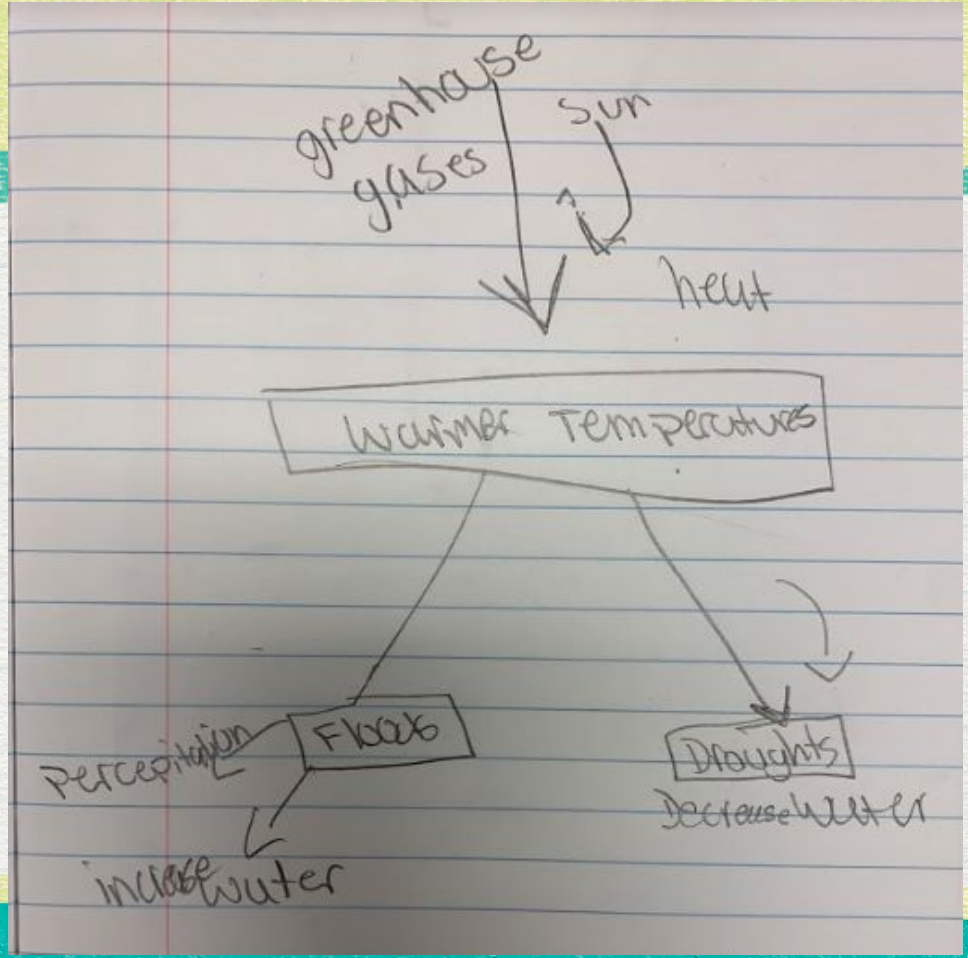

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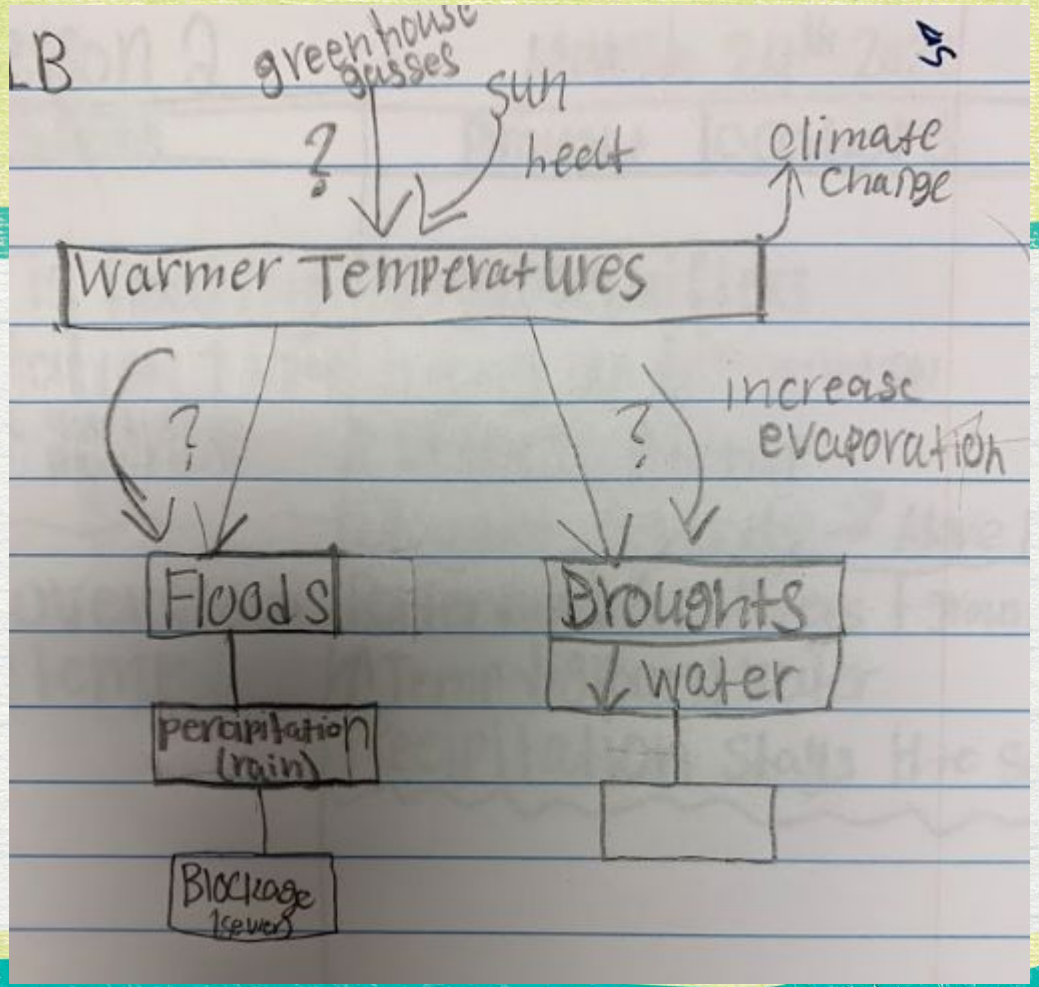

How does this work support building student agency with Science and Engineering practices?