### Modeling, Questions, and Climate Change

Submitted by: Emily Butterfield, Science Bearden Middle School, Knoxville, TN

Target Grade: 6<sup>th</sup> Grade Science

Time Required: 240 minutes

#### Standards

• MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

#### **Lesson Objectives**

Students will:

- Develop a model based on prior knowledge and assumptions of the factors causing global climate change.
- Generate a series of questions about the factors causing global climate change.
- Refine their questions by making them higher level and more focused.
- Conduct research to answer their questions using reliable resources.
- Refine their model to reflect their learning.

#### **Central Focus**

In this lesson, students will create and refine a model of the factors contributing to global climate change. They will use this model as the focal point for generating questions that will lead to research on the topic. Students will work to improve their questions by changing them from recall to extended thinking. Students will use these questions to conduct research, which will inform their revisions of their model.

#### **Background Information**

Before beginning the lesson, the teacher should become familiar with the different depth of knowledge question types (see image below).

### Applying Bloom's Taxonomy in Your Classroom

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### 1. REMEMBER

Students are expected to retrieve information from memory, but aren't expected to change it in any way.

#### In-Class Instruction

Students memorize a definition of an associative property.

#### Assessment

Students are given a multiple choice question and asked to recognize the answer, or are asked to recall the answer and fill in a blank.

3. APPLY Certain procedures or steps are

#### expected to be followed in order to answer new problems.

In-Class Instruction

Students learn about Newton's three laws.

#### Assessment

Students are asked to examine the information about a car crash and determine which if any of Newton's laws apply to the situation.

5. EVALUATE



assess their quality and decisions are made based on identified criteria.

#### In-Class Instruction

Students read about the physical effects of exercise on humans.

#### Assessment

Read an article about a famous athlete. Identify one piece of information in the article that fails to support the author's case that hard work was the main reason for the athlete's exceptional athletic skills.



#### Adapted from

Assessing Critical Thinking in Middle and High Schools: Meeting the Common Core and

Assessing Critical Thinking in Elementary Schools: Meeting the Common Core by Rebecca Stobaugh

2. UNDERSTAND

Students are building new connections in their minds.

#### In-Class Instruction

Students identify the key characteristics needed for an organism to survive in a particular ecosystem.

#### Assessment

When given the description of a fictitious animal. students explain whether the animal will survive in a given ecosystem.





Students utilize lower-level thinking skills to identify key elements and examine each part.

#### In-Class Instruction

Students read a student lab report and identify the evidence to support the finding.

#### Assessment

Read the results of the scientific study and find supporting statements for each conclusion or finding.



Learners organize information in a new or different way.

#### In-Class Instruction

Students research the role of economics in business.

#### Assessment

Students brainstorm reasons for a problem and generate suggested solutions, and design and implement a campaign designed to solve the identified problem.



Teachers should plan for and locate resources for research. This could include online or print resources such as scientific articles, websites, videos, etc., technology that will allow students to conduct independent research, or a combination of both. If the teacher is having students conduct independent research, there should be some instruction on finding reliable resources and citation of sources.



Before the lesson, students should be familiar with the concept of a model. Teacher should show examples of models and describe their different forms and function.

In science, a model is a representation of an idea, an object, or even a process or a system that is used to describe and explain phenomena that cannot be experienced directly. Models are central to what scientists do, both in their research as well as when communicating their explanations.

https://www.sciencelearn.org.nz/resources/575-scientific-modelling

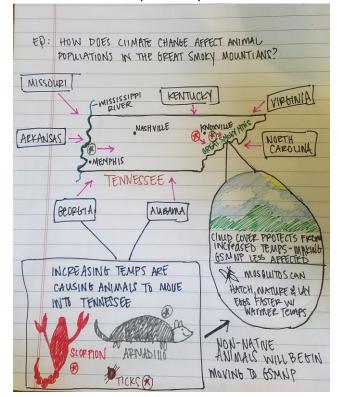
#### Materials

- Paper
- Pencils
- Markers
- Post-it notes
- "Critical Thinking" hand out
- Teacher identified research resources
- Technology for conducting research

#### Instruction

1. At the beginning of the lesson, pass out paper, pencils, and markers. Ask students to create a model of the factors that affect global temperatures causing them to increase over time. Instruct students that this model should reflect what they currently know or think to be true

about this topic. It is OK if the information isn't completely correct and some students may have to guess. Artistic skill is not the focus; however, students should strive to make their model easy to read and understand. Student models should include images (drawings, representations, symbols), labels, and descriptions. Attached is an example of a model created by a student.



- 2. After drawing their model, have students reflect on the process by answering the following questions.
  - a. What did you learn about your level of understanding of this topic?
  - b. What was most difficult about creating a model?
  - c. What would you improve the next time you create a model?
  - d. What would make this process easier?
- 3. Have a class discussion about the process of creating the model. Ask students to share their reflections with the class.
- 4. Hand out Post-it notes. These will be used for feedback and the questioning activity.
- 5. Have students conduct a gallery walk of the models created by their classmates. As they walk around, they should take a pencil and Post-It notes with them. During the gallery walk, students should give feedback on post-it notes in the form of:
  - a. I like\_\_\_
  - b. I wish\_\_\_
  - c. I wonder\_\_\_
- 6. Ask students to return to their model and review the feedback they were given by their peers.
- 7. Tell the students that they will be generating questions about their model and the topic of the factors causing global temperature increase. Ask them to think about what they need to know to make a more accurate and informative model. What would they like more information about? Where do they need clarification? Was there feedback that they could ask a question to address?
- 8. As students generate questions, instruct them to use one Post-it note per question. They should strive to write as many questions as possible.
- 9. Set a timer for 10 minutes and ask students to write questions for the full amount of time. If a student thinks they are done, tell them to continue to write questions until the time is up.
- 10. As students work on writing questions, the teacher should circulate and encourage students through the process. During this time the teacher can also write and leave questions on Post-it notes to help push student thinking forward.
- 11. At the end of 10 minutes, pass out the "critical thinking" hand out. Have students look over their questions, and then identify and label what level each of their questions would fall under.
- 12. Ask students to revise their questions so that they hit a higher level of thinking using the "Critical Thinking" handout.
- 13. Once students have revised their questions, instruct them to arrange their questions and their model at their seat so that they are organized and easy to read.
- 14. Have students conduct a gallery walk of the models and questions created by their classmates. The teacher can set a number of models to view based on the available class time.
- 15. As they walk around, students should take paper, pencil, and Post-it notes with them. During the gallery walk students should:

- a. Look for questions that they would like to use.
  - i. Put a star on the Post-it to let the author know someone likes the question.
  - ii. Write the question on their paper so they can remember to add it to their series of questions.
- b. Add any question they think would help their classmates' research.
- 16. Have students return to their model and give them time to review any added questions and to add any new questions they would like to add to their collection.
- 17. Ask students to prioritize their questions and arrange their Post-it notes to reflect which questions are most important.
- 18. Students should conduct research to answer the questions using the materials and technology provided by the teacher. This could include scientific articles, reliable websites, textbook, library databases, library books, videos, teacher mini lessons, and calling outside experts.
- 19. As students conduct research, they should transfer their questions and new knowledge to their notes, interactive notebook, or digital document.
- 20. Once research is complete, ask students to revisit their original model looking to identify how their understanding has changed. What new information should be reflected, and what might need to be omitted?
- 21. Hand out a new sheet of paper, pencils, and markers and ask students to revise their model based on their research.
- 22. Have students complete a written reflection on the following questions:
  - a. How did my understanding of increasing global temperatures change throughout this process?
  - b. How did creating a model improve my learning?
  - c. How did my model evolve after writing questions and conducting research?
- 23. Have a class discussion around these reflection questions asking students to share their answers with the class.
- 24. Provide an opportunity for students to share their models showing the changes between the initial model and the second iteration. This could be in a presentation format or as a gallery walk.

#### Differentiation

This lesson allows for students to work at different levels without modification. Students who have no prior knowledge and/or learning difficulties are able to further their understanding and use resources that meet their needs. At the same time, students working at a higher level who may have more prior knowledge are able to push past foundational information and expand their understanding by using higher-level resources and more in-depth topics.

The teacher can modify the resources available based on student ability and need. The website <u>www.dogonews.com</u> has scientific articles with a read aloud option, <u>www.newsela.com</u> offers articles at different reading levels.



#### Assessment

- 1. Pre-assessment: Initial model and questions
- 2. Formative: Student reflections
- 3. Formative: Revised and prioritized student questions
- 4. Summative Assessment: Final model

# **CRITICAL THINKING SKILLS**

	define	label	name	state
1	fill in the blank	locate	recall	tell
	list	match memorize	spell	underline
Knowledge	identify	memorize		
	Who	?	How	?
Identification	What	?	Describe	•
and recall of information	Where	?	What is	?
mormation	When	?		
			1	
	convert	interpret	restate	summarize
2	describe	paraphrase	retell in your own words	trace
Comprehension	explain	put in order	rewrite	translate
Comprenension	Do toll in your	ownwords	What differences exist bet	2
Organization	Re-tell in your What is the main idea of	2	What differences exist bet Can you write a brief outli	
and selection of	matis the main face of _	·	our you white a brief out	ile.
facts and ideas				
-	apply	demonstrate	give an example	show
3	compute conclude	determine draw	illustrate make	solve
Application	construct	find out	operate	state a rule or principle use
	construct	inia out	operate	use
Use of facts,	How is an example	of?	Do you know of another ir	
rules,	How is related to Why is significant?	?	Could this have happened	l in?
and principles	Why is significant?			
	analyze	contrast	diagram	examine
4	categorize	debate	differentiate	infer
4	classify	deduct	dissect	infer specify
<b>4</b> Analysis				
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