Modeling, Questions, and Climate Change

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Target Grade: 6th 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:

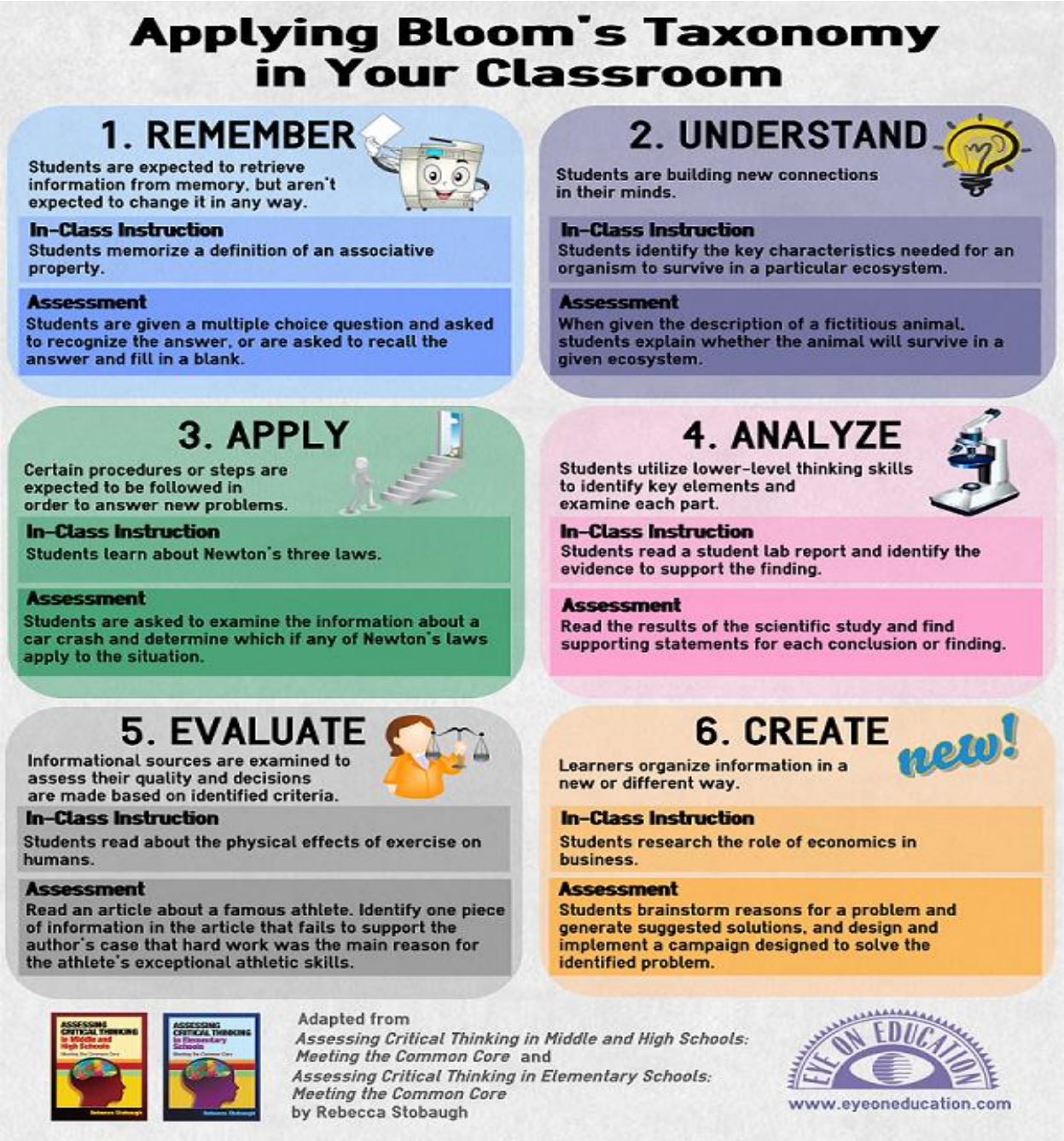
- Develop a model based on prior knowledge and assumptions of the factors causing global climate change.
- Generate a series of questions about the factors causing global climate change.
- Refine their questions by making them higher level and more focused.
- Conduct research to answer their questions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



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.

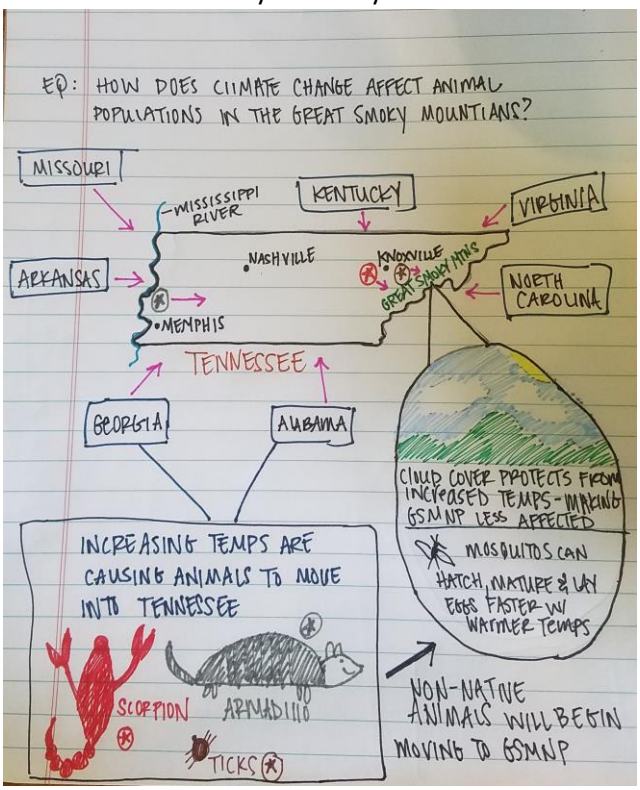
https://www.sciencelearn.org.nz/resources/575-scientific-modelling

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 www.dogonews.com has scientific articles with a read aloud option, www.newsela.com 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

1 Knowledge

Identification and recall of information

define	label	name	state
fill in the blank	locate	recall	tell
list	match	spell	underline
identify	memorize		

Who _____?
What _____?
Where_____?
When _____?

How _____?
Describe _____.
What is _____?

2 Comprehension

Organization and selection of facts and ideas

convert	interpret	restate	summarize
describe	paraphrase	retell in your own words	trace
explain	put in order	rewrite	translate

Re-tell _____ in your own words.
What is the main idea of _____?

What differences exist between _____?
Can you write a brief outline?

3 Application

Use of facts, rules, and principles

apply	demonstrate	give an example	show
compute	determine	illustrate	solve
conclude	draw	make	state a rule or principle
construct	find out	operate	use

How is _____ an example of _____?
How is _____ related to _____?
Why is _____ significant?

Do you know of another instance where _____?
Could this have happened in _____?

4 Analysis

Separating a whole into component parts

analyze	contrast	diagram	examine
categorize	debate	differentiate	infer
classify	deduct	dissect	specify
compare	determine the factors	distinguish	

What are the parts or features of _____?
Classify _____ according to _____.
Outline/diagram/web/map _____.

How does ____ compare/contrast with ___?
What evidence can you present for _____?

5 Synthesis

Combining ideas to form a new whole

change	find an unusual way	predict	revise
combine	formulate	pretend	suggest
compose	generate	produce	suppose
construct	invent	rearrange	visualize
create	originate	reconstruct	write
design	plan	reorganize	

What would you predict/infer from _____?
What ideas can you add to _____?
How would you create/design a new _____?

What solutions would you suggest for ____?
What might happen if you combined _____ with _____?

6 Evaluation

Developing opinions, judgements, or decisions

appraise	decide	judge	rate
choose	defend	justify	select
compare	evaluate	prioritize	support
conclude	give your opinion	rank	value

Do you agree that _____? Explain.
What do you think about _____?
What is most important?

Prioritize _____ according to _____?
How would you decide about _____?
What criteria would you use to assess ____?