

Unit 1: Using Models [in *The Day After Tomorrow*] to Predict Climate Change

Introduction

Students will be engaged as they are asked a series of driving questions about climate then watch the popular film *The Day After Tomorrow*. They will eventually be asked to describe how scientists in the movie use models to predict future climate and change.

Expectations –

- C1.1B** Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions.
- C1.1D** Identify patterns in data and relate them to theoretical models.
- C1.1E** Describe a reason for a given conclusion using evidence from an investigation.
- C1.1f** Predict what would happen if the variables, methods, or timing of an investigation were changed.
- C1.2A** Critique whether or not specific questions can be answered through scientific investigations.
- C1.2B** Identify and critique arguments about personal or societal issues based on scientific evidence.
- C1.2C** Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.
- C1.2D** Evaluate scientific explanations in a peer review process or discussion format.
- C1.2E** Evaluate the future career and occupational prospects of science fields.
- C1.2j** Apply science principles or scientific data to anticipate effects of technological design decisions.
- C1.2k** Analyze how science and society interact from a historical, political, economic, or social perspective.
- B3.4C** Examine the negative impact of human activities.
- B3.4x** Humans can have tremendous impact on the environment. Sometimes their impact is beneficial, and sometimes it is detrimental.

Resources

- *Day After Tomorrow*
- <http://www.epa.gov/climatechange/science/future.html>
- <http://climatesight.org/2012/04/26/the-day-after-tomorrow-a-scientific-critique/>

Safety

- There are no safety precautions to note for this unit.

Engagement

Day 1: Monday:

- Pre-Test – <https://sites.google.com/site/iccarsproject/resources/iccars-lessons-and-projects/assessment>
- Engagement Activity Guidelines - Set up stations where students answer questions (see “Driving Questions” for the Module, page 2, also included on page 4 of this unit for convenience) on index cards as a jigsaw-style activity. I have seven lab stations in my classroom. I place each question on 11” x 14” paper in the middle of the table. I rotate the questions part way through the hour, as well as rotating the students from station to station. Encourage students leave their name’s off of the index card and be sure to write legibly. Have them leave the cards in a box on the table that holds the question! I do this on a Monday and come back to it on Thursday. By Thursday I have posted the questions along my classroom walls with all the index cards posted beneath the appropriate question.
- The index cards will expose prior conceptions
- Typical Engagement lessons last approximately 15 minutes. This lesson may take longer, however, I also use this to satisfy my school’s literacy needs and guidelines.

Explore

Day 2 and Day 3: I show *The Day After Tomorrow* on Tuesday and Wednesday. Each student must write questions about the movie on an index card each day. For grading purposes, I have the students write their names on the back of the card. These will be posted on the wall by Thursday as well. Encouraged questions follow along the lines of: Do they really use ice samples? Are there ice samples for our area? What are the Kyoto Accords? How are the scientists in this movie using models to predict future climate change? I pause for discussion when desired, but am conscious of time limitations.

Explain and Evaluate

Day 4: Explanation Writing Activity: During the class period on Thursday students will read all of the cards on the walls around the room for a quarter of the hour. They will then be asked to free-write (blog-style) about *The Day After Tomorrow* for the second portion of the hour. There are no recommended written responses for this activity, but I do evaluate the writing using our AP Program’s Blogging Rubric (see page 4). So while this is simply an opportunity to record their thoughts about the movie, they are expected to write well and respond to ideas presented on the wall. (*Literacy Principles v, vi*) Students will have studied the rubric earlier in the year, so they are aware of what is expected.

- The writing activity may make connections between past and present learning experiences
- The writing activity will begin to organize thinking toward learning outcomes of current activities

- If I find they are finishing with time to spare, I have them write one question about climate that they would like to live in answered on a fresh index card. Their name and hour must be written on the back of this card. (CI.1A)
 - This card will be used to develop groups for the explore, explain, and elaborate activities in the Local Climate and Climate Change Unit.
 - Index cards are also used as an assessment of understanding.
 - Sort interest cards into groups and assign students to work with each other. Keep skill level and attendance record in mind as you make these “permanent” groups.

Student Assignment:

Evaluate Prompt: Describe how scientists use models to predict future climate and change in the movie *The Day After Tomorrow*. Is this use of modeling accurate and/or plausible?

In order to complete this assignment students will access the following link on their own time:

<http://www.epa.gov/climatechange/science/future.html>

They should read that webpage and click on the blue link for "models" under the heading "Future changes will depend on many factors" . A slide show called "Climate Models and Scenarios" will pop up. Students should take notes as they watch the slide show, pausing as necessary. Encourage them to record questions for you to address as a class to enhance understanding. Give them an evening or two to construct their responses and schedule ample class time to discuss their progress.

After attempting to answer the writing prompt based on notes taken from the pop-up slideshow, most students should only be able to make a connection to the movie in the sense of computer models. They should also begin to discuss how inaccurate or unrealistic the computer models are in the movie.

Direct students to read the post found at

<http://climatesight.org/2012/04/26/the-day-after-tomorrow-a-scientific-critique/>

and encourage them to continue drafting their responses. Finally, review the standards for this unit with the students and discuss how each relates to computer modeling in the movie. Host after school help-time as necessary.

Final responses could include some of the following points of interest:

- Computing technology allows us to create complex mathematical models that can diagnose the past and evaluate future scenarios
- A description of how Jack is able to convert his paleoclimate model to a projection model or why he believes this will be useful
- This movie is relatively inaccurate with regards to current modeling capabilities, but could be plausible in the future

Students will produce responses to this prompt while we have already moved onto another Chemistry Unit in our district Curriculum. I use any and all downtime in the next unit to my advantage and have class discussions whenever possible. It may take up to a week before students are expected to turn in their final responses.

AP Program Blogging Rubric

	4	3	2	1
Ideas and Topic Development	Communicates a sophisticated and original point of view, using strong support. Uses textual references as appropriate.	Communicates an original point of view, using adequate support.	Communicates a point of view, but may be vague or merely echo previous posts without contributing original ideas or support.	Fails to communicate a point of view on the topic.
Voice and Style	Effective word choice and varied sentence structure contribute to a clear and powerful voice.	Adequate word choice and sentence structure contribute to an appropriate and effective voice.	Word choice and sentence structure show little variety, undermining the sense of voice.	Inappropriate word choice or problems with sentence structure obscure meaning; voice may be overly informal.
Contribution to Learning Community	Meaningfully and respectfully references at least one colleague; attempts to motivate the group discussion with new and creative approaches.	Respectfully references at least one colleague; does not disrupt the flow of the group discussion.	Does not reference any specific colleagues; fails to acknowledge the ongoing discussion.	Makes limited effort to engage with the group; may post off topic.
Grammar and Mechanics	There are few or no errors in grammar, spelling, and punctuation.	There are several errors in grammar, spelling, and punctuation.	There are many errors in grammar, spelling, and punctuation.	Extensive errors in grammar, spelling, and punctuation obscure meaning.

Driving Questions:

- a. Why do you think it is important to understand local climate and its change?
- b. How would you describe our climate to your family?
- c. How do scientists use models to predict future climate and change?
- d. How does our government (NASA) help your understanding?
 - d.i. Question – Why do I need to understand climate?¹
 - d.ii. Problem – How do I know what my climate is and if it has changed?²

1 Science begins with a question and seeks to develop theories. It then constructs and uses models to develop explanations about natural phenomena.

2 Engineering begins with a problem. It then uses models and simulations to analyze existing systems to identify or predict flaws, or to test possible solutions.