

Description of Teaching and Learning

During the 2022-2023 school year, I taught our unit on nuclear energy as a transitional unit between our Rocks and Minerals Unit and our unit about Climate Change and Environmental Justice. The goal was for students to be introduced to the popular framing of nuclear energy as a “solution” to greenhouse gas emissions, but then critique this argument after reading narratives about the effects of nuclear radiation on the human body and the environment. They also learned about human rights violations involved in nuclear testing in the Southwestern part of the United States (Downwinders, Indigenous communities), in the Marshall Islands, and the fallout from the devastating bombings of Hiroshima and Nagasaki. The students also learned about the importance of renewable energy sources and the development of renewable technology as alternatives to fossil fuels.

The questions below were generated by a small group of students who expressed interest in learning about the history and the science behind nuclear energy, even before I shared that we would be doing a unit of study together. We began to meet as an independent inquiry group in Fall 2022 before my leave of absence. During our meetings, the students began to generate these inquiry questions using their own background knowledge about nuclear energy and the history of nuclear bombing. After I returned from my leave in Spring 2023, I shared with the students that they would be great leaders within our unit of study, and should find resources that we could use as a class to help their peers understand more about the science behind nuclear energy. We created a Google Classroom to gather resources and share ideas within this inquiry group, and students posted videos and discussion questions there.

As a “hook” for our unit (an activity to spark student interest), students participated in an activity called Question Formulation Technique using images of mushroom clouds from nuclear testing in the Southwest as well as the bombings of Hiroshima and Nagasaki, plumes of smoke from the 2023 train derailment in East Palestine, Ohio, and plumes of ash and debris from the implosion of the Crawford Coal Plant in the Little Village neighborhood of Chicago. Through these images, students wrote as many questions as they could within a short time frame, generating questions based on both observations and inferences about what these plumes could be from. Each group shared their questions, and then students worked in their groups to sort their questions into open vs. closed questions as a way to narrow down their questions to possible discussion and inquiry questions. The goal of our discussion after this opening activity was to make connections between each of the images, connections that were specifically about who is harmed/who is doing the harming, who holds power and made decisions about these catastrophic events, what are the consequences of these events, and connections to concepts like *justice* and *exploitation*. I wanted to spark initial thinking about our unit’s essential question - What are our ethical responsibilities as scientists when examining the nature of nuclear energy? (and what are our ethical responsibilities in relation to justice for people and the environment).

After the QFT, I moved on to sharing narratives of Downwinder and Diné experiences in an activity called Big Paper or Write Around. The quotes from these narratives were pasted on large poster paper, and students were instructed to circle powerful words they notice, to write questions about what the text says (including clarifying or vocabulary questions), and to write what the passages made them think about and feel. My intention was for students to connect with the human/environmental impact of nuclear energy first before delving into the science of

nuclear energy so that they would have a different lens than my students did last year when I began the unit using resources about the mechanics of nuclear energy production. We also watched parts of the PBS documentary "[Downwinders and the Radioactive West](#)" and students responded to the film on a RECORD/REFLECT sheet, where they recorded key information or quotes from the film, and reflected on connections they had, questions, or what they were feeling while watching. In order to share their thoughts about the film, students then played the "Give One, Get One" game, where they walked around the room, responded to the reflections of at least 4 people, and were responsible for bringing back insights from others to the whole group discussion.

Unfortunately this year we were not able to carry out a Structured Academic Controversy nor were we able to culminate the unit with an action project. I am hoping that in the coming year because I am working with this same cohort of students, we can build on what we began last school year and work on an action research project geared towards environmental justice and teaching others about the impact of nuclear energy.

Small Group Student Inquiry Questions

Scientific Focused Questions -

- 1) How does nuclear radiation become so deadly and lethal?
- 2) How can nuclear radiation be detected?
- 3) What is nuclear radiation? Where does radiation come from? What causes nuclear radiation?
- 4) How can nuclear radiation be used in medicine?
- 5) How does nuclear radiation spread?
- 6) How does nuclear radiation affect atoms?
- 7) What is the difference between molecules in nuclear radiation and in nuclear bombs?
- 8) Why is radiation good for killing cancer cells?
- 9) What would the outcome be if nuclear radiation was released on the earth's core?
- 10) What would happen if a nuclear bomb landed in a super volcano?
- 11) What is the outcome of uranium explosion to the human body?
- 12) What is the difference between nuclear fission and nuclear fusion?
- 13) How much nuclear radiation can a human handle?

Social Science/Humanities Focused Questions -

- 1) How can nuclear radiation affect society?
- 2) Why do people start wars?
- 3) What was the purpose of bombing Hiroshima and Nagasaki?
- 4) How does Hiroshima and Nagasaki still have aftereffects of the radiation?
- 5) Why are nuclear bombs used in war?

RECORD/REFLECT Template

Name:

Date:

Downwinders and the Radioactive West

We will watch part of a documentary about uranium mining and the history of nuclear testing. This will provide us with some further background knowledge to start discussing the human and environmental impact of nuclear energy.

<p>RECORD (At least 15 notes, quotes, facts, or important information you learned from the documentary)</p> <p><i>I notice...I observe...This detail really stuck out to me because...</i></p>	<p>REFLECT (At least 10 QUESTIONS or CONNECTIONS)</p> <p><i>I wonder...This makes me think of...This connects to...This surprised me because...This was troubling...This was intriguing/interesting...</i></p>

