

Environmental Sciences - High School

Eliciting Student Thinking

Scenario Guide
Activation Date:
Intensity Level: Low

Author(s)	Avatar(s) & Environment	Suggested Learner Audience
Simulations for Secondary Science Teachers Conference John Clark Dr. Anita Deck Dr. Michael Hynes Dr. Liz Kolb Dr. Demetrice Smith-Mutege Mursion Julie Snyder	Host Avatar(s) Nina/Michael Simulation Avatars Ciara, Angela, Jordan, James, Stephanie Environment [ML3z] High School	<ul style="list-style-type: none">• Pre-Service Teachers• Non-credentialed Teachers• Novice Teachers
Delivery Mode(s) Available for Scheduling 1:1, Facilitated Group		
This scenario was created in partnership with AACTE and the convening, Enhancing Science Education through Virtual Reality: A Conference to Design Simulations that Enhance the Clinical Preparation of Secondary Science Teachers, is funded by the National Science Foundation (NSF) 20-572 Discovery Research PreK-12, award #2040747.		

Learner-Facing Vignette:

You are a teacher in a High School Environmental Sciences classroom focusing today on an assignment related to Nuclear Power. For homework you gave your 11th grade students the following prompt:

"You have been elected mayor of your city and you have been charged with determining if a nuclear power plant is a viable type of energy. Be prepared to present your conclusion to your citizens and share your justification."

You are prepared to spend your lesson digging into your student responses by posing questions that provoke students to share thinking about the content in order to evaluate understanding and surface ideas that will benefit other students. You may also find opportunities to clarify the difference between personal opinion and unbiased fact. To do this effectively, carefully choose your questions and check alternative interpretations of students' ideas and methods.

Outcome:

Your goal in this scenario is to elicit thinking from all students.

Strategies/Best practices to consider:

- Pose higher order questions that provoke students to share thinking about content
- Encourage students to consider the sources of their justification for accuracy and bias
- Build on questions to help connect students' responses

Information about Intensity Level: Low

- Low intensity sessions are meant to build confidence for the learner. This setting is recommended for first time learners.

Supplemental Materials:

This scenario is gearing toward practicing the following of the
[Next Generation Science Standards 8 Practices of Science & Engineering](#):¹

Engaging in Argument from Evidence
Argumentation is the process by which explanations and solutions are reached.
Obtaining, Evaluating, and Communicating Information
Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity.

Information for Course Instructor Scenario Selection:

This lesson utilizes the following Next Generation Science Standards listed below:²

- LS2-07. Students design, evaluate, and refine a solution for reducing the impact of human activity on environmental diversity.
- PS-1C Physical science standard-students are made to understand *what is the chemical process that's happening in the power plant*.
- ESS-3C Human Impacts on Earth Systems
- AP Standards:
 - ENG-3 (overarching): Humans use energy from a variety of sources, resulting in positive and negative consequences.
 - ENG-3.G.4: Nuclear power generation is a nonrenewable energy source. Nuclear power is considered a cleaner energy source because it does not produce air pollutants, but it does release thermal pollution and hazardous solid waste

Background (Internal, not Learner-Facing)

¹ NSTA, and using information from Appendix F of the Next Generation Science Standards © 2011, 2012, 2013 Achieve, Inc. "Science and Engineering Practices." *National Science Teaching Association*, 2014, <https://ngss.nsta.org/practicesfull.aspx>. Accessed 10 8 2021.

² Achieve. "Next Generation Science Standards." [Next Gen Science](#), 2013, <https://www.nextgenscience.org>. Accessed 10 July 2021.

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Activation Date:
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Review Time	Delivery Mode(s)
Mursion Bank: Up to 15 minutes: bill Trainee directly to client	1:1, Facilitated Group
Scenario Specific Content	
Intensity Level: <ul style="list-style-type: none">Low: In a low intensity, the students exhibit mostly on task behavior with a few instances of off task behavior. Most students are engaged and off-task behavior is likely a result of over-participation or excitement over the subject matter. Off-task behavior can be redirected at the first attempt by the Learner.	
Host Specific Inquiries: <ul style="list-style-type: none">N/A	

What is this scenario intended to address?

This scenario provides the experience of introducing new lesson content in a high school classroom.

Simulation Specialist Goal:

To provide learners with opportunities to elicit individual student thinking, correct misconceptions and encourage higher order thinking.

Avatar's perspective:

Note: Color coding indicates if the Perspective is For or Against the Nuclear Power Plant, it does not reflect if the student is Correct. Feel free to expand on the student's perspective based on their "research."

Perspective 1: (Wikipedia)/Lobbying Organizations ³
Student has determined that Nuclear Power plant is <i>not</i> a viable/potential type of energy by utilizing a Wikipedia article.
As mayor of this city, I have concluded that the nuclear power plant is not a good choice for an energy plant. I have three reasons why I am not advocating for nuclear power over other types in our city. First, because according to Wikipedia, there have been three huge nuclear power plant accidents since the 1970s; Chernobyl in 1986, Three Mile Island in 1979 and , Fukushima in 2011. These disasters resulted in deaths and cancers of not only adults but children too, some with lifelong illness related to the radiation from the accidents. Since there has been an accident as recently as 2011, it is clear that we still do not know how to fully contain the nuclear energy so that it doesn't harm people. In Addition, according to Wikipedia, both Greenpeace and The Nuclear Information and Resource Service (NIRS), have been outspoken that nuclear power may pose threats to people and the environment. In addition, they are concerned about nuclear power plants leading to more "use of nuclear weapons proliferation and terrorism ⁴ ." It is clear from the Wikipedia readings that these nuclear reactors are

³ Nuclear Power. (9, July, 2021). In Wikipedia. https://en.wikipedia.org/wiki/Nuclear_power#Debate_on_nuclear_power

⁴ This is an intentional grammatical error from the Wikipedia Article

complicated where things could easily go wrong if not properly maintained. Finally, and more practically nuclear power is not an economical electricity source compared to other options, thus financially it does not make sense to invest in nuclear power.

Perspective 2: Social Media Influencer (Isodope)⁵

Student has determined that Nuclear Power Plant is a viable/potential type of energy.

Avatar's POV on nuclear energy and nuclear power plants is guided by Isodope**, who is the self-proclaimed "world first nuclear energy influencer". With more than more than 60,000 followers on Tik Tok and 29,000 on Instagram, Isodope produces informational videos about climate change with a focus on nuclear energy. Avatar started following Isodope when they were drawn in by one of her fashion videos. While Isodope modeled fashions, she talked about nuclear energy and Avatar became enthralled by her message.

Avatar watched an interview with Isodope on YouTube. During the interview, the host asked Isodope "Why nuclear power?" She replied, "After the Australian and Amazon fires, I felt a need to use my platform to help tackle climate change," she says. "As I started reading into what it would take to solve it, it became clear nuclear energy needs to be a part of the solution. There's one problem, though, which is that people hate and fear this technology, even though it's one of the safest and most reliable forms of energy production." She adds that "people go on and on about nuclear waste, when in reality nuclear is the only energy-generating industry that's responsible for its waste. It's a very small amount, all accounted for, and it's properly stored and has never hurt anyone. Meanwhile, the waste from fossil fuels spills into the environment, pollutes our air, causes climate change and kills five million people every year, with zero accountability to the industry that produces it.

Avatar also viewed Isodope's one-minute video, How Does a Nuclear Power Plant Work? (<https://i-sodope.com/videos>).

Avatar shares many of Isodope's fun facts about nuclear energy and/or nuclear power plants:

- Uranium pellets are roughly the size of a gummy bear
- One uranium pellet has as much energy as 2,000 pounds of coal
- One uranium pellet has much energy as 12000 Big Macs
- One uranium pellet has as much energy as 149 gallons of oil
- One uranium pellet can power a house and every appliance in to for 2.5 months

Isodope is also on Twitter where she regularly connects with scientists and science communicators on Twitter, including NASA heavyweight Carolyn Porco. Her target audience is young people online who would otherwise never think about nuclear energy. "The idea is to present just enough information in a crazy enough way to instill curiosity and motivate them to do more research."

**Isodope is actually 30-year-old Brazilian model Isabelle Boemeke. After moving to the U.S. to advance her modeling career, she "accidentally" read the book that sparked her scientific curiosity, Richard Dawkins' *The Greatest Show on Earth*, and she has been a voracious consumer of scientific information ever since.

⁵ Energy for Humanity. (2021). Retrieved from <https://energyforhumanity.org/en/top-ten-facts/isodope-a-radical-new-voice-for-nuclear/>.

Grist. (2021). Retrieved from <https://grist.org/energy/this-radiant-model-wants-you-to-stop-worrying-and-love-nuclear-energy/>.

Isodope. (2021). Retrieved from <https://i-sodope.com/>.

TikTok. (2021). Retrieved from <https://www.tiktok.com/@realisabelleboemeke?lang=en>.

[Source](#)

Perspective 3: Internship/Summer Camp Experience

Student has determined that Nuclear Power Plant *is* a viable/potential type of energy.

Student attended a Summer Camp on Nuclear Energy (for example: URL: nuclear.duke-energy.com). Student is basing their perspective on what they learned about the science of nuclear reactions.

- Atoms are split in nuclear reactions. These reactions are the key to using nuclear fuel to make electricity in power plants.
- Although the student may be more familiar with the *process* they're "research" was based on personal experience and is more of a surface level understanding of Nuclear Power plants
- *The camp was through the Nuclear Information Center at Duke Energy. They have 6 Nuclear Power plants and 11 nuclear units so they're clearly experts*

Perspective 4: Editorial from Paper ([Nuclear Power Can Save the World](#), 2019)⁶

Student has determined that Nuclear Power Plant *is* a viable/potential type of energy.

- Renewable energy only works with fossil fuel backup, there's just not enough wind & sun to only use clean energy.
- France & Sweden use nuclear energy (i.e. Carbon Free Energy)
- In fact, most of the fastest additions of clean electricity historically are countries rolling out nuclear power.
- The 98 U.S. reactors today provide nearly 20 percent of the nation's electricity generation.
- Basically the only reason everyone doesn't have nuclear power is cost and because they're afraid
 - New nuclear power plants are hugely expensive to build in the United States today.
 - China and South Korea can build reactors at one-sixth the current cost in the United States.
 - The reality is that nuclear power is the safest form of energy humanity has ever used. Mining accidents, hydroelectric dam failures, natural gas explosions and oil train crashes all kill people, sometimes in large numbers, and smoke from coal-burning kills them in enormous numbers, more than half a million per year.
 - By contrast, in 60 years of nuclear power, only three accidents have raised public alarm: Three Mile Island in 1979, which killed no one; Fukushima in 2011, which killed no one (many deaths resulted from the tsunami and some from a panicked evacuation near the plant); and Chernobyl in 1986, the result of extraordinary Soviet bungling, which killed 31 in the accident and perhaps several thousand from cancer, around the same number killed by coal emissions *every day*.

Perspective 5: Grandmother from PA

Student has determined that Nuclear Power plant *is not* a viable/potential type of energy

"My grandmother told me that when she lived in York, PA, there was a nuclear plant accident in 1979. There were lots of people who moved away from the area because they were afraid of the contaminants."

- More than 120,000 people evacuated.

She said

"You just sat in your house with everything closed and wondering if there was going to be a meltdown or not"

⁶ Goldstein, Joshua S., et al. "Nuclear Power Can Save the World." *New York Times*, 6 4 2019, NYTimes.com, <https://www.nytimes.com/2019/04/06/opinion/sunday/climate-change-nuclear-power.html>. Accessed 11 8 2021.

Source: <https://www.voanews.com/usa/three-mile-island-32-years-later>

Resources: [Personal Testimonials](#)

Perspective 6: Lived Overseas

Student has determined that Nuclear Power plant *is* a viable/potential type of energy

Student lived overseas in France and Nuclear power was normal. Doesn't really understand the big deal.

Perspective 7: Activist Website

Student has determined that Nuclear Power plant is *not* a viable/potential type of energy

Student googled *Is Nuclear Energy Bad* and the top search was: (www.greenamerica.org) "10 Reasons to Oppose Nuclear Energy"⁷

From the Website: *Nuclear energy has no place in a safe, clean, sustainable future. Nuclear energy is both expensive and dangerous, and just because nuclear pollution is invisible doesn't mean it's clean. Renewable energy is better for the environment, the economy, and doesn't come with the risk of a nuclear meltdown.*

Ten Strikes Against Nuclear Energy

1. Nuclear Waste
2. Nuclear proliferation
3. National security
4. Accidents
5. Cancer risk
6. Energy production
7. Not Enough Sites
8. Cost
9. Competition with Renewables
10. Energy dependance of Poor Countries

Pushback Techniques:

N/A this a content heavy scenario so the Intensity Level is a Low.

⁷ Green America. "10 Reasons to Oppose Nuclear Energy." <https://www.greenamerica.org>, 2017, <https://www.greenamerica.org/fight-dirty-energy/amazon-build-cleaner-cloud/10-reasons-oppose-nuclear-energy>. Accessed 07 09 2021.