



## TERCER EJERCICIO PROMOCIÓN INTERNA

### PARTE B

#### WHY AND HOW ASTRONOMERS SHOULD TEACH CLIMATE CHANGE

Many years ago, one day in my solar system astronomy class, we were talking about the searing hellscape of Venus. A student asked me, "Is that what climate change is going to do to the Earth?" I assured her the answer was no — we weren't going to turn into Venus. But I soon realized I didn't really know how to answer her other questions. What was going to happen to the Earth? How worried should we be? And what can we do about it? That day, and future ones, made it clear that many of my students were deeply concerned about climate change, and they weren't getting the information they needed from other places. As the climate crisis has hurt my home state of Alaska, in ways that are no longer deniable, that desire has only increased.

Why astronomers? Should we be teaching about climate change? Or should we leave it to the "experts"? The good news is that astronomers are in an excellent position to teach climate change. The science is woven into the topics we teach. For example, the climate history of the terrestrial planets is a common pathway to talking about climate change. This topic is particularly important because the most common misconception is that natural variability, not human activity, can explain climate change. Solar variability is also often mistakenly blamed. Other pathways include exoplanets, Milankovitch cycles, and astrobiology. Even topics such as the nature of light and telescopes are connected, e.g., we put infrared telescopes on mountaintops and in space to get above the water vapor that traps heat. You are often teaching about climate change even though you may not know it.

Second, the astronomer's perspective is important. A common question is, "Can we move to another planet?" The frequent announcements of the discovery of exoplanets, often in "habitable zones," has led to a misconception that there is a wealth of worlds out there that we could possibly move to if needed. The message that there truly is "no Planet B" is an important educational goal for an astronomy course.

Third, astronomers are highly trusted. We tend to be less controversial than other branches of science. And we have no "skin in the game." Climate scientists are often accused of being in it for the money — that is, they are motivated to fabricate or exaggerate the science of climate change to attract funding for their research. Astronomy is therefore a way to approach the topic that is less political.

Finally, astronomers reach a lot of people. Andy Fraknoi has estimated that in the United States about 300,000 undergraduate students take an "Astro 101" course every year. And for many this will be the



last science class they ever take. If you don't teach it to them, perhaps no one will. Whether you intend it to be or not, climate change is the most important topic you teach.

In teaching climate change you need to be aware of the following:

Climate change is different from other topics we teach. It is of course highly politicized and more prone to scepticism. An audience that readily listens when we talk about supermassive black holes may be doubtful if we describe how satellites are used to measure the temperature of the Earth (which is ironic, considering it is largely the same technology.) Climate change is also highly emotional. We are after all talking about the survival of humanity! There is valuable research on effective communication strategies that I link to below.

You need to talk about solutions. Otherwise, you can create the misconception that there's nothing we can do about climate change. The good news is that we can still avoid the worst consequences, but time is running out. We need to convey the urgency of the situation, but we also need to create hope. Project Drawdown is a wonderful resource for learning about solutions that address climate change and can also make our lives better.

It's not just about the science. People make decisions about how they feel about climate change primarily based upon their livelihoods, communities, and values. You therefore need to help people see how climate change affects things they care about. Don't talk about polar bears (unless you live in Alaska!). Keep it local. How is climate change affecting where you live? What are solutions that will appeal to your audience?

There is an active campaign of climate change disinformation. The goal is to confuse and distract so as to prevent or delay solutions that affect the profitability of some industries, particularly fossil fuels. You need to address it. Show examples of climate disinformation and talk about why it is happening. Talk about topics like "climate doomism" and "greenwashing." I also like to give examples of denialism from other industries, e.g., tobacco.



1. What sparked the author's realization about the need to educate students on climate change?
  - A) A student's question about Earth becoming like Venus
  - B) A request from the astronomy department to teach climate science
  - C) A lecture given by another astronomer
  - D) A government mandate on climate education
2. Why does the author believe that many students are concerned about climate change?
  - A) They witness frequent political debates on the topic
  - B) They want to major in climate science
  - C) They notice impacts in their communities
  - D) They aren't receiving sufficient information from other sources
3. What unique challenges does the author mention about Alaska in relation to climate change?
  - A) Its residents are not interested in climate change
  - B) It is too remote to gather data
  - C) It has limited educational resources
  - D) Climate change impacts are increasingly visible and undeniable
4. Why does the author think astronomers are well-suited to teach about climate change?
  - A) Astronomy directly involves studying Earth's ecosystem
  - B) Astronomy naturally includes relevant topics like climate history and solar variability
  - C) Astronomers have a formal background in climate science
  - D) Climate science is required in astronomy curricula
5. Which of the following topics is mentioned as a "pathway" for discussing climate change in astronomy?
  - A) Black holes
  - B) Dark matter
  - C) Exoplanets and the Milankovitch cycles
  - D) Gravitational waves



6. What misconception about climate change does the author say is common among students?
- A) That biodiversity will stop climate change
  - B) That climate change results from human activities alone
  - C) That global warming only affects polar bears
  - D) That natural variability can account for climate change
7. How does the nature of light and telescopes help illustrate climate change concepts?
- A) They demonstrate how water vapor traps heat
  - B) They directly track climate temperature change
  - C) They showcase how carbon capture works
  - D) They reveal how light is captured by heat-absorbing materials
8. What question regarding space exploration does the author suggest is often raised by students?
- A) How many stars exist in the galaxy
  - B) If humans can live on exoplanets
  - C) Whether humans can alter other planets
  - D) Why planets orbit the sun
9. Why does the author say it's crucial to emphasize the message "no Planet B"?
- A) To correct the misconception that Earth-like planets are plentiful
  - B) To make students more interested in astronomy
  - C) To promote space exploration as an alternative to climate solutions
  - D) To reduce interest in exoplanet research
10. What advantage do astronomers have when discussing climate change?
- A) They are funded by industries to promote climate awareness
  - B) They focus only on terrestrial issues
  - C) They are seen as less controversial
  - D) They directly engage in climate politics
11. Approximately how many students in the U.S. take an introductory astronomy course annually?
- A) 1 million
  - B) 100,000
  - C) 50,000
  - D) 300,000



12. What makes climate change a challenging subject to teach, according to the text?
- A) It is less understood than other sciences
  - B) It is highly politicized and emotional**
  - C) Students are generally indifferent to the topic
  - D) It requires little scientific background
13. Why does the author suggest including discussions of solutions to climate change?
- A) To prevent a sense of helplessness among students**
  - B) To give students a purely scientific view
  - C) To promote space exploration instead
  - D) To persuade students to join the climate science field
14. What is "Project Drawdown" mentioned in the text?
- A) A student organization focused on climate education
  - B) A resource that lists solutions to climate change**
  - C) A government report on climate impacts
  - D) A project to develop new astronomical tools
15. How does the author suggest connecting with students on climate issues?
- A) By focusing only on global policies
  - B) By only covering abstract scientific principles
  - C) By talking about the polar bears in Alaska
  - D) By discussing local climate effects and solutions**
16. Which industry does the author say is involved in disinformation about climate change?
- A) Renewable energy
  - B) Fossil fuels**
  - C) Digital technology
  - D) Automotive manufacturing
17. What is the goal of the disinformation campaign, according to the text?
- A) To spread accurate scientific knowledge
  - B) To prevent climate-related solutions that could affect profitability**
  - C) To gather more funding for climate studies
  - D) To promote renewable energy options



18. Which of these terms does the author mention as part of climate disinformation?
- A) "Climate denial"
  - B) "Environmental extremism"
  - C) "Climate doomism"
  - D) "Eco-activism"
19. Why does the author compare climate change disinformation to denial in other industries?
- A) To illustrate how industries with vested interests have resisted change
  - B) To show that tobacco is equally harmful
  - C) To suggest that climate denial is a new phenomenon
  - D) To emphasize the unique impact of fossil fuels
20. In what way does the author feel astronomers can impact climate change awareness?
- A) By changing laws directly
  - B) By providing a unique perspective on human survival and our planet's uniqueness
  - C) By diverting students to other branches of science
  - D) By working to disprove climate science critics