

OPINION

More than just facts: Countering climate mis-and-disinformation with critical thinking and empathy

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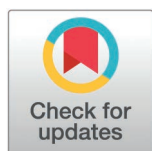
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Introduction

Simply presenting scientific facts is not enough to help students understand climate change and its complex impacts and solutions. Educators should teach students to critically evaluate climate change information and reflect on how their emotions, experiences, and pre-conceived ideas shape their perspectives. These elements of climate education are essential because students live in an information ecosystem where they may be exposed to mis-and-disinformation about climate change, often produced and disseminated by groups such as the fossil fuel lobby [1]. This mis-and-disinformation builds narratives that regularly find a foothold in individuals by connecting with their belief systems [2]. This dynamic may manifest itself in students that reject climate change-related instruction because it conflicts with their worldview. To counter the impact of this climate change mis-and-disinformation, we present several variably applicable teaching approaches educators can use when teaching their students about climate change. These approaches employ socioemotional learning, critical thinking exercises, and game-based learning to help students assess the accuracy of climate change information and realize how their lived experiences and values connect to the climate crisis. Each approach is highly adaptable and is meant to provide inspiration for new experimentation in countering or prebunking common climate change disinformation.

Building empathy and connections with underlying beliefs

Although there is research that shows that accurate information can shift people's attitudes, people also engage with, and process information in ways that are connected to their culture and underlying belief systems, also referred to as "attitude roots" [3]. However, little research discusses what pedagogical strategies can help instructors (and other students) hear, identify and engage with students' underlying attitudes in ways that these participants feel heard and motivated to have deeper discussion. Broader research on teaching and learning best practices would suggest that creating a supportive atmosphere for students to share their beliefs would allow for students to express aspects of their cultural identity, which is not included in most classroom practices [4].



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Instructors should focus on building a strong community in their classroom by providing various ways for students to interact, such as small group activities where students can share their background, what motivates them, and their goals for both the course and their career. Students can also engage in dialogic, deep listening activities to practice sharing and validating experiences and beliefs. To provide one such example, Sampaio (2021) [5] describes a dynamic listening activity to develop empathy entitled “Listen, Identify, Feel and Exchange” (LIFE). The goal of the activity is for students to tell a story to a partner about a time when someone failed to empathize with them, or when greater empathy would have made the situation easier. This activity could be modified to relate to a particular situation involving a climate or environmental topic (extreme weather, energy, resources, global instability, etc.).

After listening to their partner, students switch partners, or join new groups, and have to tell their partner’s story *as if it were their own*. Students can then share back to the class with reflections on how the activity helped them build empathy and understanding for others. Activities like this create a strong foundation for later discussions in which students share and examine their deeper attitudes toward climate change, articulating not only their positions but also the personal and cultural roots that shape them.

Critical literacy games

Once misinformation is introduced, research shows it can be surprisingly resistant to correction, with effects persisting even after individuals acknowledge the falsehood [6]. One effective countermeasure is *inoculation*, or warning an audience about an upcoming misinformation attempt and then refuting the anticipated argument to reveal its inaccuracy [7,8]. Instructors can integrate this process into their teaching in a foundational way by guiding students in how to spot and evaluate misinformation in various media.

For example, Lutzke et al. [9] found that simply reviewing and ranking guidelines for assessing the truthfulness of news reduced participants’ likelihood compared to a control group, to trust, like, or share fake news posts on Facebook. Instructors can embed this kind of inoculation process by teaching strategies to spot and understand misinformation in different forms of media. First, students can review guidelines for evaluating social media posts:

- (1) Do I recognize the news organization that posted the story?;
- (2) Does the information in the post seem believable?;
- (3) Is the post written in a style that I expect from a professional news organization?;
- (4) Is the post politically motivated?” (9, p.2)

Then, students can rank these guidelines by importance. Afterwards, the instructor can organize a collection of social media posts: half of them fake, and half of them truthful. Students can then work in pairs or groups to rank their truthfulness and explain their evaluation process to assess accuracy of the news. We recommend first doing a round with non-climate related news and placing an emphasis on funny news

stories to get students engaged and then transitioning to climate-related news stories in a second round. Options for this activity include providing points for correct answers to teams, prizes, timed rounds, and chances to switch groups frequently to move around the room and meet others. This kind of interactive game should be considered an important way for students to interact, understand each other's backgrounds, and can be combined with short ice-breakers as students start to work with and join new groups during the different rounds. A final option would be to connect the topics from the news stories to that class session's lecture or readings, where the literacy game plays a role in prebunking and inoculating common disinformation strategies and topics related to the day's climate change content.

Simulations, role-play and interactions

Student engagement with climate-related simulations has been shown to deepen knowledge, strengthen emotional connection, and even foster empathy toward the natural world [10,11]. One large-scale study [10] evaluated over 2,000 participants who took part in *World Climate*, a simulation that blends role-play with the C-ROADS online policy tool [12]. C-ROADS allows users to test and visualize the long-term impacts of climate strategies across regional groups, while the simulation assigns participants roles within UN negotiations and challenges them to co-create an agreement to limit warming below 2.0°C by 2100. This interactive process, which combines simulation, negotiation, and role-play, produced statistically significant gains in three areas: “[1] knowledge of climate change causes, dynamics, and impacts; [2] affective engagement, including stronger feelings of urgency and hope; and [3] motivation to learn more and take real-world action” [10].

These findings are compelling not only because they span diverse cultural, regional, and educational contexts, but also because they illustrate how experiential learning situated in simulation, role-play, and interaction can simultaneously build scientific understanding and affective competencies. Importantly, they suggest that countering climate disinformation requires more than lectures or the passive delivery of facts. Instead, learners benefit most when immersed in context-rich environments like UN climate negotiations, where they can actively interact, negotiate, and experience the complexities of climate decision-making first-hand. Educators that encounter students who repeat climate disinformation should start by reviewing this kind of research, and experimenting with simulations and interactive activities or workshops as a starting point in their classrooms.

Conclusion

Educators can prepare students to respond to the climate crisis by helping them build empathy for each other and the natural world [10,11], gain insight into their peers' underlying beliefs [5], and critically assess the media they consume [9]. In this piece, we review three approaches for teaching climate change. We feature several activities derived from these approaches, such as activities where students learn about each other's beliefs and identities before engaging in discussions about climate change. We also discuss how students could be given critical literacy tools to evaluate climate change information and how participating in climate-related games and simulations may help them develop empathy for the environment and those affected by climate change. We also think the teaching activities we describe, such as providing accurate information before misinformation is encountered to “inoculate” a learner [13], could be used when teaching subjects where mis-and-disinformation is prevalent. In sharing these approaches, we hope to inspire educators to take bold approaches when teaching students about climate change to help them become lifelong critical and emotionally adept evaluators of information.

Author contributions

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