As scientific misinformation proliferates, due largely to growing use of social media, our profession has learned the hard way that it is not enough to teach students accurate science. Misinformation is now so common that, as an editorial in *The Science Teacher* observed, “evidence-based reasoning seems under assault” (Metz 2017). As a result, it is imperative that science teachers help students use critical thinking to examine claims they see, hear, or read that are not based on science.

Although many of us know intelligent people who accept false “scientific” claims, it still may be shocking to learn that research finds a lack of knowledge is not the decisive reason why some people accept scientific misinformation (Kahan et al. 2012); in fact, cultural polarization is a more important factor. Still, as teachers, our job is to help students resist misinformation. Teaching accurate scientific information remains critically important; however, it is not sufficient.

The good news is that social science research offers teachers experimentally tested methods that help students identify misinformation. One successful approach is to educate people about misleading argumentation techniques, which reduces the influence of those techniques (Cook, Lewandowsky, and Ecker 2017). For example, until a court settlement was reached in 1998, tobacco companies tried to deceive the public with a misleading argument (Oreskes and Conway 2010). The companies knew that smoking caused cancer and other health problems, but pretended the science was “uncertain” and that smoking was safe, spreading misinformation because they wanted customers to buy more cigarettes. “The science is uncertain” argument is used to mislead on other issues, too. In 2017, the Heartland Institute—a group that had erroneously argued that secondhand smoke does not cause cancer—sent packets of misleading information about global warming to thousands of teachers nationwide. As the National Science Teachers Association wrote to its members, “labeling propaganda as science doesn’t make it so” (NSTA 2017).

In addition, a recent experimental study provides evidence “that it is possible to preemptively protect ('inoculate') public attitudes about climate change against real-world misinformation” (van der Linden et al. 2017). The study used an effective approach by giving its participants accurate information about the overwhelming expert consensus (97%) that human activities are the main cause of climate change. Surprisingly, large numbers of science teachers do not know about this strong consensus (Plutzer et al. 2016), so they cannot teach about it.

Scientific institutions play a vital role in developing a consensus and disseminating that information to policymakers and the public; they are integral to the *Next Generation Science Standards* Practice 8, “obtaining, evaluating, and communicating information.” We have confidence in what scientists know about climate change because the Intergovernmental Panel on Climate Change (IPCC) has had input from hundreds of scientists, scientific organizations, and national governments for 30 years. As another example, although flu
vaccinations do not prevent illness from every strain, we do have confidence that flu shots are effective because the federal Centers for Disease Control and Prevention (CDC) brings together experts to critique and review findings about vaccinations. To better resist scientific misinformation, students should learn more about the role of institutions such as the CDC, the IPCC, the National Academies of Science, and the World Health Organization.

Another recent study exposed thousands of young people to some true messages and some false ones, similar to those they may see on social media. The study confirmed that greater knowledge about the topic of a message did not in itself improve judgments of accuracy (Kahne and Bowyer 2017). However, participants who had many prior media literacy learning experiences provided more accurate responses when they were exposed to a post containing misinformation and an evidence-based post. This means that media literacy education helps people reject misinformation.

Teachers should teach students how to investigate suspicious “scientific” claims they encounter in media. In general, students should be taught to think critically using Purpose, Author, Relevance, Currency, and Sources (PARCS):

- **Purpose:** Is someone trying to sell you something or create an emotional reaction (such as anger), or is their aim to provide accurate information?
- **Author:** Who made the claim, and what qualifications does the claimant have?
- **Relevance:** Does the claim apply to you (perhaps a claim about a special diet is accurate but applies to individuals with an illness)?
- **Currency:** When was the information published (e.g., it is not unusual for old photos to be used to mislead viewers about a claim)?
- **Sources:** Are there good references, and do well-qualified people agree with the claim or do they hold another view? *Note:* A past article in *Science Scope* describes media literacy at greater length and provides ideas for integrating media literacy in science classrooms (Sperry 2012).

Although some schools are helping students identify and resist false news, my colleagues and I are not aware of tested curriculum units specifically aimed at understanding and combating scientific misinformation. It seems appropriate to think of this deficit as an opportunity for the profession to be inventive. I hope readers and textbook publishers will develop and disseminate some excellent lessons and units aimed at combating misinformation.

Even if we do our best to teach students the facts about evolution, climate change, phony diet fads, or products that claim to raise babies’ IQs, some students still accept claims that scientists reject. For those students who do not accept scientists’ conclusions, teachers should keep in mind the National Science Teachers Association guidelines that state, “Science teachers … should be nonjudgmental about the personal beliefs of students” (NSTA 2013). Our job is to promote critical thinking and teach students what scientists have concluded and why. However, in the end, we cannot dictate what students believe.

**AUTHOR’S NOTE**
The author, a colleague, and PBS NOVA staff at WGBH created and tested a one-week science curriculum unit for grades 6–12 called “Resisting Scientific Misinformation.” Download the curriculum unit for free at [http://tumblehomebooks.org/services/resisting-scientific-misinformation](http://tumblehomebooks.org/services/resisting-scientific-misinformation).

**REFERENCES**


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