

Lessons About Climate Change Pose Many Challenges for Science Teachers

By [Sean Cavanagh](#)

Vanishing glaciers, rising sea levels, ravenous droughts. The natural world today offers a broad—and dire—catalog of scientific phenomena for teachers wanting to craft classroom lessons on the topic of climate change.

As public concern about global warming increases, teachers are carving out a larger place for those issues in science classes, particularly at the high school level.

Yet educators also say they face challenges in finding accurate and student-friendly classroom activities and lessons on the topic, partly because textbooks and other materials have not caught up to a growing body of scientific evidence about climate change.

Consequently, many science teachers are turning to Web sites and resources produced by scientific organizations. They're also sharing strategies at conferences and workshops and by word of mouth.

"The textbooks don't do a good job of it," said P. John Whitsett, the curriculum and instruction coordinator for the 7,600-student Fond du Lac, Wis., school district, who came up with his own lessons on climate change when he was a teacher. "Teachers are putting it together on their own, but that's not all bad. I encourage people to go beyond the textbook."

Teachers also face questions about how to present the science of climate change without being accused by students, parents, or administrators of harboring a political agenda.

Robert W. Penrose, a science teacher at United High School in Armagh, Pa., occasionally hears divisions about the causes and economic implications of climate change emerge in his environmental science and biology classes.

Some of his students are convinced that human activity is the driving factor causing global warming, and that stronger pollution controls are needed to cut greenhouse emissions.

Others are less convinced. Some students in the western Pennsylvania community have parents who earn a living in the coal industry—emissions from coal-fired power plants are a major source of greenhouse gases—and are wary of stronger government mandates.

Mr. Penrose, who is in his 15th year teaching, remembers first touching on climate-change issues in the 1990s, mostly among academically gifted students. He took one such group to attend a symposium on the emerging topic at a nearby college, about a decade ago.

“It probably wasn’t even in the top 10 of topics I would talk about then,” he recalled.

Film’s Influence

Students today often come to him with a solid grasp of the issue. Like many educators, Mr. Penrose attributes that heightened understanding partly to the influence of “An Inconvenient Truth,” former Vice President Al Gore’s documentary about global warming. He has shown the film—an Academy Award winner earlier this year—in his environmental-studies class, an elective for juniors and seniors.

Changing Classroom Climates



One curricular tool for middle and high school science teachers on climate change is offered by the Keystone Center, a Colorado nonprofit. Those lessons (www.keystonecurriculum.org) include experiments for use in biology, earth science, and physical science classes, over a four-week period.

Week 1: Give students various objects, such as sunscreen, insect repellent, and photos, and data, such as temperature records, and ask them to make scientifically based connections between them and what is known about climate change.

Week 2: To help students understand how greenhouse gases trap infrared heat radiated off the Earth, students can work with lamps and hair dryers to heat glass beakers and clothing to simulate changes in how different surfaces absorb heat.

Week 3: Ask students to find out where their school's electricity comes from and where their state's largest electric power plants are located. What kinds of energy do those plants use, and what are their advantages and disadvantages, in terms of availability and environmental consequences?

Week 4: Students can create biodiesel fuel in class through a chemical reaction, using materials such as plastic soda bottles, beakers, distilled water, vegetable oil, and methanol. They make observations about their experiment and the potential impact of biodiesel fuels on greenhouse emissions.

SOURCE: The Keystone Center; *Education Week*

Mr. Gore, along with the Intergovernmental Panel on Climate Change, recently earned the Nobel Peace Prize for his role in raising awareness of the issue.

In writing classroom lessons, Mr. Penrose has tapped the Web sites of the U.S. Environmental Protection Agency and other sources, as well as materials published by the National Science Teachers Association, of which he is a member. His approach to talking about climate change is similar to what he uses for other topics: Students must be able to back up their opinions and arguments with scientific evidence. He requires them to search for that information on their own.

Global warming occurs when greenhouse gases are emitted into the Earth's atmosphere, trapping solar heat and warming the planet's temperatures. While that process occurs naturally, the amount of carbon dioxide being released by burning fossil fuels and industry has risen over time, and is very likely a contributor to rising global temperatures, scientists say.

Those rising temperatures have caused ice sheets in Greenland and the Antarctic to melt and sea levels to rise, according to scientists, and they have coincided with more severe weather and more severe droughts, among other climatic changes. While those events are often called "global warming," scientists say "climate change" is a more accurate descriptor, because the trend can produce erratic, and in some cases colder, temperatures in some regions.

Mr. Penrose believes human activities are contributing to global warming, though he also thinks natural planetary warming cycles may be a factor. He said he takes care to avoid presenting personal views in classes, however.

“One of my biggest fears is that I’m going to create a whole group of students who think exactly like I do,” he said. “The kids need to be involved in finding information, [rather] than having teachers be the only people supplying it.”

Political Conflicts

Tensions over how to teach climate change emerged in the Federal Way, Wash., district earlier this year when some parents objected to a middle school teacher’s plan to show “An Inconvenient Truth” during a science lesson.

Officials in the 23,000-student district eventually said the film could be shown if the district’s policies were followed. Those policies require that school principals approve any movie to be shown in class, and mandate that potentially biased information be balanced with opposing views.

“I said, ‘You’re not going to show this propagandist film to my kids,’ ” said Frosty E. Hardison, a parent who raised objections. The film, he argues, presents Mr. Gore in an overly favorable light and his political opponents, such as President Bush, more harshly.

“Obviously, it’s political,” Mr. Hardison said of the film.

The National Science Teachers Association became immersed in another controversy involving the documentary last year, when it turned down a request by one of the producers to have the science group distribute 50,000 free copies of the film. The NSTA said doing so would have violated the organization’s policies against distributing materials promoting products or individuals. (["Critics Accuse NSTA of Having Conflict Over Film,"](#) Dec. 6, 2006.)

The film’s supporters, however, suggested that the NSTA’s position may have been influenced by donations it had received from oil and gas companies—a charge the group denied.

Despite the furor, Mr. Whitsett of the Fond du Lac district, who is the president of the 55,000-member NSTA, said he often recommends that science teachers use the film because of its plain-spoken and accurate presentation of climate change. "The science in it is fundamentally correct," he said.

Across the Disciplines

Information on climate change from more traditional resources, such as textbooks, is hard to find, educators and others say. Several recent editions of popular high school biology textbooks make little or no reference to the subject.

Textbook publisher Houghton Mifflin includes global warming in a subsection of a widely used 6th grade general science book, released in 2005, and textbooks for earlier grades discuss greenhouse gases more generally, said Joe Degnan, the editor of K-6 science for the Boston company.

The relatively limited treatment climate change receives in science textbooks today is due more to its scant treatment in state academic standards—the single largest influence on publishers—rather than any controversy associated with the topic, he said.

"Everyone's following the same sets of standards," Mr. Degnan said.

That absence is not surprising, according to several experts, who note that most school districts select new science textbooks every five to seven years, and that public understanding and scientific consensus about climate change were not as firm a decade ago.

Various organizations, meanwhile, have sought to provide teachers with their own resources. The Washington-based American Association for the Advancement of Science, for instance, has offered a free guide, "Communicating and Learning About Climate Change," that explains how global warming connects to other areas of study, from energy to technology to earth science. The AAAS also staged a Climate Change Town Hall, an event that drew an estimated 1,000 educators, at its annual meeting earlier this year in San Francisco.

The National Center for Atmospheric Research, a federally financed research organization in Boulder, Colo., has offered online information on climate change and workshops for teachers for years. Last year, it produced a six-week online course for middle and high school teachers on the topic.

One enrollee was Dave Swartz, who teaches physical science and Advanced Placement environmental science at Rocky Mountain High School in Fort Collins, Colo.

Although Mr. Swartz had an interest in climate change before taking the online courses, the program helped him see the potential for using the topic across disciplines, such as biology and chemistry. He has brought up climate change in his units on hydrology, because of global warming's potential effect on precipitation and water supplies in the arid West.

He has also asked students to take part in classroom games, in which they roll dice and examine the nitrogen cycle and the carbon cycle, to explain the various characteristics of those elements and how they behave in nature and the atmosphere.

"You don't have to present it as an overarching topic," Mr. Swartz said. Climate change "connects the sciences. It doesn't have to be in any one science."