When Politics Enters the Classroom: Teaching Climate Change in Schools

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When Politics Enters the Classroom: Teaching Climate Change in Schools

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I. Climate Change and the New Science Standards


From the coal mines to the classroom, climate science is a divisive topic.

The now-famous comment above from President Donald Trump buttressed his June 2017 decision to exit the Paris Agreement, an international initiative designed to tackle global warming. President Trump cited economic reasons for his decision to withdraw as he forecast a drop in production for certain sectors of the economy if the U.S. remained in the agreement: “paper, down 12 percent; cement, down 23 percent; iron and steel, down 38 percent; coal, and I happen to love the coal miners, down 86 percent; natural gas, down 31 percent,” he said.

In addition to the president, other political and business leaders, such as Environmental Protection Agency Administrator Scott Pruitt, have dismissed the importance of climate science. Yet, aside from some criticisms, the overwhelming majority of climate scientists believe the earth’s rising temperature is predominantly created by human activity.

In light of the current political debate over economics versus the environment, as well as skepticism of scientific research, how should public schools go about teaching climate change? What should school board members and other school leaders know about this critical, yet politically-charged, topic?

The need to address these questions has grown more pressing with the inclusion of climate change in the national Next Generation Science Standards. These standards are being rolled out in several states. In New York, initial transition to the new P-12 Science Learning Standards (based, in part, on the Next Generation Science Standards) starts in 2017. New York State science standards clearly deal with climate change and the contribution of human activities to global warming.

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For example, a snapshot of one state learning standard, MS-ESS3-5 (see Fig.1) helps illustrate the goal of the standard in relation to climate change and how students can meet that goal.6

The role of humans in climate change is outlined in the MS-ESS3-5 science standard. Additionally, in the national Next Generation Science Standards, concepts like sea-level rise - a result of climate change - can be addressed in multiple standards across the K-12 grades. While standards at the middle or high school level may more directly state their relationship to climate change, elementary grade-level standards may address climate change in more indirect ways.7

With these standards as a guideline for educators, the question is not whether to address climate change in the curriculum, but how best to do so. As stated earlier, while some have criticized a widely reported study that claims 97 percent of climate scientists think the earth’s rising temperature is predominantly caused by humans, research does show that most climate scientists believe this to be true.8 Yet, data from a national survey of 1,500 science teachers shows that nearly 33 percent teach that climate change occurs due to natural, not human-made, occurrences in nature. “Conservative political identity was the strongest indicator that a teacher would suggest that climate change may be rooted in natural rather than human causes,” the study found. Moreover, scientific knowledge about climate change doesn’t necessarily sway teachers to teach that climate change is man-made, according to the author of the study, because teachers may feel pressured to appease members of their community.9 While this may be a reason teachers don’t cite human contributions to climate change, only about 4 percent of teachers who answered the survey said they experienced such pressure.10

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Fig. 1 MS-ESS3-5

A student may show understanding of the following science standard via the examples listed below.

MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

**FACTORS**

- Natural Processes
- Human Activities
- Volcanic Activity
- Combustion of Fossil Fuels

**EVIDENCE**

- CO2 Levels/Human Activities
- Graphs of Global Temperatures

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7 Ibid.


Climate change, according to NASA, “is a change in the typical or average weather of a region or city.” Unusual rainfall amounts or pronounced seasonal temperature changes classify as climate change, according to this definition, which also includes variations in the Earth’s temperature, of which “an increase of 1 or more Celsius degrees in a period of one hundred to two hundred years would be considered global warming.”

Natural causes like our planet’s orbital changes or variations in the sun’s energy contribute to climate change, notes NASA, but scientists say man-made causes like “the burning of coal, oil and gas” contribute more heavily to the increase of the Earth’s temperature because “heat-trapping gases such as carbon dioxide” are released. Other heat-trapping gases are nitrous oxide (which is in nitrogen fertilizer) as well as methane, which is in natural gas but can also be generated by humans through coal extraction and the breakdown of trash in landfills. Once these heat-trapping gases are released into the air, they absorb the sun’s energy as this energy heads back to space. These gases then give off heat, which contributes to the warming of the planet. This process, known as the greenhouse effect, is actually beneficial because it regulates the Earth’s temperature to keep it warmer than the atmosphere. If the greenhouse effect did not happen, the Earth would not be able to retain heat and would mimic Mars, note scientists.

However, while the greenhouse effect is an organic process that occurs normally, scientists say that the industrial revolution kick-started the man-made proliferation of larger amounts of heat-trapping gases like carbon dioxide, nitrous oxide, and methane into the sky. In fact, the Intergovernmental Panel on Climate Change (IPCC), a global entity tasked with reviewing updates about climate change (http://www.ipcc.ch/), noted the jump in carbon dioxide levels in the air in 2005 compared to before the industrial revolution: “the pre-industrial amount of CO₂ in the Earth’s atmosphere was about 280 parts per million (ppm), meaning that for every million molecules of dry air, 280 of them were CO₂. In contrast, 2005 levels of CO₂ were measured at 379 ppm.”

So, what will happen when the earth’s temperature gradually increases due to the release of high levels of heat-trapping gases? In areas of the world that experience four seasons, there would be more rain. In less moderate climates, there would be hotter temperatures with less rain, which would likely result in droughts. According to research, these major differences in precipitation can have many consequences, including negatively affecting crop production and, therefore, costing billions in lost revenue. In addition, climate change can also be detrimental to animals if they are accustomed to a certain climate and that climate eventually changes. They may perish due to this change, which can disrupt the food chain.

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5 Ibid
6 Ibid
7 Ibid: p. 8.
8 Ibid
II. Teaching Climate Change: When Politics, Economics and Ideology Collide

Why is political identity so closely tied to one’s approach to teaching climate change? (see Sidebar #2). The likely answer is that climate science education marks a point at which economics, politics and ideology converge. Understanding this requires some background knowledge of recent political and economic developments surrounding climate change. For example, the 2010 Supreme Court Citizens United case had a profound effect on the politics of climate change and in fortifying ideological positions on the issue. The ruling reversed a ban on the authority of corporations to finance advertisements and similar communications (not contributions) to support or refute political candidates.11

In the aftermath of this ruling, “No piece of carbon dioxide regulation legislation has managed to get a single Republican co-sponsor in the Senate,” according to Sen. Sheldon Whitehouse (D-RI). That’s significant because with spending on political ads now unfettered, Whitehouse believes many lawmakers, especially moderate Republicans, fear political attacks from companies in the coal and oil businesses.12

One such organization is Koch Industries,13 a corporation with $100 billion in annual revenues that operates oil refineries in Texas and supplies natural gas. The organization is the second largest private company in the United States, according to Forbes’ 2016 annual ranking of America’s largest private companies.14 This family-owned giant in the fossil fuel industry earned the nickname “the Kingpins of Climate Denial” from Greenpeace,15 and according to a 2013 Drexel University study, from 2003-2007 was a major player, along with the ExxonMobil Foundation, in publicly financing efforts to deny climate change.16 Democrats also have heavy-hitters in their camp when it comes to climate change. One is Thomas F. Steyer, a wealthy environmentalist who heads up NextGen Climate, a political advocacy organization that focuses on “electing climate-friendly lawmakers.” The group spent no-less-than $25 million on a millennial voting campaign in 2016, since millennials, according to Steyer, really care about climate change.17

(continued on page 6)

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13 Ibid.
If climate change is a scientifically-based concept, then why is there so much controversy about it? Politics and economics are two primary reasons why climate change is considered such a hot topic, according to research.

The title of a 2016 Pew Research Center article, “The Politics of Climate,” based on the Center’s 2016 survey assessing the views of 1,534 U.S. individuals on climate change, sums up most of the reason for the controversy. According to the survey’s findings, political affiliation is a factor in how people rationalize climate change and the work of climate scientists.¹

The crux of the controversy that surrounds climate change, according to the Center, isn’t about if it’s happening at all or if people are contributing to the problem. One of the main drivers of the controversy is political affiliation. People at either end of the political spectrum – conservative Republicans or liberal Democrats – in general, have the most divergent views about climate science research and the motivations of climate scientists, according to the survey’s findings. For example, more than one-half of liberal Democrats surveyed think climate research is based on the most credible existing research “most of the time” compared to less than 10 percent of conservative Republicans. In addition, conservative Republicans are more skeptical of the intentions of climate scientists compared to liberal Democrats. More than one-half of conservative Republicans surveyed think “most of the time” climate science research results are affected by the researchers’ intent on furthering their careers (57 percent) or the researcher’s political affiliations (54 percent).²

In a 2015 Washington Post article, Andrew Hoffman (author of the book, How Culture Shapes the Climate Change Debate), explained that a lot of the impasse between climate change believers and deniers is “over culture, worldviews and ideology.”³ And, switching entrenched worldviews is not an easy or quick psychological process.⁴

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² Ibid: p.39
This use of corporate money to attack or support political candidates and issues provides much of the political backdrop for instruction on climate science in U.S. schools.

### Money’s Influence in the Classroom

Organizations with significant financial resources can influence scientific research about climate change, which, in turn, can influence education on the topic. For example, Wei-Hock Soon, a solar physicist and Harvard researcher, is unconvinced about man’s contribution to climate change and is hailed as a “high priest” in climate change denial circles, according to The Washington Post. Soon is backed to the tune of approximately $1.2 million by conservative oil companies like ExxonMobil and the American Petroleum Institute, as well as the Koch Foundation. In addition, the Heartland Institute (https://heartland.org), a libertarian research organization that challenges man's role in climate change, awarded Soon the “Courage in Defense of Science Award.”

Soon’s skepticism is reflected in his recent efforts to influence climate education. The Heartland Institute recently mailed science teachers across the nation a book entitled Why Scientists Disagree about Global Warming that serves its skeptical agenda. The organization aims to get the book into the hands of all U.S. K-12 science educators – more than 200,000 teachers. While that may be the Institute’s goal, the National Center for Science Education, a nonprofit organization that focuses on raising public awareness about climate change, notes that approximately 75 percent of the educators who have posted on social media about the mailing have ignored the book. Some teachers even intend to develop the mailing into a lesson about “vetting resources.”

### Legislative Action

Politicians can influence how climate change is taught in schools through legislation known as “academic freedom bills.” These bills promote the teaching of scientific concepts as two-sided issues rather than as fact. Oklahoma, South Dakota and Texas are among the states that introduced such bills in 2017. Some of these bills skirt the topics of both climate change and evolution in their exact language but, nonetheless, are intended to discredit the scientific basis of such topics by promoting teaching methods that address multiple perspectives on these topics, notes The Washington Post.

With the rollout of the Next Generation Science Standards, Idaho became the first state that took the topic of climate change out of its science standards through legislative action. As of the spring of 2017, six other states attempted to “roll back similar standards” through legislation while two states – Texas and West Virginia – accomplished this rollback through their state education departments, not the legislature.

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Lack of Adequate Preparation for Teachers

In order to help their students meet the new science standards, teachers and school leaders should possess a solid understanding of the history and context of climate change denial and the general scientific consensus about humans’ role in climate change. Yet, due to insufficient coursework in teacher preparation programs and a lack of updated textbook content on climate change, teachers may lack sufficient understanding of the topic and, therefore, may not be equipped to teach climate change accurately.24

Moreover, a 2017 University of Missouri study that examined climate change misunderstandings among 220 high school science educators in Florida and Puerto Rico found that practically all of the participants from Puerto Rico and more than 70 percent of the Florida participants falsely believed that occurrences such as the reduction of the ozone layer cause climate change. These findings point to a need for professional development about climate change.25

Professional Development and Resources for Teaching Climate Change

Teaching about climate change requires a solid grasp of the material. While climate change is an interdisciplinary topic that can and should be addressed in a variety of courses, earth science courses are the logical primary forums for instruction about climate change. Only a small percentage of U.S. students (11 percent) have earth science teachers who are qualified to teach climate change, however.26

New York is an exemplar of strong earth and space science (ESS) teacher certification requirements, since certified educators must complete a minimum of 30 hours of coursework in that specific discipline, plus the same number of hours in general science coursework. Other states aren’t so rigorous in their requirements. In some states, teacher candidates can take minimal coursework in ESS to earn certification in a general science field. One way to ensure consistent teacher quality for ESS across the nation is to make the coursework and certification process more demanding.27

In addition, until recently, climate science coursework wasn’t a necessity for teacher candidates in biology.28

Eric Plutzer, a professor of political science at Pennsylvania State University who worked on a national climate change survey of 1,500 science teachers, believes a three-pronged approach is needed for both teacher preparation and student learning about climate change:

1. Update teacher education coursework for science teacher candidates to reflect contemporary climate change research;
2. Establish state and local climate change learning objectives for students; and
3. Offer teachers professional development about the subject of climate change and how to teach it effectively.29
Professional development should include specific references to human (“anthropogenic”) contributions to climate change and to educators’ “political ideologies and worldviews,” according to a 2016 study of how teacher perspectives about climate change affect their students’ learning about the subject. The study found that what matters most for students learning about climate change is that their teachers think it is occurring (whether or not they agree it is human-caused) and that students have accurate data on the topic.30

To compensate for the lag in teacher preparation and possibly politicized views of educators, school districts should be aware of the myriad resources on climate change. The National Aeronautics and Space Administration (NASA) and National Oceanic and Atmospheric Administration (NOAA) both provide online information that often lines up with Next Generation Science Standards.31 Professional development resources for teachers on climate change include a program from the National Center for Science Education that matches teachers with climate scientists in their communities (https://ncse.com/scientistinclassroom). Through this process, scientists visit classrooms to help teachers educate their students.32

Dartmouth College offers free online teaching courses to K-12 educators about climate change.33 Dartmouth also offers a one-day workshop each year on regional polar science for high school educators who collaborate with Dartmouth graduates on polar science curriculum.34 The American Museum of Natural History provides an online professional development course for teachers on climate change (http://www.amnh.org/learn-teach/seminars-on-science/courses/climate-change), and the National Science Teachers Association also provides online climate science materials.35

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32 Ibid.

33 Ibid.


For educators, teaching climate change effectively is equally as important as knowing the specifics about climate change. Climate change is a sensitive topic, so it's best to heed a few effective pedagogical practices, which include fostering critical thinking skills in students, letting students make sense of climate change via scientific findings, and helping students “tolerate alternative opinions.”

The National Center for Science Education offers four effective strategies for teaching climate change:

1. Discuss how climate change affects the local community by analyzing local forecasts;
2. Bring out the humanity in studying climate science by introducing stories of scientists in action on climate science projects;
3. Teach climate change in an interdisciplinary way via teacher collaboration; and
4. Teach climate change in terms of problem/solution while avoiding personal preferences, so students can objectively understand that they can have an influence on a seemingly insurmountable problem.

If students don’t believe they can curtail climate change, they can feel helpless; therefore, empowering students to take action that can reduce the effects of climate change is important. Also, educators should keep politics out of the classroom and teach climate change from an objective, facts-based position.

A classroom lesson on ocean acidification can include a simple demonstration that requires students to blow into a bottle of water and use a pH strip to assess pre- and post-acidity differences based on the release of carbon dioxide.

Two additional ways students can learn about climate change are playing with models and analyzing data. These kinds of learning methods are best delivered through digital formats, since textbooks can’t provide the needed real-time updates that a dynamic topic like climate change demands. For example, NASA’s Global Climate Change website (https://climate.nasa.gov/) provides digital resources on the topic for students in grades 6-12. For younger students (grades 3-6), NASA has a more developmentally appropriate website about climate change that is accessible from the main Global Climate Change website.

Stanford University also has interactive resources for students to learn about climate change. One online activity, the International Student Carbon Footprint Challenge (http://footprint.stanford.edu), tracks students’ daily activities like traveling and eating that contribute to the release of carbon dioxide. Students can then compare their carbon footprints to their global peers’ carbon footprints.

For younger students (grades 3-6), NASA has a more developmentally appropriate website about climate change that is accessible from the main Global Climate Change website. For example:

- A recent Reddit (unscientific) analysis of a discussion of 66 ex-climate deniers who became believers in climate change found that almost one-half of the respondents to the discussion thread cited science as the reason for their decision. The three other most popular reasons cited for changing one’s mind about climate science, in respective order, were stewardship (it’s cool to care about Mother Earth); weird weather patterns; and, mistrust of climate deniers. Kirk, Karen. Changing Minds on a Changing Climate. Yale Climate Connections. April 4, 2017. https://www.yaleclimateconnections.org/2017/04/changing-minds-on-a-changing-climate/.
IV. Climate Change Instruction: Students in Motion

Learning about science and applying that knowledge are two different things, and both are important when studying climate change. Katie O'Reilly Morgan, youth climate program coordinator at The Wild Center, a natural history center in Tupper Lake that offers programming about climate change, notes the importance of applying climate change knowledge at the local level. According to Morgan, the climate change programs offered at the center are dedicated to “student[s] acting on climate change,” not just knowing about it.43

For example, the center offers a two-day Adirondack Youth Climate Summit for teams of four-to-five students with a facilities manager or other adult supervisor like a superintendent. Participants from 30 high schools and colleges attend. On day one of the summit, there are workshops with speakers like organic farmers and environmental hip-hop artists who help students with message creation for their environmental clubs. On day two, students complete a climate action plan to implement that year in their schools (see http://webassets.wildcenter.org/sites/default/files/Climate%20Action%20Plan%202015%20correct.pdf). The design of this summit, according to Morgan, is intended to provide students with a hands-on workshop accompanied by a “tangible” skill or idea for a school-based initiative. Morgan assists and acts as a liaison for students and school staff with external organizations and identifies grant funding for climate change projects.44

In August 2017, the Wild Center hosted an Adirondack Youth Climate Leadership Retreat to provide professional development to both teachers and students. Teachers “need to learn how to be facilitators” when it comes to the topic of climate change, says Morgan. They shouldn’t be passive facilitators, nor should they (at the other extreme) push their opinions on their students.45

The Wild Center has created a toolkit for school districts that want to develop their own summit with Morgan as a consultant (see http://www.wildcenter.org/youth-climate-summit-toolkit/). The Ballston Spa Central School District used the toolkit, with assistance from the center, to develop a Youth Climate Summit in the greater Capital Region in May 2017. Judy Selig, a biology and chemistry teacher in the high school, helped spearhead the effort after a student trip to The Wild Center in 2015.46 According to Selig, the summit yielded a climate action plan for reducing

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44 Ibid.
45 Ibid.
food and solid waste in Ballston Spa High School’s cafeteria. Students calculated the degree of solid waste for a baseline. They then created a “cart” to hold bins for such items as recyclables and compost. Lunchtime volunteers will motivate students to throw out waste in “a green-friendly” way.47

In addition to climate action plans, students can put their knowledge of climate change into action by talking to their school boards. Saranac Lake high school students did just that by presenting a cost-benefit analysis of solar energy to the Saranac Lake School District Board of Education. Solar energy is climate-friendly because it emits less carbon than natural gas and other energy sources.48 According to the students’ calculations (see Fig. 3), the estimated cost savings of using solar energy in the district would be a little more than $54,000 per year, according to their presentation – money that the students note could be used toward “sports and better education.”

Fig. 3

A snapshot of the student solar energy presentation to the Saranac Lake Board of Education

Benefits of having Solar Energy at this High School

- Annual savings would be 54,289.30
- Monthly savings would be 4,524.11
- Our electric bill would go way down!
- We would have more money to use for sports and better education
- If a power outage happens, we will not be affected.

Saranac Lake Environmental Club students worked to get several solar installations in the local community.

V. Next Steps

The Next Generation Science Standards offer a foundation for student understanding of climate change. Within this report, NYSSBA has presented an analysis of the politics and practicalities of teaching climate change in school, including ways to view the sociocultural, economic and political context surrounding the topic; effective communication strategies and pedagogical tools for instruction; and considerations for school boards regarding the professional development needs of educators.

Finally, NYSSBA offers the following proposed takeaways for school board members and school district personnel:

Learning about climate change is great. Acting on it is even better.

Students should learn about climate change, then put their knowledge into action to effect local change.

Don’t politicize, just present.

The data, that is, in the classroom.

Go digital.

The best resources are those that are frequently updated.

Prioritize professional development for teachers (and students).

Educators need content and pedagogical knowledge. Professional development should also provide educators a space to gain awareness of their belief systems. Students, through use of climate action plans and assistance from partnerships like The Wild Center, may not only develop skills for college and career readiness, but, they can help prepare our world for generations to come.

Ready to Teach The Next Generation Science Standards?