

Textbooks inaccurately present science on climate change as uncertain and doubtful, research shows

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Middle school students learn about climate change largely through textbooks, which may be misrepresenting the science behind the phenomenon, new Stanford research shows.

Major California science textbooks may be misrepresenting the science behind climate change as much weaker than it actually is, new Stanford research shows.

In doing so, the textbooks more closely reflect the public debate about [climate change](#) rather than the scientific reality, according to the paper, which was published in the Environmental Education Research journal.

"We found that through language choices, the text portrayed climate change as uncertain along several lines, such as whether climate change was happening, whether humans were causing it and what the effects will be," said K.C. Busch, a doctoral candidate in [science education](#) at Stanford Graduate School of Education.

Busch is co-author of the article with Diego Román, assistant professor of education at Southern Methodist University, Dallas.

Classroom influence

Middle school students learn about climate change in large part through textbooks used in their classes, Busch and Román wrote. And what they learn during those formative years does matter, they wrote, noting a recent poll found that only 54 percent of American teens believe that climate change is actually happening, and 43 percent do not believe that it is caused by humans.

"What might be the sources of this erroneous belief among American youth? Some answers may be found in the students' classrooms," they wrote.

Their study measured how four sixth-grade [science](#) textbooks commonly used in California, which were published nearly 10 years ago, present the subject of climate change. The works studied were *Focus on Earth*

Science (Prentice Hall, 2008), *Focus on Earth Science* (Glencoe-McGraw-Hill, 2007), *Focus on Earth Science* (CPO Science, 2007) and *Earth Science* (Holt, Rinehart & Winston, 2007).

Under California state standards, sixth grade is the first time that students learn about climate change in their formal science curriculum, the researchers said.

'Uncertain' climate change

In their research, Busch and Román analyzed each textbook's section about climate change, comprising 279 clauses that contained 2,770 words. They found that the message communicated in the textbooks was that climate change might be happening and that humankind may or may not be causing it. Those works were unclear about the need for a human response and action against the threat of climate change, Busch and Román said.

In an interview, Busch said that science textbooks typically read as an encyclopedia or a book of facts.

"This authoritative stance is accomplished through the use of declarative sentences, which read primarily as definitions. However, in the section on climate change, modal verbs like could, might or may appear," she said. "In addition, indeterminate quantifiers are added such as not all or some to statements about scientists. This changes the interpretation and introduces uncertainty."

An example of a textbook passage from *Focus on Earth Science* (Prentice Hall) is: "Not all scientists agree about the causes of global warming. Some scientists think that the 0.7 Celsius degree rise in global temperatures over the past 120 years may be due in part to natural variations in climate."

In another instance, the textbook Earth Science noted, "Until recently, climatic changes were connected only to natural causes. However, studies indicate that human activities may have an influence on climate change."

In another example, Focus on Earth Science (Prentice Hall) offered this scenario: "Global warming could have some positive effects. Farmers in some areas that are now cool could plant two crops a year instead of one. Places that are too cold for farming today could become farmland. However, many effects of global warming are likely to be less positive."

Also, scientists were portrayed as not doing the work of science – such as observing, measuring or analyzing – but rather as thinking and believing something about it, Busch added.

"While scientists do think and believe, these words have different connotations in everyday language, which can be interpreted as uncertain or 'just a hunch,'" she said.

As Busch and Román wrote, when the negative effects of climate change are described in the book, the effects are not called "negative" but "less positive."

Such a view on climate change, they argued, could reduce the sense of urgency for students to do something about it. In fact, they wrote, young people may start believing that this is a "phenomenon that is beneficial to human beings."

Busch said, "While uncertainty is inherent in science, in this case, the text is not scientifically accurate."

Human influence and politics

As Busch and Román noted, research shows that less than 3 percent of scientists who are experts in climate analysis disagree about the causes of climate change.

For example, their study cited a 2013 report from the U.N. Intergovernmental Panel on Climate Change backed by 600 climate researchers in 32 countries, which stated that "human influence on the climate system is clear," as evident from the increasing greenhouse gas concentrations in the atmosphere and warming trends, among other dynamics.

Sometimes textbook publishers may try too hard to strike a balance on some issues, Busch pointed out.

"I think the textbook adoption process is one that is social and political. I imagine that textbook publishers have to 'toe the line' in order to both meet the state science standards and have their book be palatable to a wide range of political ideologies," she said.

Busch acknowledges that climate change is a controversial political issue in the United States.

"With that said, however, the science in the science textbook should be accurate. There can be societal debate as to what we should do about climate change, but continuing to portray a scientific debate is dishonest," she said.

Purpose of science education

Busch has worked in science education for more than 20 years. "I always saw my role as helping students see how science was relevant to their everyday lives," she said.

Busch believes science education has multiple goals, such as strengthening the global economic position of the United States, creating the next generation of scientists and inventors, and cultivating a scientifically literate citizenry.

"The point here is that being misinformed about climate change serves as an impediment for us to achieve any of these goals," Busch said.

Provided by Stanford University

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