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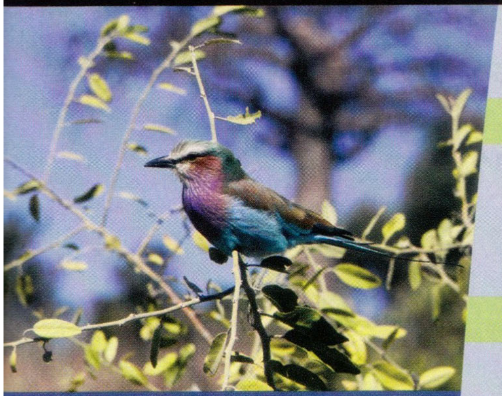

About Our Cover

The primary rationale we apply when selecting a cover photo for *The American Biology Teacher* is that it offers a small teachable moment. However, that goal was secondary this month, in favor of this image of a visually striking but very common African bird, the lilac-breasted roller (*Coracias caudatus*). These are Old World birds in the family Coraciidae, a name derived from the Latin for "raven-like." The name "roller" refers to their aerial acrobatics. The genus *Coracias* is widely found in sub-Saharan Africa. This individual was photographed in Chobe National Park, in northern Botswana, with a majestic baobab tree (*Adansonia* sp.) in soft focus in the background.

These birds are typically about 37 cm in length, with wing spans of about 55 cm. They eat a variety of creatures, primarily insects but also other arthropods, small vertebrates such as rodents, and even other birds. They prefer open areas of savanna and woodland, where they survey possible food sources from high perches. They are solitary nesters, typically in natural holes in trees. They are monogamous, with clutches of two to four eggs that are incubated by both parents. They defend the nest aggressively with swooping behaviors and their namesake rolling to distract predators. They exhibit few distinctions between the sexes in form and behavior.

This digital image was recorded with a Nikon D850 camera using a 28–300 mm image-stabilized zoom lens. The photographer is William F. McComas, editor of the *American Biology Teacher* and Parks Family Professor of Science Education and director of the Project to Advance Science Education at the University of Arkansas (mccomas@uark.edu).

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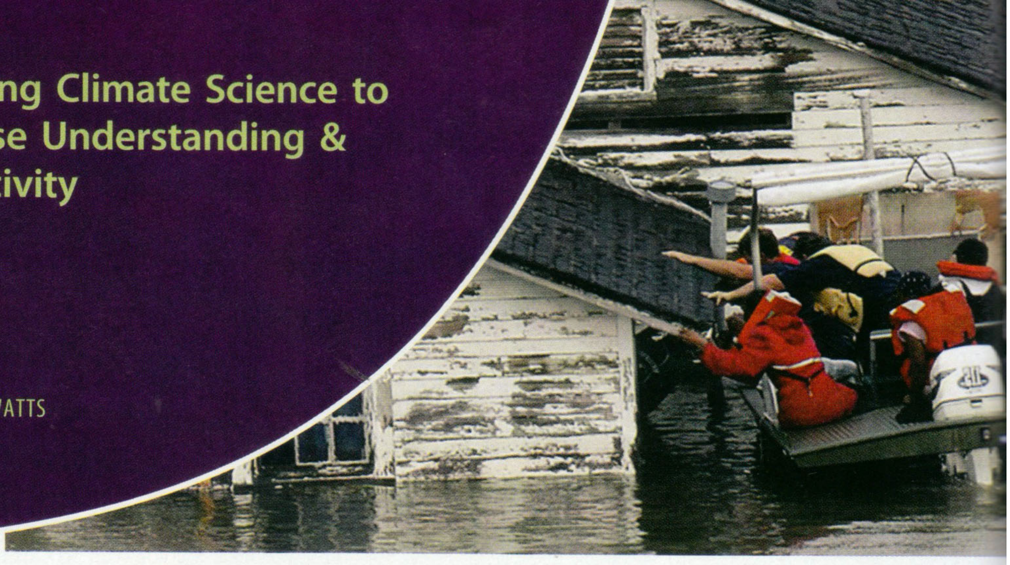
In our April 2019 issue, we incorrectly spelled Carolina Biological Supply Company in our Buyers' Guide Listing Information. We apologize for this error.

FEATURE ARTICLE

Teaching Climate Science to Increase Understanding & Receptivity



ELIZABETH WATTS

Abstract

Only about half of Americans are convinced that human activity is the major cause of climate change. This statistic highlights the increased need for high-quality climate science education but also highlights the fact that lessons on this subject are often complicated as denial argumentation abounds in classrooms. In order to achieve greater efficacy of and receptivity to climate science instruction, I propose the inclusion of lessons on the nature of science and the reframing of lessons in terms of risk management.

Key Words: *Climate change; education; belief persistence; risk management; nature of science; inquiry teaching.*

○ Climate Change Denial

The global consensus regarding anthropogenic climate change and the necessity to act was highlighted in 2016 as nations all over the world ratified the Paris Agreement (United Nations, 2016). Despite the consensus within the global community of scientists and politicians regarding the need for immediate action to ameliorate the situation, President Donald Trump announced last year that the United States will be pulling out of the agreement in an attempt to renegotiate the terms. Trump's announcement, which was met with applause by the small crowd gathered on the White House lawn, reflects the fact that <50% of Americans believe that climate change is caused by human activities, as shown in a 2016 Pew research report (Funk & Kennedy, 2016). Further results from this poll also highlighted the political nature of climate change opinions and how party identification is one of the strongest predictors of individual views regarding climate change (Funk & Kennedy, 2016). While >30% of Americans claim that they are greatly concerned about climate change, 72% of those individuals are Democrats and 24% are Republicans (Funk & Kennedy, 2016). These results reflect a similar gap found in a previous study conducted from 2006 to 2015 (Schlossberg, 2016), causing Hamilton (2010) to go as far to say that climate change has become so polarized in recent years that climate change has been recast as a political wedge.

While this lack of acceptance regarding Americans' recognition of anthropogenic climate change is alarming, even more so is the finding of a recent study published in *Nature Climate Change* that ~40% of adults worldwide have never even heard of climate change (Lee et al., 2015). In general, this study found a striking difference between developed and developing countries, with 90% public awareness of climate change in North America, Europe, and Japan and only 35% in developing countries such as Egypt, Bangladesh, and India. By examining data from >100 countries, Lee et al. (2015) found that the greatest predictors of public awareness of climate change in the United States are a person's educational level, civic engagement, and access to communication. Yet it is a well-known fact that awareness does not necessarily translate into concern or action.

> *"It is clear that convincing the general public to become actively involved in the decarbonization of our economies is not a simple task."*

A 2007–2008 Gallup poll focused on three aspects of climate change opinion – awareness, responsibility, and threat perception – found that the United States was one of the top five countries in terms of awareness, with an estimated 97% of Americans responding that they knew either "something" or "a great deal" about climate change (Pelham, 2009).

More recent studies based on opinion polls from 2008 and 2016 show that 70% of Americans not only recognize that climate change is occurring but believe that it will cause harm to future generations. These studies also show that a large majority of Americans (82%) support increased research into renewable sources of energy and that 69% are in favor of setting

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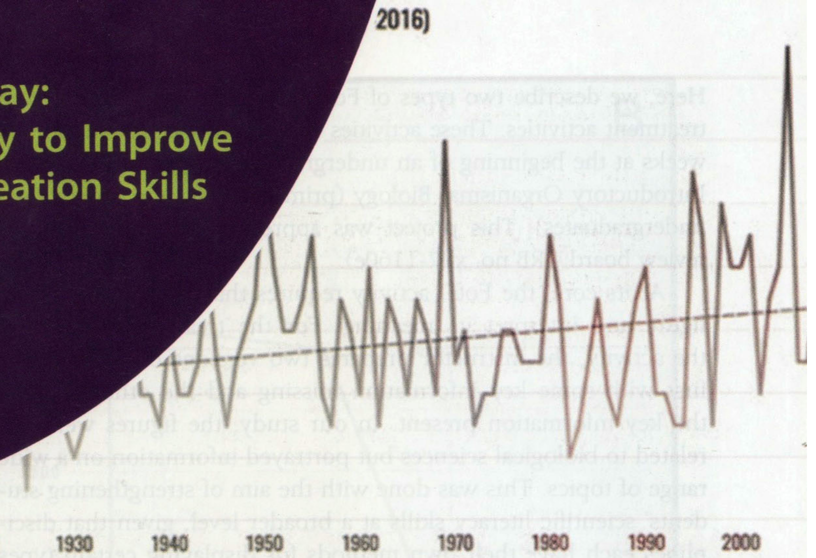
RESEARCH ON LEARNING

The Figure of the Day: A Classroom Activity to Improve Students' Figure Creation Skills in Biology

CAITLIN K. KIRBY, ARIETTA FLEMING-DAVIES, PETER J. T. WHITE



Abstract

Creating and interpreting visual displays of data is an important component of quantitative and scientific literacy. We examined a figure-analysis activity called "Figure of the Day" (FotD) and its impact on undergraduate biology students' figure creation skills. The treatment FotD activity required that students interpret a figure with some contextual information missing (e.g., titles, labels, legends). The control FotD activity required that students interpret a figure with no missing contextual information. Students in both the treatment and control groups made significant gains in their figure creation abilities. Bootstrapping of the Wilcoxon signed-rank effect sizes, r, shows large effect sizes for both the treatment ($r \pm SE = 0.708 \pm 0.034$) and control ($r \pm SE = 0.688 \pm 0.0395$) activities. Students most often reported that the activity's positive aspects were increases in their figure interpretation and creation skills. Commonly reported negative aspects of the activity were that it took too much time and the figures were confusing. Students in the treatment group more often reported that the activity was enjoyable. This suggests that regular interaction with figures in the style of the FotD activity can improve students' figure creation skills in a meaningful and enjoyable way.

Key Words: *Undergraduate coursework; graph interpretation; graph creation; scientific literacy; quantitative literacy.*

Introduction

Many undergraduate science courses aim to improve students' quantitative and scientific literacy, which are skills in which students utilize mathematical thinking and scientific understanding to make decisions related to real-world situations (Steen, 2004; Bray Speth et al., 2010; Gormally et al., 2012). In particular, students must call upon both quantitative and scientific literacy in order to analyze, interpret, and create graphs and figures (Shah & Hoeffner, 2002; Bray Speth et al., 2010). Biology courses and textbooks frequently use figures and other visual representations of data, biological concepts, and processes in an effort to aid student learning (Shah & Hoeffner, 2002). Graphs and figures have a high cognitive load for students because they require students to think deeply and analyze the visual representation of data to determine the quantitative relationships between variables (Bowen et al., 1999; Offerdahl et al., 2017). Creating graphs and figures is also a challenging activity for students. Choosing the correct type of figure to display data, scaling the graph axes, and including accurate titles, labels, and legends are skills that college science students often lack (McFarland, 2010). Mastering these skills to be able to communicate clear representations of visual data is a key ability for future scientists (Glazer, 2011).

Biology course instructors should be scaffolding students' interactions with graphs and figures (Offerdahl et al., 2017). Improving students' ability to link visual displays of information with biological concepts and processes requires practice interacting with figures and graphs. That practice can take many forms. Pedagogical approaches that lead students through the process of scientific inquiry are often promoted as important components of developing scientific literacy (Wood, 2003; Glazer, 2011). Inquiry-style activities require students to ask and refine questions, utilize background information, and make and communicate conclusions (Glazer, 2011). Providing students with inquiry-style opportunities to practice figure interpretation and creation skills may thus bolster scientific and quantitative literacy.

Here, we describe an inquiry-style intervention in which undergraduate biology students engage in a challenging and puzzle-like figure-interpretation activity called "Figure of the Day" (FotD). This activity responds to the need to provide activities focusing on visual data that scaffold students' learning, involve active inquiry, and incorporate higher levels of thinking than memorization. We report on the outcome of the activity for students' figure creation skills and their perceptions of the activity.

Methods

We implemented the FotD activity as part of a pilot research study to examine its efficacy in improving students' figure creation skills.

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strict CO_2 emission limits for coal-fired power plants (Leiserowitz et al., 2017b).

So, while Americans may be ahead of many countries in their awareness of and concern about climate change, they still lag behind regarding the recognition of human responsibility for climate change. Pelham (2009) writes: "Despite the fact that the U.S. ranks third in overall awareness of global warming – at 97% – only 49% of this 97% say they think rising temperatures are a result of human activities." This is a crucial point, because recognizing our role in climate change is the first step to recognizing our ability to mitigate climate change through carbon-reducing policies.

○ The Role of Education

The data cited above tell us that education and communication have been effective in creating general public awareness about climate change, but there is still a large gap between citizens being aware of climate change and recognizing our ability to mitigate climate change. Bridging this gap is no easy feat and will require ingenuity in education and science communication.

It is clear that convincing the general public to become actively involved in the decarbonization of our economies is not a simple task. According to economist John List, Kenneth C. Griffin Distinguished Service Professor of Economics and chairman of the Department of Economics at the University of Chicago, the problem lies in perception of the immediate costs of mitigation, combined with the fact that the projected benefits are not scheduled to occur for 50–200 years (Dubner, 2014). The general presentation of data makes it difficult to convince a population to make these perceived economic sacrifices for an environmental trade-off that they may not experience in their own lifetime. Sadly, it appears that the general public does not yet realize that we are already paying for disturbances related to climate change. (For information on the economic impact of climate change in the United States, see sidebar: "Who is really paying for climate disturbances?")

Who is really paying for climate disturbances?

Excerpt from Natural Resources Defense Council (NRDC) Issue Paper 2013:

- Climate disruption was one of the largest non-defense discretionary budget items in 2012
- In total all federal spending on 2012's climate disruption events such as droughts, storms, floods, and forest fires added up to $96 billion
- U.S. Climate Disruption Budget covers the costs of climate change related expenditures including: the actual costs of disaster recovery as well as insurance plans to cover flood and crop damages, etc.
- 2012 expenditures were an all-time high, but costs are expected to increase due to continued and worsening climate disruptions
- Simultaneously, the budget for programs to prevent further climate change and thus prevent greater disruptions – e.g. environmental enforcement, energy efficiency – have suffered budget cuts of more than $100 million and remain under continued pressure from the budget-cutting process
- Economic implications: general damage to the economy, heightened uncertainty with respect to investments, funding not available for other government programs such as education
- Suggested solution: Address climate change now, reduce carbon production, etc. NRDC's Using the Clean Air Act to Sharply Reduce Pollution from Existing Power Plants provided as roadmap to describe how carbon emissions from existing power plants can be reduced by 26% by 2020: http://www.nrdc.org/air/pollution-standards
- Takeaway message: addressing climate change now is not only good for the environment and future generations but also chips away the costs Americans pay every year in taxes to address climate disruption

List believes it is possible that education and information can change beliefs – but over generations, not overnight (Dubner, 2014). Thus, from an economic standpoint, if we want changes in behavior to occur more quickly, then we need to come up with incentives to increase the level of motivation for action. To accomplish this, we will have to begin by reexamining the manner in which we are teaching our students about climate change and realize the influence of informal education on students' perception of the legitimacy of climate science.

When looking at where the general public gains information about climate change, it is clear that the majority of individuals do not obtain information directly from climate scientists or scientific journals, but instead they inform themselves about this complex issue via intermediary sources, predominantly mass media that present the various opinions using language and graphics that are easy to comprehend (Soroka, 2002), as well as social media. What this means is that the majority of Americans' knowledge and understanding of climate change has been almost entirely indirect, informal, and mediated (Weber & Stern, 2011). This fact is very concerning because it has been shown that certain media channels, including many websites, are devoted to discrediting climate change and thus act as ideal conduits for spreading contrarian arguments (Hamilton, 2010). These types of sources are not only easily accessible but also easily and quickly shared with audiences that are predisposed to accepting and supporting such antiscientific arguments. Due to this rampant spread of falsehoods and so-called alternative facts, the need for educational interventions that support critical thinking is exponentially important.

International and national education programs have been proposed to address the need for better information dissemination. International agencies such as UNESCO have already recognized the need for better education about climate change and have consequently created educational programs such as the Education for Sustainable Development as part of their Global Action Programme. A major national program was also recommended to Congress in 2016, called the Climate Change Education Act (CCEA). If enacted, the CCEA would specifically authorize the National Oceanic and Atmospheric Administration to establish an educational program to provide nationwide formal and informal learning opportunities for all ages. Such a national educational program would be an ideal way to offer all Americans a better chance of understanding the complexity of climate science and the effects of climate change on the environment as well as on social and economic systems. The introduction of such a program would also be a crucial step in meeting one of the goals set in the early 1980s by the National Science Teachers Association, namely that science education should enable students not only to understand how science, technology, and society are intrinsically related, but also how to use this knowledge in everyday decision making (NSTA, 1982; Blanco-López et al., 2015).

Moreover, the implementation of such a national education program would also be in line with most Americans' general views on climate education, as found by the study "Climate Change in the American Mind" by the Yale Program on Climate Change Communication (Leiserowitz et al., 2017a). While public opinion on the truth of anthropogenic climate change appears to be split, the resounding majority of Americans believe that climate change should be part of school curricula: 38% of Americans *strongly* agree and 38% *somewhat* agree that lessons on the causes, consequences, and potential solutions of global warming should be taught to students in the classroom (Leiserowitz et al., 2017a; Figure 1).

Yet, as of this writing, the CCEA has not been implemented, nor has any action been taken regarding the enactment of the act since 2016 (though it should be mentioned that the National Center for Science Education is still actively supporting its implementation). Even if the CCEA is not passed, the current status of climate change education in the United States does not look too bleak, given that lessons on sustainability have been incorporated into the *Next Generation Science Standards* (NGSS). While lessons on climate change have been incorporated into a number of lesson plans, the largest concentration on the impact of human activity on the environment is in "HS. Human Sustainability" (Table 1).

In line with these recommendations, a comprehensive national study conducted by Pennsylvania State University and the National Center for Science Education also brought forth an optimistic picture, showing that 70% of middle school teachers and 87% of high school teachers report that they teach about climate change in their classes. The average amount of time spent teaching about climate change, its observable consequences, and possible means of mitigation was about four hours, representing about a week of class time (Branch et al., 2016), while other studies have shown that less than three hours per academic year is dedicated to teaching about climate change (Plutzer et al., 2016a, b). Regardless of whether an average of three or four hours is spent teaching about climate change, both sets

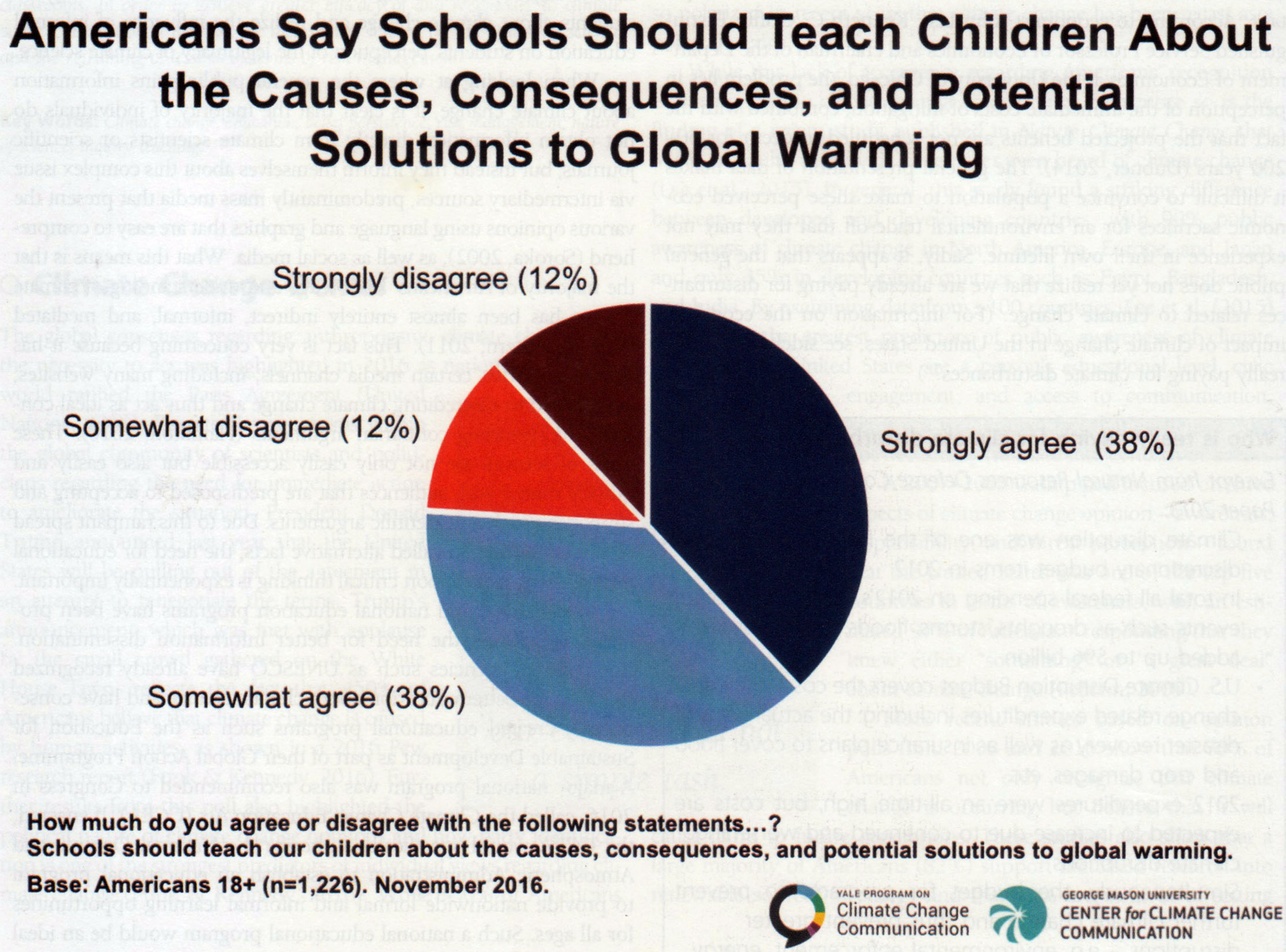

Figure 1. Results of a Yale Program on Climate Change Communication study showing that 76% of Americans either agree or strongly agree that children should be taught climate science in the classroom (Image copyright: Leiserowitz, Maibach, Roser-Renouf, Rosenthal, & Cutler, 2017)

Table 1. Overview of the NGSS focused on teaching high school students about climate science and the impact of human activity on the environment.

HS. Human Sustainability	Students who demonstrate understanding can:
HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
HS-ESS3-3	Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
HS-ESS3-6	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

of data mean that practically all students who graduate from an American high school will have had the opportunity to receive some education on climate change.

Yet these reports only show that teachers are offering lessons on climate change; they give no details about the nature of those lessons. Lessons on climate change can be exceedingly different if taught in accordance with the scientific consensus or instead presented as a matter of controversy, conspiracy, and debate. A 2011 study conducted by the National Earth Science Teachers Association found that 47% of teachers were in fact teaching "both sides" of the climate change "debate" – thereby mispresenting climate science as a scientific controversy (Johnson & Holzer, 2011; Branch et al., 2016). Another study, conducted by the National Center for Science Education, showed that 30% of these teachers state in their lessons that scientists are not in agreement regarding the reasons for global warming (i.e., human activities vs. natural causes; Plutzer et al., 2016b). This confusion among school teachers regarding the scientific consensus of evidence for climate change reflects the fact that there is a major lack of formal education for preservice teachers. In fact, studies have shown that about a third of American teachers who do not receive formal education on climate science during their preservice training rely instead on climate-change-denial websites to gather information for their classes (Branch et al., 2016). This finding is very concerning because it has already been established that readers often gather and assimilate evidence in a manner that is biased toward their existing attitudinal position, causing attitude polarization (Corner et al., 2012).

Yet even with better teacher training, one major hindrance remains – how can teachers effectively teach about climate change when lessons on climate change are actively resisted and rejected by students due to their own existing beliefs on the subject? How can we deal with students' misconceptions about anthropogenic climate change at a classroom level? How do we get our students to think critically when it comes to climate science? As pointed out by Weber and Stern (2011), climate change denial in the United States is not caused by a lack of information but instead by the need for conceptual change, as research on science education has shown that preconceptions that conflict with scientific understanding can be obstinate and that instruction will need to address these in order to help students adopt mental models that are scientifically accurate (National Research Council, 2005; Weber & Stern, 2011).

○ Educational Tactics

Teaching about climate change can be particularly difficult emotionally for educators because of the politicization and polarization of views on the topic (Swim & Fraser, 2013). Moreover, it has been found that the topic of climate change often causes emotional debate within a science classroom due to students' religious beliefs (Quigley, 2016). These same studies have shown, though, that through certain teaching practices, teachers can either create a productive space where students can reflect on the science and their own views or close down the conversation entirely. I propose that by teaching students about the general nature of science and by reframing climate change mitigation as practical risk management, teachers can deal with the topic of climate change more effectively and hopefully diminish the amount of negative emotional states within the classroom.

Lessons on the Nature of Science

While it is necessary to address students' false preconceptions that make them resistant to science teachings, science education should never be used to force students to believe things (Taber, 2017). In fact, for students to be considered "scientifically literate," they need to be able to make scientific, evidence-based judgments for themselves and not simply memorize and repeat facts (DeBoer, 2000; Oulton et al., 2004). Therefore, it is imperative that, in addition to straightforward lessons on humans' effect on the environment, students learn about the nature of science so that they can better understand *how* scientists around the world have come to a consensus about anthropogenic climate change. By educating students about the nature of science and about *how* scientists come up with theories, it may be easier for teachers to deal with ideological resistance by explaining to them more about how our understanding of anthropogenic climate change came to be, instead of just stating that this is a fact that needs to be accepted.

Moreover, by helping students understand the nature of scientific discovery in general, this approach presents teachers with the opportunity not only to increase their students' understanding of climate science but also to increase their students' general level of science literacy and socioscientific decision making (Clough, 2017; McComas, 2017). It has also been argued that including lessons on the nature of science is essential because it helps students develop into future scientists, informed citizens, and cultured members of society (Taber, 2017).

By addressing the nature of science in connection with lessons on climate change, students also have the opportunity to better understand the value of science as a central tool in explaining and understanding the natural world (McComas, 2017). They can thus better appreciate how scientists use observation, empirical data, and other evidence to develop working theories that may change over time as new data are gathered. This newly gained knowledge, not only about climate change but also about the scientific endeavor, may also enable students to better judge which sources are the most reliable with regard to statements about scientific consensus and enable them to eventually distinguish between reliable and unreliable sources.

Risk Management Lessons

In the best-case scenario, an appreciation of scientific inquiry will enable students to integrate the data on climate change into their own understanding of the natural world and allow them to see how scientists have been able to come to a consensus on the anthropogenic *causes* of climate change as well as predict long-term *effects* of climate change based on theoretical knowledge. Students may also then recognize that the acquisition of such scientific knowledge is essential because a better understanding of the causes of climate change can help develop policies that alleviate further environmental destruction, while a deeper understanding of the effects of climate change can also enhance our ability to anticipate complex issues arising from climate change and enables scientists to improve projections that support more informed decisions by policymakers and land managers (Urban et al., 2016).

This emphasis on effects of climate change also presents a new educational tactic that focuses simply on reframing the issue as "risk management" (Weber & Stern, 2011). Risk management is a concept that students are readily familiar with through activities in everyday life at school or in the home, such as wearing a helmet to reduce the risk of brain damage in case of a bike accident or securing heavy furniture to the wall to prevent injury in case of an earthquake. Risk management can be introduced to students using Table 2, which presents an overview of risk management strategies for catastrophic events that students are familiar with, such as life-threatening diseases, car accidents, house fires, and even climate-related events such as floods or wildfires. Weber and Stern (2011) point out that there are multiple ways of managing risk. The table highlights two of these strategies: (1) reducing the likelihood of a catastrophe occurring and (2) lowering the damage/cost of catastrophic events when they do occur.

By reframing climate change discussions in the classroom into a conversation about risk management, teachers can use these everyday activities to show how it is logical to do things to prevent or mitigate possible risk situations. Thus, instead of presenting students with a simplistic statement on how human activities are a major cause of climate change, it is beneficial to look at exactly how humans can mitigate climate change danger and how those mitigation efforts could have direct effects on their own health and safety.

When using a risk management approach, it is best for teachers to find local or personal examples. This motivation and incentive can come through the emphasis on effects of climate change at a local and personal level and on mitigation measures that offer quicker and more visible results. A focus on how climate change affects human health can also be very influential; for example, decarbonization measures can have immediate and local benefits for human health (Luber et al., 2014). This is in stark contrast to the general global and long-term effects of climate change and something that individuals can understand more easily (Nemet et al., 2010).

If teachers are unaware of how climate change is affecting their local area, they can refer to the National Climate Assessment, which is broken down into various areas, not only geographic (e.g., Midwest or East Coast) but also rural vs. urban. This report also includes an excellent chapter on human health and climate change, which lends itself very well to explaining the risk of climate change on a personal level. For more information on the effects of climate change on human health, see the chapter on human health in the National Climate Assessment, which appears every four years (the 2014 report can be found at https://nca2014.globalchange.gov/report/sectors).

This approach also allows instructors to circumvent the "debate" – and the various denialist arguments over whether or not climate change is caused primarily by humans or if the change is severe enough to result in severe global environmental changes – and simply state the benefit of preparing for and preventing potential risks. This reframing of the issue may also allow citizens to more easily accept the legitimacy of scientific consensus because it no longer appears to be a situation of blame, and thus they could be more willing to learn about measures that would help diminish global warming, thereby becoming active participants in the mitigation of global climate change.

Table 2. Introducing the concept of risk management using familiar scenarios and two different strategies (reducing likelihood, reducing costs/damages).

Reducing the Risk Presented by Catastrophic Events	
Strategy 1: Activities Designed to Reduce Likelihood of Catastrophe	**Strategy 2: Lower the Cost (Monetary and Personal) of Catastrophic Events If They Occur**
Disease: getting vaccinated, watching our diets, seeing the doctor, precancer screening programs, etc.	Disease: medical research to find cures for deadly diseases, health insurance, quarantine, etc.
Car accident: staying off icy roads, rotating tires, driving sober, etc.	Car accident: airbags, seatbelts, first aid kits and training, etc.
Fire: chimney inspection, removal of faulty electrical wiring, cleaning lint from dryers, etc.	Fire: fire extinguishers, smoke detectors, fire insurance, etc.
Climate change: adoption of energy-efficient and low-emissions technology, reducing carbon production, etc.	Climate change: protection of vital infrastructures, improvement of early warning and emergency response systems, etc.

A perfect example of how an entire governmental agency has gone beyond the controversy to recognize that action is needed is the U.S. Department of Defense, which has stated:

> While scientists are converging toward consensus on future climate projections, uncertainty remains. But this cannot be an excuse for delaying action. Every day, our military deals with global uncertainty. Our planners know that, as military strategist Carl von Clausewitz wrote, "all action must, to a certain extent, be planned in a mere twilight". It is in this context that DoD is releasing a Climate Change Adaptation Roadmap. Climate change is a long-term trend, but with wise planning and risk mitigation now, we can reduce adverse impacts downrange. (Department of Defense, 2014a, p. 2)

A full version of the Department of Defense roadmap can be found in the sample lesson plans below.

Sample Lesson Plans

To assist teachers in getting started, I have provided some initial ideas and resources in Appendix 1. These can, of course, be amended and improved upon based on a teacher's own expertise and interests as well as the needs and interests of the students.

Conclusion

Getting students to become actively interested and involved in the decarbonization of our economies is not easy. As economist John List explains, the problem lies in the immediate cost of mitigation efforts, combined with the perception that the effects of our efforts will not be visible for decades or centuries (Dubner, 2014). The general presentation of data makes it difficult to convince a population to make perceived sacrifices for an environmental trade-off that they may not experience in their own lifetime. While a change in belief systems occurs very slowly, behavioral change can occur more quickly and thus new educational tactics are necessary that (1) help students understand how scientists have come to a consensus by teaching them about the general nature of scientific exploration and (2) present our students with tangible concepts of the local and personal risks of climate change.

While we must acknowledge that the political nature and polarization of the climate change issue make it difficult to bridge the gap between climate change denialists and science advocates, adolescents represent a receptive audience since their worldviews are not yet set in stone (Stevenson et al., 2014). Ultimately, effective climate science education that emphasizes the nature of scientific inquiry and encourages critical thinking could be the key to offering the upcoming generation a chance of understanding climate change before they are indoctrinated by party lines, ideologies, and special interest groups. Moreover, the reframing of climate science as a lesson on risk management gives students a clear idea about their own ability to mitigate the causes and effects of climate change. The combination of these educational tactics may enable students to understand the validity of climate change science and later act as advocates within their own social circles as they bring newly won insights home to share with their families. Despite the perceived difficulties of teaching climate science, we must remember that the students of today are the most crucial population when it comes to discussing climate change because they will grow up to become active participants in society and will either ameliorate or aggravate our effect on the global environment.

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Sample table to fill out:

Reducing health risks caused by climate change	
Strategy 1: Prevention	**Strategy 2: Preparedness**