Turning Misinformation into Educational Opportunities

Thank you for your interest in being a part of this exciting professional development opportunity! By participating in the second Turning Misinformation into Educational Opportunities (TMEO) workshop and project you will help expand effective teaching of climate change, strengthen the understanding of climate change science, and inoculate students and peers across the country against misinformation and misconceptions.

Overview

This is a multi-phase project that will take place in three steps:

1. Bring together a cohort of the best teachers from around the country. Teachers who are already doing a great job teaching climate science in their classrooms through strong content knowledge and pedagogical skills, and who are effectively confronting opposition from their communities.

2. Develop a unit of five lessons focused on addressing key misconceptions about climate science, and field test the lessons in the teacher’s classrooms. This is the focus of this workshop. The unit will be developed by the teachers themselves from lesson templates designed by experts at NCSE, the George Mason University of, and NOAA.

3. Each teacher participating in this process and field testing the lessons will then create professional development opportunities for their district or wider area. Administrators from the teacher’s school or district will be included as workshop participants and then help facilitate the delivery of the second round of localized professional development.

If you accept this challenge, you will be one of eight new master teachers selected to be trained to become NCSE Teacher Ambassadors!

Being an NCSE Teacher Ambassador is not a short-term commitment or reward. We are looking to change the culture of how climate change is taught, and NCSE Teacher Ambassadors will be at the vanguard of this effort. We are looking for teachers anxious and willing to develop the tools and relationships needed to effect sustainable transformational change in their schools and larger communities.

Project Description

This will be the second TMEO workshop. You will join the cohort of teachers who participated in the first workshop as NCSE Ambassador Teachers in 2018. Eight teachers participated in the first TMEO workshop, and we are looking for eight more amazing teachers from areas across the country where teaching climate change is particularly challenging.

This workshop is a collaboration between NCSE, The George Mason University Center for Climate Change Communication (GMU C⁴), and the NOAA CLEAN Network. Dr. Brad Hoge from NCSE, Dr. John Cook from GMU C⁴, and Frank Niepold from NOAA will be presenters at the
workshop. We will also have experts join us virtually to answer questions about the science of climate change.

We have produced a unit of 5 unique lessons using the misconception-based learning approach developed by Dr. John Cook at GMU. These lessons address misconceptions identified in the Heartland packet, and include lessons on the scientific consensus on climate change, modeling, the geologic record of climate change, extreme weather events, and solutions and sustainability. All lessons are hands-on PBL and utilize activities from the NOAA CLEAN interactive database. Lessons are also flexible and place-based so that the lessons can be adapted to local issues and data.

All five lessons are designed to guide students through real data so that they can form their own understanding of the connections between the causes and impacts of climate change. In this way, the students not only come to see how the misconception presented in the lesson is wrong but they also become inoculated against misinformation in general.

As a participant in this workshop you will each develop specific strategies for each of the lessons for use in your own classroom. We are looking for a diverse group of teachers. Workshop participants are likely to include high school teachers, middle school teachers, and 4-5th grade teachers.

The lesson plans from the first TMEO workshop are available here, but you will be able to adapt the lessons for your specific needs. We will walk you through each of the lessons and then work with you at the workshop to make them fit your needs. We will also give you hands-on experience with the misconception-based approach developed by John Cook and the no-conflict approach developed by NCSE.

You will field test your lessons in your classroom during either the remainder of spring 2019 or in the fall. We will assess the impact of the lessons on specific student learning outcomes, and use this feedback to develop final lessons which you will use to train teachers in your area.

Following the first TMEO workshop, we worked with the Alliance for Climate Education (ACE) to produce a series of webinars which you can view here. We are currently helping our current Teacher Ambassadors to develop workshops in their own areas.

After participating in this workshop, we will work with you to develop professional development where you will be the master teacher. If you are able to field test your lessons in the spring of 2019, we could help you develop PD for the summer or fall of 2019. If you field test your lessons in the fall of 2019, we will help you develop PD for the spring or summer of 2020.

**Pedagogy**
Misconception-based learning is a powerful way to neutralize misinformation while improving science literacy (Bedford, 2010). This approach involves explaining scientific concepts while directly refuting related misconceptions. Misconception-based learning results in greater and more long-lasting learning gains relative to standard lessons (McCuin et al., 2014). It increases student’s argumentative skills and awareness of the importance of evidence (Kuhn and Crowell, 2011), fosters critical thinking skills (Berland and Reiser, 2008), and provokes greater student interest (Manson et al., 2008).

There is also a unique synergy produced by using a misconception-based inquiry approach with place-based lessons. TMEO lessons are strategically designed to encourage students to seek out content knowledge and apply it to real world scenarios. In this way they construct their understanding through discovery. This teaching approach inoculates students against misinformation in the future, also equips students with the tools and confidence to engage in conversations with family and friends about contentious topics such as climate change.

**TMEO Lessons**

The first lesson does not identify the misconception at the start. The challenge of this lesson is to guide the students through a hands-on experience where they discover the consensus for themselves. Groups of students work with different lines of evidence that lead to the conclusion that climate change is due to human activity. Teams share their conclusions with the class and come to realize that all lines of evidence lead to the same conclusions. The teacher will then introduce the misconception that there is disagreement among climate scientists, and the students will finish the lesson by exploring how this misconception is perpetuated by misinformation. In this way, student’s ability to spot the misconception acts as the assessment of learning outcomes for this lesson.

Lesson 1 is different from the rest of the lessons in that it’s learning outcomes are not related to the content of climate science, per se, but rather student’s ability to analyze data and come to logical conclusions. This lesson establishes the skills students will use in the next four lessons as they explore climate science more directly. Lesson 1 also inoculates the students to the use of misinformation to create misconceptions.

Misconceptions are then used to introduce Lessons 2-5. Lesson 2 focuses on modelling and will require students to build their own models. The teachers in the workshop had a very interesting discussion of the best ways to do this. Some will approach it as a discovery lesson where students must explain patterns in real data. By grappling with the needs of explanation, students will realize the need to model the data and thus “discover” how modelling works. Others will have students identify climate parameters needed to model climate predictions accurately and build their own 2-D models. In both strategies, students will realize that models make predictions and that future predictions depend on the interplay of many parameters. Students will also begin to see the value of mediating climate change in order to mitigate future climate change. Students will also see that the misconception that models are not real science, is based on misinformation.
Lesson 3 has students analyze ice-core records to discover the patterns of Milankovitch cycles and compare them to current trends. This lesson will enforce the conclusion that current trends are caused by human activity and not natural causes. Some teachers may also choose to use other sources of paleoclimate, such as tree rings, coral reef growth, oxygen isotopes, etc. Lessons 4 and 5 will both be place-based lessons appropriate to each teacher’s location. Lesson 4 is on extreme weather, but could also be geared towards any local problem that relates to climate change. The teachers at the workshop identified snow pack records, invasive species migration, disease vectors, crop yields and planting schedules, and heating and cooling costs as some of the datasets they will utilize. Lesson 5 is based on solutions such as alternative energy strategies, but could also involve conservation strategies. The teachers may develop games for their students to play along the lines of the Wedge Strategy Implementation Game.

To learn more about the NOAA CLEAN database, go to https://cleanet.org/index.html.

To learn more about the NOAA Planet Stewards program, go to https://oceanservice.noaa.gov/education/planet-stewards/.

To learn more about NCSEteach, go to https://ncse.com/teach.

Further Background

In March 2017, the Heartland Institute began mailing unsolicited packets of climate science denial propaganda to tens of thousands of teachers across the United States. Heartland, a libertarian think-tank that has been active in casting doubt on the health risks of tobacco as well as established climate science, claimed that it intended to send out up to 200,000 packets with the goal of reaching every science teacher in the country. The packets included a DVD and a booklet entitled “Why Scientists Disagree about Global Warming”, suggesting that teachers “use them in your classroom.” A misleading New York Times quote was featured on the outer envelope. In short, the goal of the packets was to encourage teachers actively to misinform their students about climate science.

The National Center for Science Education (NCSE), immediately sprang into action to get accurate information to teachers that would both discourage them from using the packets themselves and give them detailed explanations of why the material was unacceptable for use in the science classroom. The flyers were designed to help teachers dissuade parents, administrators or colleagues who might be in favor of using the materials to "teach the controversy". The three flyers that NCSE developed were made available free on our website, distributed to our own network of 6,000 teachers, and widely disseminated by other organizations including the National Science Teachers Association. The National Center for Science Education was able to respond quickly because we have been active for over 30 years in ensuring that evolution is taught accurately and resisting efforts to introduce the non-scientific alternatives of creationism or intelligent design into science classrooms. In 2012, NCSE added
climate change education to our mission, as similar efforts to require or encourage teachers to devote “equal time” to casting doubt on climate science were becoming more common. We have a long history of helping teachers cover topics that are societally, but not scientifically, contentious. When we began working on climate change education, one of the challenges was a dearth of information about which teachers, at what grade levels, and in which science courses, were covering the topic and how.

Accordingly, in 2015, NCSE, in collaboration with researchers at the Pennsylvania State University, carried out the first representative national survey of U.S. middle and high school science teachers to learn how climate change is actually being taught. The results were published in the journal Science in 2016 (Plutzer et al., 2016). Encouragingly, the survey found that climate change is being widely taught. On the other hand, the majority of teachers conceded that they have little formal training on climate science and were not especially confident in their content expertise. This lack of expertise was confirmed by the response to a question asking what percentage of climate scientists agrees that human activities are the main driver of climate change. The correct answer is an overwhelming 97%, but only 40% of teachers chose the correct survey option of 80%-100%. This worrying result suggests that science teachers, like so many others, have been affected by misinformation campaigns, such as those by the Heartland Institute, that falsely suggest that the reality of climate change is still in substantial scientific doubt.

The Heartland Institute’s mailing, beginning with its title, exploited precisely this widespread misconception. Knowing, as we did, that a great many teachers were themselves unaware of the depth of the scientific consensus, one of the flyers developed by NCSE explained exactly how the 97% consensus claim was arrived at, undergirded as it is by a wealth of evidence from several lines of research. Helping teachers overcome the prevalent misconceptions about what climate scientists know and how they know it is, however, only the first step. Ideally, teachers need tools to help their students recognize and overcome those misconceptions as well.