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Executive Summary

The survey provides front-end analysis of the opinions of middle and high school teachers on the topics of climate change science education and the most pressing needs for teacher professional development on this topic. Highlights from the results are presented below.

- Survey respondents were well-distributed among teachers of grades 6 through 12. Zip codes collected indicate that respondents were from a wide variety of areas around the country.

- Data collected for Free and Reduced Lunch eligibility among students indicated that teachers were from schools of varied socioeconomic demographics, although the most common characteristics were for less than 50% Free and Reduced Lunch.

- Respondents taught a variety of courses; the majority taught life science/biology, earth science, and environmental science, followed by physical science, general science, integrated science, and chemistry.

- The types of classes taught by respondents were mostly general courses, with 40 or more teaching ELL/bilingual, AP/IB, or college prep/honors courses.

- Overall, the most commonly-used technologies seem to be internet-based resources, in-class activities based in school computer lab, and DVD- and CD-based resources. Laserdisc and ebook type resources are the least-used.

- Almost all respondents teach about renewable energy or conservation in class, most in formal lessons. Almost all respondents teach about climate change in class, most in formal lessons.

- The main reason cited by those who did not teach climate change was that the topic did not fit with curriculum and standards.

- For those who do teach it, the main barriers to climate change education were listed as being that it doesn’t fit into curriculum and standards, closely followed by respondents not knowing enough about the topic to teach it. In their comments, many mentioned being concerned about the controversy (“both sides”) issues and their need for more materials for instruction.

- The most commonly listed learning experiences in climate change were television, film documentaries, and magazine articles. Books, climate
change websites, and professional development workshops were also commonly selected.

- Survey respondents indicated a high level of interest in all the climate change topic categories that were suggested.

- When asked about their knowledge level about the same climate change topic categories as the interest question, the results were that their knowledge was less than their interest levels. The lowest level of knowledge was in how climate change is predicted to appear in their local area. Also slightly lower than other topics was how scientists know what they know about climate.

- When asked about their teaching of these same topics, most respondents teach about all but the same two categories—climate changes predicted to happen near their area and how scientists know what they know about climate. These two categories were taught slightly less than the other categories.

- When asked to identify NASA resources dealing with climate, over half of the respondents were not able to do so. Over a third of the respondents were able to do so, however. GLOBE was the most commonly cited NASA resource.

- The most commonly cited student misconceptions were Earth gets closer to sun in summer, and is further away in winter, If climate change is happening, it is due to natural cycles of the Earth, The greenhouse effect is bad and caused by humans, and Climate change is caused by the hole in the ozone

- Most respondents were interested in online resources for climate change education, online courses, and a week-long workshop in Boulder. The most common concern for all these was cost, closely followed by the scheduling and time required.

- When asked whether they agreed with statements about global warming being mostly caused by humans, a large majority of respondents agreed. When asked if there was agreement among climate scientists about the cause of global warming, there was slightly less agreement from the survey respondents.

- In their open-ended comments, respondents largely wanted more information about resources, agreed with the importance of the topic, expressed concern about scientist agreement on the topics, and suggested possible topics and methods for resource/workshop development.
Introduction

The survey included 24 questions (22 multiple choice and 2 open-ended). One question was a logical branch to two alternative questions, which means that each respondent was presented with 21 questions. The average time it took to complete the survey was 15 minutes.

There were 284 responses to the survey that were from the target audience (teachers of grades 6-12). Most (264) were classroom teachers. Two administrators, six college instructors of teachers, and twelve informal educators were also included in the data. (Data from the 40 K5 teachers who responded to the survey were not included in this analysis and report since they were not in the target audience for the project.)

Data were collected between November 30, 2009, and December 4, 2009. The survey was located at surveymonkey.com. The first 200 respondents to the survey received a $5 Amazon gift certificate. Teachers were invited to participate via a number of email lists, including GLOBE.

Responses to questions are included in the bar graphs (multiple-choice responses) and bullet points (open-ended, direct quotes) below. Ranges for the bar graphs are representative of the number of respondents who were offered the question.
Survey Results

Multiple-choice question data are presented as bar graphs. Open-ended questions are summarized and the exact quotes are presented in italicized bullets.

The first two or three pages of the survey included information about the incentive, a consent form, and a question that clarified who the audience of the survey was intended to be. If visitors indicated they did not consent to be a part of the evaluation project or that they were not a part of the intended audience, they were moved to the exit of the survey.

Once past the introductory pages, the first survey question asked respondents *What is your profession?* Two choices were offered—*Classroom teacher grades 6-8* and *Classroom teacher grades 9-12*. *Other* was also an option, offering them a chance for an open-ended response. Respondents could select as many of the options as they liked. The responses to each of these options plus the data from teachers who selected both options are shown in Figure 1.

Over 100 respondents were from each of the two categories, with slightly more from grades six through eight. Zip codes were well-distributed throughout the country.

The results were adjusted based on more detailed answers to other questions. (For example, a teacher may have selected 6-8 when in a comment they said they actually taught 6-9; in this case, the selection would have been coded as *Classroom teacher, grades 6-8 and 9-12* in Figure 1.)

Zip codes of respondents were well-distributed throughout the country.
Six respondents mentioned they taught a gifted, honors, or accelerated program. Four taught special education. Others simply provided more detail on their experience and position.

Open-ended responses were as follows:

- *freelance outreach: environmental and physical science, math*
- Community college science; I was a 7th-12th grade science teacher in Montana.
- I am a professor of science education and teach pre-service elementary education teachers.
- special education teacher grades K-6
- Science Department Chair
- K-12 Science Instructional Specialist
- Middle Years Programme Science Teacher Grades 6-9 (an IB school)
- Special Education support for chemistry and a GLOBE certified instructor.
- I teach earth science to grades 3-12
- Special education teacher K-8
- University assistant professor
- 4th -6th
- Education manager of an informal education science museum
- Program Director for Outdoor Learning Center at Camp Tyler. We host k-6th graders out for field investigation day programs and overnight resident camp.
• Informal teacher (though certified for classroom) in a children’s museum. We have over 16,000 students (PK – 8th) visit the museum for our educational tours.

• Outdoor Educator K-12 Director of Conservation Education for the Boone and Crockett Club

• HS Assistant Principal and MS science team coach.

• Science Lead Teacher K-12

• Home hospital instruction 7-12

• Nature Center Leader (grades 4-9)

• Science teacher grades 8-12

• Gifted intervention specialist grades 3-8

• Education Teacher at Environmental Center

• Environmental Educator in k-12 school – working with teachers of all subjects throughout the school

• I teach 7th grade and 9th grade, as well as tutor students in 10th-12th grade.

• Superintendent

• Teacher of gifted grades 1-8

• Mathematics and Science Professional Development Leader

• College professor in education

• I teach in the Gifted and Talented Program for grades 3 through 6.

• Alternative Learning Center teacher grades 5-12

• K-8 science curriculum coordinator

• Science coach for teachers grades 1-12

• outdoor classroom teacher for grades K-12

• mentor

• Program manager for an environmental education program on a National Wildlife Refuge

• Middle School Science Curriculum Teacher Leader

• Special Education teacher teaching grade 6-8 science for students with cognitive impairment.

• Grade 1-12 –Science & math

• Elementary education specialist for NASA. I have taught the past 25 years in the classroom and just began work at NASA’s IVV facility as an education specialist last month.

• Science teacher

• gifted and talented pull out 6

• Part time teacher and education director at a nature center

• Educator at Environmental Center

• I’ve taught in the USA as a k-6 science coordinator for 3 years training teachers and students. I’ve worked for 15 years as a classroom teacher grades 2, 4, 6. I’m presently a science consultant in Qatar for 2 years and will return to USA in fall, 2010. I train K-6 grade science teachers here in Doha, Qatar.

• I currently teach 3 classes of Honors and 3 classes of regular 7th grade science. My Honors students tend to receive more detail on concepts, more projects, and are expected to demonstrate a higher level of understanding on concepts. They receive a different test than regulars and their lab reports are more detailed.
Two profession verification questions were asked next—the name and zip code of the respondents’ school. These were used to verify the validity of the survey response due to a large number of invalid entries the first few days after the survey went live.
The next question asked *What is the percentage of Free and Reduced Lunch eligible students at your school?*

Data were binned into ten-percent categories, plus a single category for 0%. The most commonly given category was 0%. Other values covered the spectrum fairly evenly, with slightly more per category under 50%. The results are shown in Figure 2.

![Figure 2. Free and Reduced Lunch eligibility at respondents’ schools.](image-url)
The next question asked *What grade level(s) are you teaching this year (select all that apply)?* Respondents were fairly evenly spread across the grades of sixth through twelfth, with between 82 and 108 selections. Responses are shown in Figure 3.

![Bar chart showing grade levels taught by respondents](image)

**Figure 3.** Grades taught this year by respondents.
A number of respondents specified other grades they taught. Nine cited grades that included elementary. Seven taught college level.

Open-ended responses were as follows:

- I also teach college and inservice courses for teachers
- Graduate class
- college freshman and sophomores
- I teach college students – mostly juniors and seniors
- senior level pre-service teachers
- PK – 6th
- grade 5
- K – 12, primarily upper elementary and middle school
- I will answer all of these questions in regard to the middle school team I coach. It is comprised of 6-9 graders.
- GED and Pre-GED level mathematics to 17-21 year old students
- grades 4-9
- Also 4th and 5th
- freshman community college
- Superintendent
- I also coach Science Olympiad grades 6-12 and National Ocean Sciences Bowl grades 9-12
- College education courses at the undergraduate and graduate level
- These numbers could change at any time due to open enrollment
- Also work with teachers in grades 1-5.
- I don't directly teach specific grades. Our resource materials can be used for all grades above
- Pre College Seniors
- and 5th
- Also K-5 I taught all science courses at the school. I have a masters in science education
- Again – training k-6 science teachers in Qatar while on sabbatical from Roosevelt Elementary in Muskegon Heights, Michigan.
- All grades
The next question asked *What science classes are you teaching this year (select all that apply)?* Earth science, Environmental science, and Life science/biology were all selected by at least 100 respondents. Geography and physics were the least-selected, at under 50 each. Results are shown in Figures 4 and 4a. Figure 4a shows the data disaggregated by grades taught.

Figure 4. Science classes taught by respondents.
Figure 4a. Science classes taught by respondents, disaggregated by grades taught.
In addition to the choices given, nine respondents teach anatomy/physiology and nine teach astronomy/space/planetary science. Another six teach mathematics. A wide variety of other topics are taught by respondents, indicating a broad range of professional skills and experience.

Open-ended responses were as follows:

- astronomy
- Anatomy & Physiology
- Astronomy 1, 2 and 3 and Freshman Studies and Senior Studies (Science & Religion)
- Science education methods
- Reading Intervention
- Anatomy and Physiology
- 6th grade curriculum with the preceding components
- general science
- writing in the content areas
- Geology – dual credit
- Senior Internship
- Astronomy, Water on Earth
- Aquatic Science
- IB curriculum
- Support special needs in the above chemistry class.
- Earth Systems
- paleontology
- Agricultural Science
- Human Anatomy and Physiology
- Social studies
- elementary science methods
- Botany/Zoology
- Space science
- Advanced Placement Environmental Science
- Our tours match the TN curriculum standards and are hands-on inquiry-based experiences. We include conservation as an environmental message.
- Health
- It is a competition team and events are comprised of all of the science areas that you have listed in addition to technology and engineering.
- Biotechnology
- math
- Mathematics. However, I incorporate scientific themes such as reading graphs and tables, gathering and recording data.
- Health and Botany
- Earth in Space
- Ohio Graduation Test
• Science Research
• anatomy and physiology
• Astronomy and Aerospace
• Geospatial Information Systems
• Environmental Astronomy/Meteorology full year “elective” type
• Astronomy
• I do a wide variety of science topics in my gifted program.
• physical anthropology
• Anatomy and Physiology
• Pre-calculus, Algebra II- during which I incorporate science concepts as a means of teaching graphing and demonstrating real life application of mathematics
• Math (Algebra 2 and Trig)
• biotechnology and forensics; experimental design; urban planning
• Social Studies
• District Administration
• The following FOSS kits: Populations & Ecosystems, Human Brain & Senses, Variables, Mixtures & Solutions, Weather & Water
• Enrichment activities involving science topics
• AP Psychology
• Advisory, Marine Science, Genetics
• Middle/Secondary School Curriculum, Instructional technology, educational leadership
• Civil Engineering And Architecture
• AP biology
• Science Research- an introductory course for 9th grade and Independent study for 10-12
• Astronomy
• I teach 6th grade Math and 8th Grade Algebra I. I am in class support for 6th grade Science (Physical Science). I also teach Basic Skills (Math) and Electronics (gr. 7 & 8).
• Work Place Readiness Family and Consumer Science
• Human Anatomy
• foods and nutrition
• Math
• Don’t directly teach students – physical science, general science and life science are being offered at Tok School.
• AP Biology and Honors Genetics
• pre Veterinary Science; Biotechnology
• Human Anatomy and Physiology and AP Biology
• Anatomy and Physiology
• Intro to Engineering
• My curriculum for 7th grade focuses on the following areas: potential and kinetic energy, simple machines, environment including components of ecosystems, natural disasters, succession, biomes, cells, and human body systems.
• Planetary Science
• Agricultural Sciences
• Lab technology
• Anatomy/Physiology
• General science to k-6 includes teaching life, physics, earth, chemistry (they all materials) and GLOBE I taught March to June, 2009- soil, surface ozone, atmosphere, phenology, hydrology. I taught this to professors from the College of the North Atlantic- Qatar, June, 2009. I taught 10th grade GLOBE hydrology protocols. With a fieldtrip and have been asked to go with a prep class this year, which I’m presently working on. Also this year I plan to include surface temperature.
The next question asked *Which of the following class types do you frequently teach? (select all that apply).* Over 200 respondents taught general courses. Over 40 respondents each taught ELL/bilingual and AP/IB classes, while 57 taught remedial and 89 taught college prep or honors classes. Results are shown in Figure 5.

![Figure 5. Class types taught by respondents.](image)

Other class types mentioned in the open-ended option included seven that teach gifted and talented classes and seven that teach special education. Seven others mentioned that their classes are inclusion-based. Two teach honors classes.

Open-ended responses were as follows:
- *Special Education*
- *Advanced Science*
- *biology majors, pre-nursing & health careers; science majors; non-majors*
- *College*
- *Language Arts writing-vocabulary*
- *MYP*
- *College Algebra*
- *college courses*
- *Many classes are not designated bilingual but may have as many as 35% ESOL students.*
Various school group types as we service many school district groups.
- gifted/talented
- Gifted
- Special Education Co-taught
- Gifted and Talented
- Special Ed classes
- inclusion
- This is a “pre AP” middle school program, and the 8th grade Earth Science class is a high school credit course
- Harding is an independent private school, with a high percentage of smart and motivated kids, so classes are appropriately accelerated.
- Honors
- I teach in a STEM program. The classes I teach are generally science-geared but integrate other components.
- GT
- General 7th grade science + STEM + Multi-disciplinary Project-based classes
- District Administration
- inclusion
- Our classes are inclusion, so I have kids with abilities ranging from remedial to very high level.
- gifted
- Title 1 ESL
- Gifted
- College level curriculum courses, instructional technology and educational leadership
- Gifted and Talented
- The general classroom includes students of low learning ability. They are in a “Special Day Class” program and leave their sheltered classroom to have science classes.
- special day class (students with mild/moderate learning disabilities)
- Alternative Learning
- un leveled class
- I have one team taught class where I get a co-teacher every other day. 50% of students in that class have modifications and an IEP.
- Don’t directly teach classes
- Mostly at-risk students based on their math testing scores, mainly CSAP
- I will be teaching AP/IB starting in 2010
- special education classes
- AP Environmental Science, AP Biology, Advanced Biology (general Biology)
- Our school is inclusive model so in my “regular” classroom I have special ed. – gifted children. The special needs can include ELL, deaf/hard of hearing, language based learning disabilities, behavioral disability, and severe disability (i.e. downs syndrome)
- I teach all 7th grade Honors students (around 85 students) along with 3 classes of regular 7th grade science (90 students)
• Special education
• ELL population and IEP populations mixed in/Inclusion
• While I frequently taught remedial, ELL and general ed., I have started to teach upper grades with GLOBE – prep, secondary, college.
• All ages and types. Adults as well.
The next question was presented as a matrix multiple choice, where respondents could select one of three responses—Frequently, Occasionally, or Never—to indicate their use level for eight types of technology. The question was *Which of the following technologies do you use in preparing curricula, or in class with students?* Responses are shown in Figures 6, 6a, and 6b. Figures 6a and 6b disaggregate the responses to this question based on the percentage of Free and Reduced Lunch (FRL) at each school. Responses were similar for all categories of FRL participation.

Overall, the most commonly-used technologies seem to be internet-based resources, in-class activities based in school computer lab, and DVD- and CD-based resources. Laserdisc and ebook type resources are the least-used. Internet-based resources were used frequently by over 200 respondents. Ebooks, electronic readers and laserdisc-based resources were never used by over 200 respondents. Other technologies never used by over 100 respondents were self-maintained websites and web 2.0 resources. Resources used occasionally by over 150 respondents were CD-based resources and DVD-based resources.

![Figure 6. Technologies used by respondents.](image-url)
Which of the following technologies do you use in preparing curricula, or in class with students?

- Internet-based resources
- Ebooks and/or electronic readers
- CD-based resources
- DVD or laserdisc-based resources

Figure 6a. Technologies used by respondents, disaggregated by FRL category, part A.
Which of the following technologies do you use in preparing curricula, or in class with students?

![Bar chart showing technologies used by respondents, disaggregated by FRL category, part B.]

Figure 6b. Technologies used by respondents, disaggregated by FRL category, part B.
The next question asked *Do you teach about or discuss renewable energy or conservation in any of your classes?* The results are shown in Figure 7.

Only 11 people replied that they did not teach about or discuss this topic in class. The majority (178) included it in formal lessons, and 89 others had informal discussions in class.

![Bar chart showing the distribution of responses to the question on teaching about renewable energy and conservation in classes.](image)

**Figure 7.** Coverage by respondents of renewable energy and conservation in class.
The next question asked *Do you teach about or discuss climate change in any of your classes?* Results are shown in Figure 8.

The numbers of responses for this question were extremely close to those in the previous question. There were only 13 who did not discuss climate change at all, while 89 conducted informal discussions and 176 conducted formal classes in the topic. Those that selected No skipped the next question.

![Bar chart showing responses to the question](image)

**Figure 8.** Coverage by respondents of climate change in class.
The next question asked *Which of the following barriers to teaching about climate change have you encountered (select all that apply).* Responses are shown in Figure 9.

There were relatively few responses (290) to this question, even though it was required. Almost half the respondents selected *None of the above.* The most commonly selected options were, however, that the topic doesn’t fit into the curriculum/standards or that the respondent doesn’t know enough about the topic to teach it. Only 30 respondents were concerned about objections to the topic, and 22 considered it too controversial.

![Figure 9. Barriers to teaching about climate change that respondents have encountered.](image-url)
Eleven respondents discussed issues surrounding controversy about the topic and student belief systems as barriers to teaching climate change. Ten mentioned that they need more and better materials to teach the topic. Seven seemed to express confusion about the topic itself or frustration about their own understanding “both sides.” Five respondents said they didn’t have enough time to teach the topic.

Open-ended responses are divided by category below.

**Controversy Issues and Student Beliefs**
- Vocal school board members have approached administration, claiming that it is not occurring
- Students have been told that “global warming” is not real and that hurdle is hard to cross sometimes.
- dealing with a lot of misconceptions that the children have about climate change
- It does not conflict with MY religion/faith, but it does with my students’ beliefs.
- Students don’t “believe in it” and don’t understand why it’s important.
- In spite of these concerns, I teach it anyway. I make it fit into the weather unit and bring it up in any other unit I find that touches on it. I deal with objections (I’ve encountered a few from parents) as they come up.
- Students like to argue about the topic, but have little or no understanding and facts about climate change to back up arguments.
- The very strong anti-climate change rhetoric of the Republican base in this part of Texas – unfortunately.
- It conflicts with my students’ religion/faith.
- We have some parents that do not believe in climate change/warming
- students feel it is not a priority in their life, do not fully understand interconnectiveness and still see “movement” to be just for the tree hugger type

**Need for More Materials**
- More support materials – from both sides of the argument are needed – in order to give this topic the time and depth needed to really inform and educate students. I don’t feel teachers have those materials at their disposals and I have witnessed many schools that are taking this topic (environmental science) out of their course offerings as they see this as “fluff” and not “real” science course material which is VERY unfortunate.
- It’s new to our curriculum so I don’t have any well defined lessons yet.
- I have a strong basic understanding, but just need more data and evidence to share with students and better inquiry based activities to use in the classroom
- Lack of monetary resources/computer software that would be beneficial to student learning.
- To understand the broad scope of climate change students need to understand basic scientific processes which they seldom really do...
- Lack of good scientific resources.
• Teaching multiple grade levels and finding resources that would be of interest and ability level for all levels.
• I cannot find good materials to encourage an inquiry-based approach that supports developmentally appropriate learning.
• It’s hard to find simplified visual aids and videos for the children to view or use.
• Academic content is not enough to sustain interest in students. Relevant classroom activities are in short supply.

Confusion by Teachers; Needing to Teach “Both Sides”
• Right now I am very concerned over the global warming emails and the implication that data has been changed to fit what the result should be not what it is. How can I teach about global change if scientists are not being honest about their results?
• Climate change is a normal earth process. Welcome to earth, carbon based bipod.
• The science seems to be in question so I must be taught as a theory that some have
• Personal belief that global climate change is both premature and over-hyped, too much media, too little long term science investigation other than recent trends. I was taught in college courses that I took in the late 1960 that we were in fact entering into another “ice age”, and today, within my career lifetime I am to teach the other end of that continuum?
• There are several different hypotheses about climate patterns/changes. Students often think of only one possibility and sometimes they are incapable of keeping an open mind.
• There is a lot of biased information. It is hard to find hard data that is not leading towards a certain conclusion
• Teaching both perspectives of the issue within time constraints

Time Restrictions
• Time
• time crunch
• Just not enough time
• time constraints ... can only teach non standards topics after the state standards test
• fitting the material into a packed curriculum

Other Issues
• This year the answer “none of the above” is correct. Next year (2010-2011) the earth science portion of the course is being removed by the state and taught in the 8th grade.
• The issues above, that climate change is controversial and there are objections from parents and students are very real but they are not barriers for me. I have studied climate change/global warming intensely for the last 3 years and have a solid understanding of the issue. I can see where some of the above issues
would be barriers for teachers but I choose to teach the science about CC, evolution and the big bang instead of being influenced by public perception.

- Only include as relates to space science primarily. However, we plan to have a climate change camp this summer.
- Kids are not interested
- I try to fit it in with ecology lessons
- I try to incorporate scientific data into my math lessons. While, I do not teach climate change formally, I do discuss it in class.
- I could always learn more.
- Our school doesn’t have technological facilities in the science classrooms
- I wholeheartedly teach this in the USA, but found resistance to working on environment in Qatar, especially at first. We came a long way from March to June, but cultural expectations sometimes prohibit the overall motivation of working on this in Qatar. Other teachers are grasping on to this more and more. This is the main reason I came back to Qatar this year...to follow up with the GLOBE project. As a teacher who used it for 8 years, I know they would need support.
The following question was given to those who responded that they did not teach climate change science: *Which of the following factors influence your choice not to teach climate change (select all that apply)?* Responses are summarized in Figure 10. The most common factor selected was that the topic doesn’t fit with curriculum and standards, which was selected by nine respondents. Lack of knowledge was cited by five. Only two thought the topic was too controversial, one said it conflicted with their faith, and none were concerned about objections from others.

![Figure 10. Factors influencing respondents who do not teach climate change.](image)

Open-ended responses were as follows:

- *I do mention it and we talk about it briefly, but I do tell the students that scientists disagree*
- *For the younger children we talk conservation of resources (water and electricity) and loss of habitat, since these fit into their standards*
- *It is part of another curriculum.*
- *If I knew more about it, then I would be able to integrate into my curriculum through loggerpro or other vernier resources.*
- *District Administration*
The next question asked *What learning experiences, if any, have you had specifically about climate change (select all that apply)?* Responses are shown in Figures 11 and 11a. Figure 11a shows the responses disaggregated by the school’s percentage of Free and Reduced Lunch (FRL).

Television, film documentaries, and magazine articles were the most commonly selected sources for climate change learning, with over 200 picks each. Books, climate change websites, and professional development workshops each received nearly 150 selections. Conference sessions, college/graduate classes were less commonly chosen. The least-chosen category was school in-service experience.

![Bar chart showing respondents' learning experiences in climate change](image)

Figure 11. Respondents’ learning experiences in climate change.
What learning experiences, if any, have you had specifically about climate change (select all that apply)?

Responses were similar for all three categories of school Free and Reduced Lunch participation levels. Those from the highest FRL category were slightly less likely to have had learning experiences from books.

Figure 11a. Respondents’ learning experiences in climate change, disaggregated by FRL category.
Ten respondents to the open-ended option detailed the type of formal courses they had taken; two of these cited GLOBE training. Six people described their self-directed learning experiences. Four people each cited news reports and internet research as their learning experiences regarding climate change. Two described field experiences they’d had.

Open-ended responses were as follows:

**Formal Courses**
- One grad class: Energy and the Environment
- Participated in a week-long summer workshop paid through a grant. (My whole science department participated) As part of the grant we also took two on-line graduate courses on climate change.
- graduate level classes were online
- NCAR Climate Change Courses
- Summer internship with climate scientists at Lawrence Livermore National Labs
- I’ve actually presented on Climate Change science lessons for middle and high school level students at the Arizona Science Teachers Ass’n and the end of this week at the National Sci. Tch. Ass’n convention in Phoenix
- I have attended several workshops including a 1 day KidWind/NEED workshop in Louisville, KY and a 3-day Climate Change/EdGCM Workshop in Madison, WI.
- Globe training
- I completed the CU online climate literacy course this past summer sponsored by Mark McCaffrey.
- GLOBE training

**Field Experience**
- Field glaciological experience
- Saw first-hand in Alaska

**News Reports**
- Current daily news
- An inconvenient truth, and radio discussions, newspaper
- I read the journals Science and Nature weekly.
- news

**Internet Resources**
- Internet resources
- Internet research
- internet searches
- Various web sites on my own.

**Self-Directed Learning**
I teach elementary educators and our curriculum included both global warming and climate change. I had to research both topics. In addition my STEM partner taught me quite a bit when we were preparing the lessons.

The topic interests me, but I haven't been to a workshop specifically dealing with it. Some workshops mention it. The rest I research on my own. Some Science Olympiad events put a lot of emphasis on climate change.

- Extensive research through high school and college debate
- Personal research into the topic in order to better understand the topic
- Network with people working in the field. Political and environmental. I tend to self-educate.
- I did research for a project for Lego-Robotics with the Lego Robotics team

Other
- Volunteer at Nature Conservancy
- Had our local school district decline an opportunity to have Steve Running - climate scientist from University of Montana - make a presentation to the high school students last year.
- Friends that work as research scientists.
The next three questions did not include an open-ended response option.

The first of these questions was *Which of the following topics are you interested in (select all that apply)?* The results are shown in Figure 12.

All the topics listed were of interest to most respondents. Six of the seven were selected by more than 200 respondents, with *Options for reducing or adapting to impacts of climate change* being the most popular at 228 selections. *How the sun affects Earth’s climate system* was the least popular at 172 selections.

![Figure 12. Climate change topics of interest to respondents.](image-url)
The next question was *Which of the following topics do you know a fair amount about (select all that apply)?*

Results are shown in Figure 13.

Among the topics investigated by this question, the most information is needed about how scientists know what they know and local climate change predictions. Five climate change topics were selected by more than half the respondents—*How climate change affects life on Earth, How the sun affects Earth’s climate system, The causes and effects of rising temperatures on Earth, How we know human activities cause climate change,* and *Options for reducing or adapting to impacts of climate change.* Fewer than half the respondents knew a fair amount about *How scientists know what they know about climate* and *Climate changes predicted to happen where you live.*

![Figure 13. Climate change topics that respondents know about.](image-url)
The next question asked *Which of the following topics do you currently teach about (select all that apply)?* Responses are given in Figure 14. The topics were the same as those in Figure 13. By comparing Figures 13 and 14, we see that these respondents teach the topics they know about. It’s possible that if teachers had more information on certain topics, they would teach them.

Over half the respondents currently teach about *How climate change affects life on Earth, The causes and effects of rising temperatures on Earth, Options for reducing or adapting to impacts of climate change, How the sun affects Earth’s climate system, and How we know human activities cause climate change.* Less than half the respondents taught about *How scientists know what they know about climate change, and Climate changes predicted to happen where you live.*
The next question was entirely open-ended. It read, **What climate-related NASA educational and data resources are you already aware of? (please describe)**.

Over half of the respondents were not able to list any NASA climate-related resources that they were aware of. About a quarter of the respondents listed non-NASA resources, and 33 mentioned GLOBE.

Seventy-nine people left this question blank. About 25% of the respondents (73) said they were not aware of any climate-related NASA resources; eight others mentioned non-NASA resources only that they knew of.

Of those who listed NASA resources, 33 included GLOBE in their response. Another 76 did not mention GLOBE, but did list various NASA-related websites they were aware of.

Eight made related comments but did not include resources.

Responses were as follows:

**GLOBE**

- GLOBE resources  SOHO website
- Too many to list! I follow many of the current orbiting missions which study everything from CO2 levels to sea temps. I also use NASA Globe data as well as submit that data from our site.
- Project globe
- GGIT, GLOBE
- I have access to GLOBE educational resources.
- The GLOBE program and website helps me to look at data in other places, and other information on how to do activities inside the classroom.
- GLOBE curriculum
- I have used and contributed to the Globe program and I have used information from the NASA website before.
- Globe
- GLOBE  MY DATA  Interplanetary Institute  Global Studies at Huntsville AL
- GLOBE
- S’COOL  The JASON Project  The GLOBE ProgramISS EarthKAM International Polar Year (IPY)  Earth System Science Education Alliance (ESSEA)
- Globe science
- Globe resources that are available at the NASA center, on the GLOBE website, and available from our Globe trainer
- GLOBE protocols and some of the satellite programs
- GLOBE, GGIT
- SPRINTT curriculum; GLOBE studies
- GLOBE workshops and information listed on the GLOBE website.
• Earth Science Week in October, Coastal Investigations workshop, Our Amazing Sun, International Polar Year, International Year of Astronomy
• The Dynamic Earth NASA Observes Our Ever Changing Planet DVD  GLOBE atmosphere protocol  SCOOL Students Cloud Observation OnLine Program
• GLOBE Lessons Plans and Training Program
• GLOBE training material
• G.L.O.B.E
• google earth  GLOBE  NASA/BCC climate change course
• Web sources
• GLOBE, climate curriculum model, epa
• The GLOBE program
• I teach the Signals of Spring. Attended class/workshop on Noctilucent Clouds in Alaska, which lead to my Globe certification.
• GLOBE
• GIS, GLOBE. I introduce both programs to 11th grade biology classes and use them to allow the students to explore conditions they find most interesting.
• Globe databases (The NASA IVV ERC is also a Globe partnership facility and we do Globe workshops)
• GLOBE - 1. Dr. Kevin C. out of Toledo, Ohio - taken 1 classes with him and participated in 1 of the investigations. Plan to train teachers in it this year. 1. Taught GLOBE for 1 years, going on 1. especially hydrology, air pollution and weather.
• NASA has several websites dedicated to the science and science education of climate change; NASA has several satellites dedicated to observing climate change; GLOBE protocols are designed for students to develop a vested interest in their Earth by observing and recording atmospheric and water quality data.

NASA but not GLOBE
• I use the website NASA.gov and access information through the website and I am on a list serve that sends data and information too.
• My NASA Data web site,
• Climate data on our area and other areas around the world.
• Online sources that I would need to look up at this moment but I have them filed away for use. NASA is a great resource for this unit and my Astronomy unit each year.
• from NASA web site
• website
• I have used EdGCM model, funded by NASA, in my classroom.
• Just the NASA website.
• I have referred to the NASA webpage.
• climate.NASA.gov  earthobservatory.NASA.gov  giss.NASA.gov
• The GISS site ```Common sense....``  climate.NASA.gov
• http://climate.NASA.gov/esw/
• Even though it is not directly part of global climate change, I use the video models from NASA showing the molecular interactions in ozone depletion in the
stratosphere. I also use various websites that have information about global
climate change.

- Website maintained by NASA.
- JPL, Goddard Institute, GOES satellite
- Earth Science run out of MSFC
- I've taken various tidbits from the NASA site, but nothing specifically from NASA.
- Satellite data on JPL website.
- an abbreviated list: MY NASA Data, Science @ NASA newsletters, the 4
  spheres poster series (Ice, Water, Land, Air), NASA Exploratorium, NASA Edge;
  plus the UCAR materials
- JPL site, Eyes on the Earth, Goddard Institute for Space Studies, Earth
  Observatory, NASA Climate Change website
- S’Cool site, Aqua & Terra Satellites
- I know they have a climate change website, and that you can access a lot of data
  for use in classes but I have not used it before, just looked.
- I'm familiar with the educators guides on NASA’s website
- I'm aware of their web site
- NASA course through BCC
- just what can be found via web browsing
- Imagine the Universe, TOMS
- Mostly----resources out of Goddard.
- I try to use whatever is of value for climate change on their website.
- web resources
- I have used some NASA and NOAA/NCAR websites Snow and ice data center
  (does that count?)
- RISA CLIMAS site at the University of Arizona and projects related to US-Mexico
  border climate change
- website, posters, postcards
- AIRS image of global CO2, El Nino, Terra satellite.
- Global Climate Change web site
- I have used a NASA website on climate.
- Sun-Earth Connection GRACE mission Sophia
- History of Winter - Global Snowflake Network, Lake Ice Studies, Snow pit data
- NASA research is frequently cited in the literature. I've read a number of articles
  by James Hansen...
- Satellite imagery showing changes in sea ice and other landscapes; aerosols
  and cloud formation data through the CloudSAT program
- BAESI workshops, websites
- learnreturn.com/resources, eosweb.larc.nasa.gov, science.gsfc.nasa.gov,
  landsat.gsfc.nasa.gov/education
- website and email related to Sun-Earth connection
  climate/index.html
• NASA's climate science education materials, satellites collecting atmospheric data, MY NASA DATA website, NASA-AIM website
• I receive regular emails from the following: NASA's Earth Observatory
• I am familiar with the NASA, NOAA, COSEE sites.
• Cryosphere data from satellites and ice cores, and ocean drilling projects.
• I use the NASA website for a number of images and other important data and support. I have some lessons that came from a branch of NASA through a workshop that I took.
• NASA programs for teachers, web site
• Visits to center, educational materials, DVD, posters
• "Climate change kids website", "Exploring the Environment" web activities. I use these sites and activities to inform and connect my students with their environment and the changes.
• Some of the curriculum information and material that I use from the Massachusetts "Teachers' Domain" site have connections to NASA.
• I have occasionally used the NASA web pages to search for information, but other than that, not much
• There is a good climate change site that I think is supported by NASA.
• I know there's a new website dedicated to the topic but I haven't really used it yet. I rely mainly upon UCAR and NCAR resources.
• on line resources
• web site
• Just what is on their website
• NASA website links
• on-line lessons
• Climate Change Resource Reel
• I attended the workshop at the Little Red School house on environmental science. We learned how weather affects environmental factors and how environmental factors affect weather.
• Discovery videos/ NASA footage etc
• I recently discovered the NASA climate change website. I have used mostly NOAA and other resources.
• International Polar Year resources, Polar-Palooza (not sure if linked to NASA)
• Great Global Investigation of Temperature This program involves students, teacher and scientists on discussions about the Climate and Global Warming.
• Climate.NASA.gov - website NASA Educational Resource Center - Huntsville, AL (workshops and educational materials)
• A-Train Satellite technology from week-long workshop at Hampton University facilitated by NASA. Many resources provided by NASA through partnership as a NASA Explorer School
• data in the classroom--used in middle school briefly
• The Datastreme programs, Windows to the Universe website, various other web sites that deal with arctic/antarctic ice, DEP "Surf your watershed" site, one cd's that NASA has put out about the sun, and the websites of workshops that I have taken.
• I'm still in the planning stages for the Spring Project on Biodiversity and Climate Change. I'm not sure if the following websites are NASA related: 1) UCAR's Project Budburst 2) GigaPan Conversations 3) Network of Conservation Educators and Practitioners 4) WW2010 5) NOAA’s Significant Event Imagery website

• EdGCM would be a great tool that every science teacher could use- I think this modeling software would show students how scientists model climate change and allow students to do the same. It would remove a lot of the "doubt" that many people seem to have. Unfortunately, these resources are not affordable to most schools and most teachers don't know about them- more money needs to be put towards providing these resources to everyone. Animations from UW-Madison and Carleton College website collections are helpful as well.

• http://www.kidsforsavingearth.org/ The best site is Climate Change for Teachers. They sent us a kit for teachers that is no longer available: http://www.epa.gov/climatechange/wycd/school.html I photocopied the wheel that taught about what students can do. I like the Climate Change Toolkit at http://www.globalchange.gov/resources/educators/toolkit/materials There are materials that are readily available for download and are also updated regularly. I like these two sites: http://climatechangeeducation.org/ Teachers' Guide to High Quality Educational Materials on Climate Change and Global Warming at http://hdgc.epp.cmu.edu/teachersguide/teachersguide.htm

• AIM (Aeronomy of Ice in the Mesosphere) mission. Changes in the frequency and extent of polar mesospheric clouds and the connection to climate change, AURA (and Earth -observing satellite looking for evidence of climate change), Datastreme - Earth's Climate System

Other Sites Mentioned Besides NASA

• The American Meteorological Society has a graduate level course in Climate studies

• I use the NOAA and NSIDC web resources regularly...I am not familiar with NASA resources.

• I'm not aware of NASA related materials. I have some from NOAA and the Maury Project.

• NOAA

• NOAA is the main source

• NCAR and NOAA

• Windows of the Universe -UCAR Helioophysics / space weather- TCU

Other Comments

• Gee - I am one of those "vacuum" learners and I just take notes and build my lessons. Anything that you produce should be print ready, simple (check reading level), effectively use my time. DO NOT SPEND A LOT OF TIME MAKING LESSON PLANS.

• None; I would LOVE to have some and learn more!
- I do not currently use any resources directly related to NASA, but I am sure that some of the information I present can be linked to the info gathered from seminars and workshops that I have attained over the years.
- None that I am aware of being available in the field of curriculum materials or curriculum guides.
- Nothing comes to mind by name.... randomly over the past 16 years I have come across and attended amazing NASA programs, used resources, and visited websites.
- I am not aware of any specific NASA related resources on climate. I have received some posters and information in classes I have taken.
- I want to know about opposing viewpoints. I would like to know about the pros and cons of using alternative resources (i.e., biofuels, solar...); as sometimes, the cost of producing can be high. Or, for example, nuclear energy - sure it is clean, but what about all of the radioactive waste - that is horrible and we have no real place to store - I want to hear about that information!!!
- I can’t think of any. My 7th grade classes get a 3 week overview of environmental topics of which global warming is only one. I have 7 websites currently in the global warming “web quest” that are more descriptive of the general concerns than “data resources”. I am convinced that overpopulation and associated problems of water shortage, food production collapse, and general environmental poisoning will create problems of such enormous proportions that global warming will soon assume a more minor place in the legacy of environmental disaster our species is creating.
The next question was *Which of these common misconceptions have you encountered in your students’ understanding? (select all that apply).* Results are shown in Figures 15 and 15a.

The four most common misconceptions, cited by over half the respondents, were as follows:
- *Earth gets closer to sun in summer, and is further away in winter*
- *If climate change is happening, it is due to natural cycles of the Earth*
- *The greenhouse effect is bad and caused by humans*
- *Climate change is caused by the hole in the ozone*

The four least common misconceptions, cited by fewer than a third of respondents, were as follows:
- *Fossil fuels are not formed from organic matter (the bodies of plankton, plants, and animals)*
- *Human activities are changing the total amount of carbon on Earth*
- *Climate change is caused by water vapor, which isn’t related to human activities*
- *The atmosphere is so big that human activities can’t change climate*

![Bar chart showing student misconceptions encountered by respondents.](image-url)

**Figure 15.** Student misconceptions encountered by respondents.
Which of these common misconceptions have you encountered in your students’ understanding? (select all that apply)

- Earth gets closer to the sun in summer, and is farther away in winter
- Gases do not have mass/weight
- Matter is destroyed when it is burned
- Plants build their bodies from water and nutrients from soil, not from CO2 in the air
- Fossil fuels are not formed from organic matter (the bodies of plankton, plants, and animals)
- Climate is basically the same as weather, so it's difficult to predict
- If climate change is happening, it is due to natural cycles of the Earth
- Human activities are changing the total amount of carbon on Earth
- The greenhouse effect is bad and caused by humans
- Climate change is caused by the hole in the ozone
- Climate change is caused by water vapor, which isn't related to human activities
- The atmosphere is so big that human activities can't change climate
- Extra greenhouse gases in the atmosphere, like CO2, have not been proven to cause warming
- None of the above

Figure 15a. Student misconceptions encountered by respondents, disaggregated by grades taught.
In addition to the choices given, a number of other misconceptions were mentioned by respondents. Seven cited some variation on whether climate change is a solidly-supported scientific issue or some combination of politics, funding, or other agendas. Three respondents mentioned misconceptions that confuse current weather patterns (cooling) with overall climate change (warming).

Open-ended responses were as follows:

**Scientists are Promoting it for Their own Agendas**
- There is a conspiracy among scientists to make up climate change so they can make money or get funding for their research.
- Many students think scientists are promoting global warming for political or personal reasons.
- That there is a LOT of disagreement among scientists about the data.
- Climate change isn't going to get bad (it is just a scare tactic), so we don't really have to change our behavior.
- Essentially it is up for debate where the majority of hydrocarbons come from (biological vs abiotic sources).
- All the "carrying on" about global warming is just a political agenda by the liberals.
- Evidence for dramatic climate change is a political issue more than a scientific one.

**The Weather is Colder, so Climate Change Isn't Real**
- Northeast Ohio had a very cold summer so global warming can't be happening. We had a record amount of snowfall last year so global warming can't be happening.
- It was cold the other day, so that means global warming isn't happening. Some glaciers are growing, so that means global warming isn't happening. Rich people cause global warming and poor people don't.
- But it was so cold this summer, global warming isn't happening (still not accepting climate change)

**Other Misconceptions**
- IZZIT video "Unstoppable Solar Cycles" has caused me some confusion.
- Earth is getting closer to the sun.
- There are many misconceptions about ozone, greenhouse effect, and global warming...all rolled into one big confusing idea in many of my 9th grade students' minds.
- Climate change has only been studied for a few years. Carbon dioxide can't be bad because plants need it. Climate change happened in the past when there were no humans so we can't be causing it now. We can't possibly make accurate predictions about the future. We don't know if the increase in co2 is due
to human activity. An increase in global average temp as small as 2 or 3 degrees is no big deal. Some of my students will visit web sites like heritage or The Heartland Institute and bring their arguments to class.

- Volcanoes cause more CO2 than any human activities
- do not discuss this, therefore, have no basis to comment
- My colleague explained to me about how the mass of a log is converted to CO2 and not to ashes. I just never thought about it. When I looked at your checklist I thought I had to comment about that. Now I have a baggie of the ashes that were left after burning a log. We compare the masses of the two. Where did all that matter go? It is an "AHA" moment every time!
- LOTS of kids make the ozone - global warming connection mistake. They're the two most famous environmental concerns, and most students in middle school know hardly anything about either of them.
- That we can not do anything so it doesn't matter OR That science will save the day so it doesn't matter
- Greenhouse gases are emitted from greenhouses (!)
- Carbon Dioxide is the most important green-house gas. There is more carbon dioxide in our atmosphere today than ever before, (throughout geologic time even)
- I've not yet assessed my student's preconceptions related to climate change. But I would modify a good baseline instrument, if you made one available.
- Note abiotic oil theory... See Thomas Gold and a host of Russian scientists. My students don't seem to have any knowledge of climate other than what they have read in textbooks and forgotten.
- Space rockets knock holes in the atmosphere. (I'm not kidding)
- If we reduce our current carbon footprints, we can cause an immediate change in global warming.
- ...a definite lack of awareness of effect on environment, and living things
- Other Natural occurrences, for example volcanoes, are causing an increase in the over all average temperature
- science can fix the problem
The next question asked *Would you be interested in attending the week-long in-person workshop at the University of Colorado, Boulder?* Responses are summarized in Figure 16.

Most respondents would be interested in attending the week-long in-person workshop in Boulder. The open-ended comments clarified that many are concerned with the cost of traveling to Boulder for a workshop and others are afraid the timing might not work with their schedule.

The open-ended responses were mainly in three categories:
- If the costs were covered, they could come (36 respondents)
- If the schedule worked for them, they could come (16 respondents)
- Expanding on why they would like to come (19 respondents)

Many of the other comments had to do with reasons they can’t travel or the type of workshop they’re looking for.

Open-ended responses were as follows:

**If The Costs Were Covered, They Could Come**
- *Cost is an issue.*
- *I'd love to attend a workshop but finances are always an issue.*
- *would love to come...can't because of travel expenses*
• I would like to attend but not sure I can afford the cost.
• Cost is a factor
• I would love to, but probably would not be able to do to cost. I live in Michigan.
• Can’t afford it.
• Only if fully-funded, including tuition, room, board, & transportation! I would consider paying my own transportation. It would have to be after June 10, 2010 - several PA schools dismiss later than that.
• Cannot afford to stay more than a week.....economy and school won't help with lodging.
• Would love to but there is no travel money for professional development.
• It would depend on funding and fees associated with the conference. I enjoy courses that are hands on and practical to the classroom. I also feel it beneficial to meet with the scientists who are doing the research. Would the conference include the option to receive graduate credit?
• But only if all expenses were paid. I could not afford to attend the conference on my own.
• My district has frozen all travel funds.
• I’d love to come to Boulder if I had my expenses paid for by my district or ICEE.
• Grant monies to assist in travel expenses (perhaps from NASA) would be very helpful in making this possible.
• I would be interested if I could get some financial help in attending.
• Can't afford to pay for it myself.
• My preference would be live, in-person (cost dependent)
• If I could find funds to pay for the trip.
• I must say perhaps - I don't know about the costs, etc.
• Depends on costs
• Are any scholarships available?
• If travel expenses are paid for. I can pay for lodging, just the flight would need to be paid.
• I would love to except for the expense of getting there.
• Also, cost would be an issue since I am all the way in PA.
• I would be interested but not sure how I would get there, travel expenses, etc.
• If it is no too expensive - as you know, teachers do not make much money
• If my county will pay for it!
• I would only be able to attend with financial aid assistance.
• whether or not I could afford the travel expense since I live in NJ.
• Possibly, it would depend on expenses
• Although I would need funding to attend.
• if it is fully paid training.
• The problem is the money.
• limited funds/advance notice of offers
• if the costs were covered- there are NO funds for professional development. however, the program could pay for the costs in lieu of stipend
If The Schedule Worked For Them, They Could Come

- but it would have to be the end of June. In new york state, we end on June 25. Everyone who has workshops for the summer forgets this, and our teachers often cannot attend such things
- Please make sure it is in JUNE so that teachers can attend. My summer break is June & July, but July is bad for me due to volunteer commitments.
- However, June doesn't fit my schedule.
- I have a 12 month teaching position, but if I know the dates in advance I may be able to work the workshop into my schedule
- If the timing worked out in my schedule
- last day of classes for us is June 24
- I would need to see if I can attend because we host summer day camp opportunities.
- It also depends on when in June this will take place (coverage of my classes, etc.)
- I already have plans for the entire month of June, but I think it sounds great.
- I would be interested but I will be traveling in Asia at that time.
- I am not sure what I am doing in June at this time.
- Note that the NYC school year ends at the end of June. If my principal would let me attend I would be there in a heartbeat :)
- Yes but I would need to know the exact dates because I have other plans for the summer.
- I'll be still training teachers in Qatar until 8-30-09. If you provide this workshop at a later date, please keep me informed. I'm very interested.
- Even thought I would love to attend the workshop, our school year doesn't end until June 26, 2010. It would be nice if you held the workshops closer to New York City. I am sure that there are a lot of people on the coast that would love to attend these workshops.
- It would depend upon dates

Expanding On Why They Would Like To Come

- I eagerly seek opportunities to learn more about the science of climate change.
- I serve as science coordinator for 50 schools (24 districts) in Western Arkansas. I do classroom mentoring, professional development, and curriculum alignment for those districts. I would like to participate in order to obtain more content knowledge as well as new techniques that could be used to teach climate change. I can than pass this information on to the 1000+ science teachers in my region.
- I would LOVE to!!!
- My first preference is to attend the workshop in person.
- LOVE to join you
- The opportunity to attend a workshop is exciting because I will be designing materials for special education and struggling students in grades 6-8 if teachers do not have the resources to help students learn at their individual learning
levels. I can take what I learn and help students own their learning in science class.

- I would prefer a workshop to the online course. I find it drives me more to use the material in class. I can also provide inservice training in my district if that’s allowed.
- This would provide more knowledge that I would need to better understand and relate climate topics.
- YES YES and YES!!! I would really enjoy the chance to solidify scientific ideas about climate change (what we know seems to change and I would like to nail down some ideas in my head better) and I have always wanted to visit CO. I would be able to share what I learn with my colleagues as well as my students! This past year I did some professional development related to our new school wind turbine, brought in community folks to talk about green jobs, created a plastic bottle recycling program at the high school, and I am on the Conservation and Sustainability for my home community. The more I know the more I can share! I learn best hands on!
- I would LOVE it!!
- If it is as great as Earthworks - I would love to attend!
- I would love to learn more. I could tell from your questions that you would address both sides and show different aspects that are not typically thought of as climate change.
- I've been waiting to do something in Boulder w/UCAR
- I would so love to attend - for my own edification, but it won't happen
- Sounds very interesting!
- I have found that participating on this type of workshop not only allows me to learn more about the content, but also to connect with other educators and share experiences. This component of the workshops has been great in my growth as an educator.
- I have attended a number of NSF workshops over the years and I find that the interaction with other instructors is just as beneficial as the workshops themselves.
- I would welcome the opportunity. I would also like to share the information with the other Geoscience teachers in my district.
- Would love to!!

Other Comments
- Maybe. I'd need more info.
- It would be awesome to attend but family obligations will prohibit me from planning to participate.
- I am director of an Audubon Camp in the summer which keeps me very busy.
- cannot travel
- I can not get away that summer, but still want the information
- I have small children
- If my husband could visit Boulder also!!
- attended workshop in 2003 through ucar/ncar that was amazing
• You may want to check on previous workshops provided on this topic at UW-Madison and contact them as possible presenters- it was great! Galen McKinley http://www.aos.wisc.edu/~galen/edu_teacher.html Mark Chandler/Linda Sohl (EdGCM) http://edgcm.columbia.edu/
• Is it possible to make it an integrated curriculum so that the modules are applicable for teaching Algebra II or higher math? Generally, the math incorporated is limited to simple math i.e. fractions and percents. Could there be a use for linear programming/matrices? Systems of Equations? Chaos Theory? Fractals?
• Health issues with my husband at home alone.
• Depends if the goals of the workshop match my personal development goals. I would not be interested in an introductory level course in the science of climate change, which I feel I have mastered. I'm much more interested in workshops which teaching teams actually design lessons, hands-on activities, formative diagnostic assessments and curricula, as opposed to being talked at by a subject matter expert.
• Maybe
• I have been and continue to be especially interested in aerosols and their effect on climate. I would like to continue some of the work I have done from MyNASA DATA and AIM workshops I have previously attended.
• Travel would be difficult
• "They" make me assign a textbook. All my neighbors send me their outgrown toys and games. I "shop" on tree lawns. My students bring me presents of giant mushrooms. I loan out field guides. I am impatient of wasted time. I teach a regular class that includes 40% IEP and autism kids.
• Not at this time
• But it's unlikely I could attend given the location, I live in Massachusetts.
• too far away
• I would be interested but the reality of getting to Colorado is pretty slim. It is hard for me to get away for a week from home and other work obligations.
• too far away
• If my school allows me to
The next question was *Would you be interested in taking the online course?* Results are shown in Figure 17.

Even more people (209) were interested in the online course than in the in-person workshop. A few expressed concerns about the timing and time required or the cost. Several emphasized that they would like to take it for credit.

Open-ended responses were mostly in four categories as follows:

- **Schedule Issues**—Concern with time required and timing (13)
- **Cost Issues** (7)
- **Taking Course for Credit** (5)
- **Expanding on why They Would Like This Option** (10)

Additional comments included the problems with online courses and other issues specific to the respondent.

Responses are included below.

**Schedule Issues**

- *Flexibility fits into daily schedules*
- *Again would depend on time and location of workshop.*
It depends on the amount of time involved and if it would be beneficial.
Again - it depends how many hours one would have to be on the computer, how much interaction there would be. So I should say perhaps.
This would be good--if it is conducive to my schedule.
If I could not travel to Co, I would take the online course.
I've found that I don't have the diligence to complete online courses, but it might have been because I was teaching at the same time. If I have time off, maybe I will be able to finish it.
depending on the pace and timing of the course
NOT during the academic year and only if there aren't narrowly limited time-frames in which lessons are available...I need flexibility.
I have very little free time.
However, it depends on time commitments and cost.
Dependent upon time and my schedule.
Depending on the time of year it is offered.

Cost Issues
• Cost is a factor
• If there is no cost
• Depends upon the cost
• Again, Cost?
• My husband has lost his job and cannot find another. An online class would probably be the way I would go because of the expenses related to traveling to Colorado. I would definitely be interested in learning more. There is something to be said about learning in a group. It's synergistic.
• If it does not cost anything.
• This will be more affordable for me.

Taking Course for Credit
• Yes, for credit
• Again, if the units contain applicable materials for mathematics, I am very interested. I am currently engaged in writing curriculum for WVDE on PBLs for Geometry and Pre-Calculus. Although, I do teach an Algebra I class as well. I've taken other graduate courses online so that would not be a problem. Possibly, if it is offered for graduate credit.
• only if "state approved" professional development credit could be arranged in an amount somewhat equal to the time that I would spend in active participation.
• Would continuing ed units be offered for purchase?
• For college credit

Expanding on why They Would Like This Option
• this option is more appealing to me.
• If I can't attend in person, I'd like to attend online.
• I have enjoyed and learned great amounts of information and possible resources in online courses.
• Yes, but would prefer face to face. But would do on-line if it was the only option.
• DEFINITELY!!
• If I would be unable to attend the workshop at Boulder, then I would like to take the online course.
• Easier for me
• This would be a "greener" way to take the course.
• That would be great!
• VERY interested.

Other Comments
• Not as likely as a classroom event.
• maybe
• Perhaps
• maybe
• Perhaps depending on time demands
• On site is easier as when I am home I will have to keep up with work activities, home and the on-line course. I find I have an easier time learning the material if I am immersed in it.
• My home computer is too slow to participate in online courses.
• I find that most asynchronous online course participants fail to participate in any meaningful dialogue. This results in the one way flow of information, which can be more easily achieved with a simple reading list.
• My son is in the Napa Sea Scouts & they plan a 6 week cruise to Alaska in celebration of the Boy Scout's 100th year anniversary. I'll be heading up to Alaska with my husband sometime during the summer.
• It depends. I like interacting face to face more than by other means. I have taken an online course.
• Not at this time
• Maybe, I would want to make sure that the coursework would not duplicate the courses I have already taken locally.
• Hard to be disciplined and there is less collaboration than with attendance at a workshop
The next question was *Would you be interested in using short, self-directed online modules on these climate education topics?* Results are shown in Figure 18.

This was the most popular option mentioned in the survey. With 250 selections, 90% of the respondents were interested in online modules.

![Figure 18. Interest in online modules.](image)

Many of the open-ended comments suggested features that would be appealing to the respondents. There were concerns that they be user-friendly and easily adaptable to the teachers’ needs.

Open-ended responses were as follows:

**Requested Features of Resources**
- *Would need to be user friendly.*
- *If they were well done - would like them to present both sides or at least mention that there are some who do not agree*.
- *Depending on the reading grade level.*
- *Maybe, if they deal with the subject on the college level.*
- *It would not currently fit in my curriculum, but I would be interested in teaching a green chemistry unit in which they might apply.*
- *If they’re more interactive than my web quests, they could replace it. If there are others addressing other global problems, I’d like to know about them.*
Will these modules include resources materials and experiments that could be used to drive student learning in the classroom? Yes, if they include math applications.

My favorite web-based delivery model for online modular instruction is WW2010, which integrates K-12 through graduate school modules that teach everything from the basics of weather to how-to obtain and interpret satellite data. I particularly like the thoughtful care that was put into the interface design to promote learning by constraining learning paths through logical sequences.

I would be interested in having my senior Environmental Research class view online modules.

Again, maybe. It would depend on how user friendly they are and how easily I could adapt them to my teaching style.

If it can be digested quickly, it may be useful, but I find that anything difficult to understand conceptually is very difficult to learn online.

references sites

Other Comments

Maybe. I'd need more info.
Depending on when during the year they were offered.
Yes!
Yes, for credit
If I can work them into the courses I teach. I could also present them to other teachers via staff development courses.
Sounds like a decent compromise
Would these modules be available for graduate credit?
I would love to know for me, and could reinterpret for younger children, but we do not hit your target audience.
I find that the more I learn, the better I can motivate my students. Even classes that are on topics I have had remind me of things I forgot. It makes me a better teacher.
Both for myself and/or students
maybe
This is less appealing to me.
I do not feel that I informed enough to use an online module
Maybe.
I find these more practical than a full online course.
Yes, as a refresher resource when needed.
If this helps me help student demonstrate mastery, yes.
Sure, show me some links so I can become more educated, & can then teach my students.
I find these modules excellent to use when I have the time to concentrate on the content.
Uncertain as I have never done something like this before.
Maybe
• I think this would be a helpful process for myself as well as teachers in my service area.
• Perhaps, but I really learn better in person.
• Maybe
• same comments as above. but short modules might be easier to be disciplined
The next question was presented as a matrix multiple choice, where respondents could select one of four responses—Disagree, Somewhat Disagree, Somewhat Agree, Agree—to indicate their agreement with two statements about global warming. The question was *From the perspective of your personal views, please indicate your level of agreement with the following statements related to climate change.* Responses are shown in Figures 19 and 19a. There was not an open-ended option to this question.

The majority of respondents either Somewhat Agreed or Agreed with both statements. The level of agreement was stronger with the first statement (*Recent global warming is caused mostly by things people do*) than with the second statement (*There is substantial agreement among climate scientists about the cause of recent global warming*). Figure 19a shows that there was more certainty among teachers of grades 9-12 than among teachers of grades 6-8.

For the first statement, 38 respondents either disagreed or somewhat disagreed. For the second, 89 disagreed or somewhat disagreed.

![Figure 19. Respondents’ agreement levels with two statements about global warming.](image-url)
From the perspective of your personal views, please indicate your level of agreement with the following statements related to climate change.

Recent global warming is caused mostly by things people do.
There is substantial agreement among climate scientists about the cause of recent global warming.

Figure 19a. Respondents’ agreement levels with two statements about global warming, disaggregated by grades taught.
The final question was open-ended, and read *Please enter any further comments on these topics in the box below.*

Seventy-two people offered additional comments that fell into five major categories as follows:

- Appreciative Comments (4)
- Requests for Further Information (13)
- Importance of the Topic (19)
- Indications of Teacher Concern About the Science and Controversy (11)
- Suggestions for the Resources and Courses (21)

Many of the respondents who offered comments were very concerned about the importance of the topic of teaching climate change, supportive of any opportunity for high-quality professional development and resources, and interested in resources that would be developed. Many gave details about the types of resources they needed or the topics they felt they needed further information on. The issue of climate change being one of politics and not one of science is of concern to many teachers and their students.

Responses were as follows:

**Appreciative Comments**

- Thank you for including me in the survey!
- thanks
- Thank you for offering more information on climate change!!
- Offering these courses online and to those of us who cannot attend is great. This will help to improve our teaching of these items in the curriculum. Thanks!

**Requests for Further Information**

- I would appreciate hearing back regarding opportunities to participate in the program if it is offered.
- Please get information out to teachers so they can be up to date with the latest information and materials to better educate our students.
- I need to know more. I am very interested in the science behind the claims for global climate change. There is so much rhetoric. I would love to know more about the data.
- I am the Chair of the Northeast Ohio Education Association Environmental Concerns Committee. We serve over 35,000 educators in Northeast Ohio. I would like to help you reach out to science teachers in our organization. Ken Riley krileyjr@yahoo.com
- I would be interested in learning more about the ICEE programs. miranda.jackson@dcs.edu
- thanks for all you do
- If ICEE has pilot projects for the classroom, I'm very interested in participating.
- I would like some direction on the reliability of IPCC reports.
• I am a literacy specialist in a gen ed classroom. I tutor students in science on a daily basis. The other thing I do is work with teachers who need specific lessons designed for science. When special needs students need portfolio items to demonstrate mastery, I design special lessons and activity modules for them. This process may be done for an entire classroom, a small group, a pair of students, or an individual. I also review science portfolios for grades 6-8 to make sure they are aligned with the standards of learning for our state. Working and learning from science educators so I learn from them while I learn the core material first-hand is an excellent learning strategy. When that is not possible, I like to research educational material that has a firm foundation in content and adapt it for student needs. I do this for fun with no compensation, so any resources or opportunities you offer are much appreciated!

• Participation in any and all of the activities would help me further understand the topic, create activities that would help my students discover answers on their own, and relate valuable information to my students.

• Keep me posted on what ever you end up publishing. It would be good to have material for my 6th graders.

• I would love to participate in professional development on this topic and would also like to have an interactive venue for my students to participate in the upcoming Copenhagen Climate Change talks.

• I would certainly be interested in attending the workshop for a week, to learn in more depth how to effectively teach the scientific content of this theme to my students and share pedagogy with my colleagues.

Importance of the Topic
• I think that much more should be done to educate people about the effects of global warming.

• I am glad that you are doing this. There are so many misconceptions out there and this will help clear them up.

• May your research be successful in reaching folks and helping them understand, what I think, is a crisis. Lack of potable water around the world will be the next sequential crisis.

• Can't wait to see what comes of this...this is an important issue facing our students and it's not in the California State Science Standards...so I have to teach the details of anaerobic respiration while Earth warms...

• A continuing outreach to educators on this topic of climate and climate change will certainly be beneficial to teachers and students alike.

• I am very interested in your project in terms of its ability to bring current relevant topics into the classroom. Good luck with its development.

• I teach a senior World Issues course that studies global warming and would love to have more resources and knowledge to share with them.

• Addressing climate change is critical at the secondary level. Middle school is the perfect time to introduce skills in evaluating data and making decisions. I hope my students learn to recognize good science and avoid being swayed by uninformed opinion.
The training is needed. There aren't many chances to get training about climate change, and to interact with scientists on this topic.

I try to work in environmental issues into both my chemistry and engineering classes. I think we have to be responsible and bring up these issues.

Due to the summit meeting next week my students have been actively researching online information. The big concern they have is the hackers that are recently keeping the news very active. This is a concern of mine and my students.

I think more needs to be taught concerning climate change and the effects that will occur because of it.

This is a hot topic for high school students--I'd like to see more of it discussed and I'd like to be armed with a wealth of information to share with my students and colleagues.

As teachers we need more of these professional development workshops on climate. It is so critical that teachers get a good understanding of climate and most of us did not learn about climate change in college. The more I learn about climate and climate change the more questions I have and the more I want to know. I hope you actually get to do these workshops!

I love Krulwich's Carbon video clips and use them in my classes. I also enjoyed the NPR Climate Connections series last year. Nonetheless there are LOTS of questions that I have and that my students have to which I would really appreciate more detailed answers! I want to go beyond "Inconvenient Truth". I want to understand more of the science of the causes both natural and human generated. This past year I mentored two students who did their senior project on climate change. Clearly students want to know some answers too!

There is a plethora of information on climate change online which actually makes it a bit difficult to sort out. I teach AP Environmental science, so I am accustomed to navigating environmental issues online. However, climate change is probably the most difficult topic that I teach since there is SO much information. Also, it is still highly controversial and therefore tricky to teach. I love the Inconvenient Truth, but I had some student resistance about being forced to watch it because my students interpreted it as a political move on my part, unfortunately.

Climate change affects us every day and its consequences are due to human interaction with the environment. Humans have used natural resources in a way that sustainability of the planet have been jeopardized for future generations. It is our responsibility to teach the new generations about things that can do to help our planet to recover.

We do need to work a little more expeditiously on finding alternative energy sources so that we can get away from the burning of fossil fuels. My only fear is that we may soon reach the point of no return. Of course the Earth would recover in a relatively short period of time, geologically speaking, a few hundred thousand years after the extinction of man. Our goal is to not be the source of our own extinction. Will we be able to adapt to the new conditions we are creating? Or is it too late?

I often feel overwhelmed by the topic of climate change. I am constantly being fed bits of information, but I have almost no formal training in meteorology or
climatology, so I almost feel as though I am faking it when I try to teach the material. I am SO MUCH more confident in the areas I studied in college and graduate school, and it is frustrating to feel so incompetent on a topic that is so important. Yet I look around me, and my fellow science teachers are, like me, only aware of bits and pieces. None of us feel competent to be resources for each other. If someone on staff could serve as a resource, we would all benefit.

Indications of Teacher Concern About the Science and Controversy

- I want very much to teach my students accurately about this serious issue. I need further instruction myself first. I am a bit leery about the "political" end of it but that will not keep me from teaching the facts.
- My answer "somewhat agree" to previous question mostly is to the word "mostly." I'm confident that humans are playing a major role in climate change, but don't know that natural variation has been ruled out as a roughly equal cause.
- With new rumors saying that global warming is not real and that data has been faked I don't know what to believe. My students also have questions and they look to me for the answers.
- After watching the IZZIT video "Unstoppable Solar Cycles" I'm frustrated with my own lack of knowledge. I need to have a firmer understanding of climate change but am limited to what is published (largely in textbooks I use to teach) and what is portrayed as a political battle in the media. Sometimes it's hard to know what information is credible and accurate and which is not. The topic has many implications for our future but the history of our awareness of climate change is somewhat rocky. I think as educators, we need help.
- I hear a lot of information that goes both ways. The changes are a natural cycle. They are caused by man. My opinion so far is that yes changes are part of natural cycle but man seems to be accelerating this cycle. Also this is a very complicated topic and I think the climate models are not accurate because we don't really understand all of the parts involved. Are we really warming? If we warm too much will the Gulf Stream stop and then climate will change drastically. It is very confusing
- I don't understand most of it and so it is hard to teach to the kids. Kids have a hard time with the climates -- Earth and Sun distances. They also think the sun revolves around the Earth. They don't get the cause and effects of what we do today affects the Earth. Recycling is just something we want to do and they understand the reasons behind it. I do try to tell them and when I do I fight opposition from parents and administrators. If you teach about Environmental Science then they think you are an activist. I join the Texas Master Naturalist....volunteer organization that is to help with nature. They are not activist. People think they are since they are volunteering to help out state parks and do volunteer work in the community. It states in the mission statement we are not activist, just concerned about the environment.
- My colleague from the university believes strongly about the human impact on global warming. I mostly agree with him but I am not sure that regular cycles of warming and ice ages are not the cause. I just am not sure. I listen and read commentary from both sides and I am not sure who to believe. I do lean toward
my STEM partner. I also think that if we are the cause of global warming and we do nothing we make the situation worse. If we are not the cause then living more simply would not be hurt anything and would save money.

- I would like to learn more about the causes and proofs of global warning from an educated professional dedicated to the study of the increase of temperature as it relates to global warming. I do see proof of global warming but do not understand enough about the topic to assume that the rise in temp is completely from global warming.
- I am particularly concerned about recent media articles relating a scientific-bias to any inquiry product that might refute or even temper the Pro-Climate Change majority in scholarly journals. Peer review of all aspects should be encouraged rather than denigrated as "worthless" data or lack of scholarly background.
- I don't like covering this topic because authors write on such a bias level that all the students are reading is other people's opinions without a lot of facts to back up what they are saying. Also, there are so many different properties that can be measured and different ways to measure them that it is hard to determine what factors are important.
- Since Earth Science is all about the different cycles of the earth. It is reasonable to teach that climate has its cycles as well. Talk radio broke the news that the major data and the scientists for global warming knowingly used incorrect data. So I'm very, very interested on how the data was collected and used. It looks like people wanted to make the data support their hypothesis, which is very bad science. Even sixth graders learn in class, not to change the data. You must record only what the experiment shows, not what you want it to show.

Suggestions for the Resources and Courses
- There should be a series of lessons that would demonstrate global warming in the lab
- I would like to explore resources that allow me to teach the students about climate change and keep to my standards. Spring is a perfect time for me as I will be teaching weather and climate in the spring.
- Local implications of climate variability and change are usually easier for students to understand and do something about.
- Need to look at all data and normal cycles to compare the differences.
- I have some students interested in the specific interplay of oceans and plankton in the climate change models. I would love more information to help them (2 sisters have worked on independent research projects).
- I would like to see curriculum support for smartboards, lessons developed in Notebook and ready to go. I would like to see opportunities to connect to GLOBE protocols.
- I hope a course will provide lessons that will be constructive and proactive rather than knee jerk reactive and based on fear. How do we make this topic real and immediate without resorting to fear mongering for middle and high school kids?
- I live in Georgia, which has seen a cycle of drought and a recent cycle of flooding. The plants are all off their cycles. I believe that you can definitely use Georgia as an example of the effects of Global Warming.
I think students need to hear positive ways in which they can make changes. They find the topic itself frightening.

I believe that we have taken great steps in informing people about global climate change and but that increase of knowledge has not created a large increase in the effort to change human behavior.

Perspectives and debates of scientists and researches at these workshops would be beneficial, with their corresponding data.

It is very difficult to find the real cause or causes of global warming.

It is becoming increasingly difficult to sift through media reports about climate change.

would like some info to teach about carbon cap and trade pros and cons since it is in the news would also like to get more info on carbon sequestration proposals, technology, pros vs cons

Thank you for working on enhancing educator’s knowledge on Climate Change. Once challenge I did not mention before is that I have found that Climate Change education is offered in elective courses that are not seen useful for college bound students. The more college prep teachers know about the topic the easier it will be to incorporate in the physics, chemistry and biology courses.

Students are currently struggling with the recent news releases that state that "Global Climate Change is a Hoax." Support needs to be given to teachers who live in areas where the general population does not believe in global climate change. Facts, activities, and support for the classroom in a "hostile" environment are very much needed.

I think the best way to educate teachers and to get them to educate others is by making as many of the resources available for the lowest price/most incentives. Offering free /low cost software (animations/EdGCM) or grants to purchase/use such software (EdGCM) is a start. Offering free/reduced cost graduate credits and housing to attend a weeklong workshop would be important as well. This may sound selfish, but many teachers, including myself, already spend a lot of our own money to buy things for the classroom because our schools do not have the money and teachers are getting laid off/RIFFed due to budget constraints. The more resources offered to teachers, the greater the response will be.

What do you know about resources for kids to learn on the web about these topics: Ocean - Oil Spills, Overfishing, Destruction of Coral Reefs, Destruction of Estuaries, Plastics Pollution, Dead Zones, Red Tide, Freshwater - Groundwater Pollution, Groundwater Depletion, Non-point source river and lake pollution, Sewage, Atmosphere - Global Warming, Ozone Depletion, Smog, Acid Rain, Land - Landfills, Toxic Waste, Soil Erosion, Mining, Life - Species extinctions, Deforestation, Evolving diseases, Resource management - Declining petroleum reserves

I would be interested in a workshop that promised richly integrated experiences in authentic practices of climate scientists in challenge-based explorations of the open questions that are still being explored by the field. In my experience, transmission of pedagogical content knowledge is most successful when I am provided with a compelling authentic challenge and have the time to experience the methods and analytical tools used by professionals in the field. Once the
experience reaches a natural conclusion, I need time to practice designing and constructing lessons based on the newly learned pedagogical methodologies.

- In light of recent climate science debate and the ongoing battle among countries to agree to policy regarding climate change, I think it is imperative to learn as much as we can to empower students to make wise decisions and to think for themselves. As a research teacher I would LOVE to explore how students can do independent research on climate science and to have access to the proper tools as well as mentors from university, labs and companies that conduct research on climate.

- I like the idea of what you are trying to do. Please do not let the "teacher of teachers" types lead you into the land of lingo and reinvention of the wheel (lesson plans, curriculum rewrites.) Make it topic driven, make it real science, come up with easy inexpensive activities that illuminate the idea, Do some research about what nonscience people like Limbaugh are saying and come up with science to counter the garbage. E-mail me the results. Good luck.

Other Comments

- I argue for clean air, water and environment
- We are all in it together: north-south-east-west
- Because of my curriculum that focuses on ecology, I've been limited as to what I can do re: climate change. The students have weather in grade 6, but little on climate. The grade 7 social studies curriculum is geography-based, so students get more exposure there as to what climate is. As for climate change I believe the best approach for my school is as we study ecosystems and what climate change means for all these various systems.

- I am also working with our environmental club (Youth Active for the Environment at Drew School = YEA DREW. I have attended a couple of short workshops on climate change and have studied a lot on my own because it is so important. I have also lead workshops on the Clean Air Challenge, an activity based program to teach students about energy sources and choice and the impact on the environment.
Appendix--Survey Instrument

ICEE Needs Assessment Survey

Thank you for your interest in the Inspiring Climate Education Excellence (ICEE) program. The first 200 respondents to this survey will receive a gift certificate. That number of responses has now been reached. Thus, the gift certificate incentive is no longer available.

However, we would still appreciate your completing this survey. At the end of the survey, you will be offered the option to sign up to receive information on teacher professional development opportunities associated with this project.

If you would like to continue to the survey, please select "Continue" below.

☐ Continue
☐ Exit

PARTICIPANT INFORMED CONSENT FORM -- October 2, 2009

You have been invited to participate in the needs assessment evaluation for the following project:

Inspiring Climate Education Excellence (ICEE): Teacher professional development in climate-specific teaching practices and the Essential Principles of Climate Literacy

Please read the following material that explains this research study. Your electronic signature at the bottom of this page will indicate that you have been informed about the study and that you want to participate. We want you to understand what you are being asked to do and what risks and benefits—if any—are associated with the study. This should help you decide whether or not you want to participate in the study.

This survey is part of a research project conducted by Susan Lynds, a faculty member in the University of Colorado at Boulder’s Cooperative Institute for Research in Environmental Sciences, 449 UCB, Boulder, CO 80309-0449. Ms. Lynds can be reached at 303-492-1714.
ICEE Needs Assessment Survey

Project Description: This research study will evaluate the Inspiring Climate Education Excellence (ICEE) project. The ICEE project is a three-year program that will develop climate change professional development opportunities for middle and high school science teachers. You are being asked to be in this study because your experience in science education will allow you to provide program designers with valuable guidance in designing the workshop. It is entirely your choice whether or not to participate in this study. Two hundred teachers will be invited to participate in this portion of the research study.

Procedures: If you agree to take part in this study, you will be asked to complete one online survey consisting of 20 multiple choice or short-answer questions. Participating should take ten minutes or your time. Participation will take place at a computer of your choice connected to the internet. You will be asked questions about your awareness of climate change science, your use of climate change science topics in your teaching (if any), and your interest in professional development workshops for teachers.

Risks and Discomforts: There are no foreseeable risks if you take part in this study. You may choose to not answer any question or choose to exit the survey at any time.

Benefits: The benefits of being in this study are that your experience will help the program developers in their design of professional development workshops for teachers.

Source of Funding: Funding for this study is being provided by the National Aeronautics and Space Administration (NASA).

Cost to Participant: There are no direct costs to you for participation in this study.

Subject Payment: You will not be paid for participation in this study.

Ending Your Participation: You have the right to withdraw your consent or stop participating at any time. You have the right to refuse to answer any question(s) or refuse to participate in any procedure for any reason. Refusing to participate in this study will not result in any penalty or loss of benefits to which you are otherwise entitled.

Confidentiality: We will make every effort to maintain the privacy of your data. Your email address will be used only for providing information about the project, if you indicate you would like it; your email will be removed from the survey response data and only an anonymous randomly generated number will be used to identify your survey responses. All data will be stored anonymously for analysis and reporting. At the completion of the study, all data will be destroyed. Other than the researchers, only regulatory agencies such as the Office of Human Research Protections and the University of Colorado Institutional Review Board may see your individual data as part of routine audits.

Questions: If you have any questions regarding your participation in this research, you should ask the investigator before signing this form. If you should have questions or concerns during or after your participation, please contact Susan Lynds at 303-492-1714.

If you have questions regarding your rights as a participant, any concerns regarding this project or any dissatisfaction with any aspect of this study, you may report them -- confidentially, if you wish -- to the Executive Secretary, Institutional Review Board, 563 UCB, ARCE Room A15, University of Colorado at Boulder, Boulder, CO 80309, (303) 735-3702.

An asterisk by a question indicates that a response is required.
ICEE Needs Assessment Survey

Authorization: I have read this paper about the study or it was read to me. I know the possible risks and benefits. I know that being in this study is voluntary. I choose to be in this study. I know that I can withdraw at any time.

I acknowledge that by selecting "yes" on this page, I create an electronic signature equal to my physical signature.

☐ Yes, I consent to participate in this study.
☐ No, I do not consent to participate in this study.

This survey opportunity is open to grade 6-12 teachers in the USA. Do you teach in the United States of America?

☐ Yes
☐ No

ICEE Survey

* What is your profession?

☐ Classroom teacher grades 6-8
☐ Classroom teacher grades 9-12
☐ Other (please specify)

ICEE Survey

* Please enter your school information below. This information is only for demographics; the school will not be contacted in any way.

Please enter the name of your school in the box below.

* What is the Zip Code of your school?
**ICEE Needs Assessment Survey**

* Do you teach about or discuss renewable energy or conservation in any of your classes?
  - Yes – Formal lessons
  - Yes – Informal discussions in class
  - No

**ICEE Survey**

* Do you teach about or discuss climate change in any of your classes?
  - Yes – Formal lessons
  - Yes – Informal discussions in class
  - No

**ICEE Survey**

* Which of the following barriers to teaching about climate change have you encountered (select all that apply):
  - [ ] It doesn’t fit into my curriculum and/or standards
  - [ ] I don’t know enough about this topic to teach it
  - [ ] The topic is too controversial
  - [ ] It conflicts with my religion/faith
  - [ ] I am concerned about objections from students/parents/administrators
  - [ ] None of the above
  - [ ] Other (please specify):

  [Please specify]

**ICEE Survey**
ICEE Needs Assessment Survey

* Which of the following factors influence your choice not to teach climate change (select all that apply)?

- [ ] It doesn’t fit into my curriculum and/or standards
- [ ] I don’t know enough about this topic to teach it
- [ ] The topic is too controversial
- [ ] It conflicts with my religion/faith
- [ ] I am concerned about objections from students/parents/administrators
- [ ] None of the above
- [ ] Other (please specify)

ICEE Survey

What learning experiences, if any, have you had specifically about climate change (select all that apply)?

- [ ] I haven’t had any
- [ ] College class(es)
- [ ] Graduate level class(es)
- [ ] School in-service(s)
- [ ] Professional development workshop(s)
- [ ] Conference session(s)
- [ ] Climate change-specific website
- [ ] TV or film documentary
- [ ] Reading book(s)
- [ ] Reading magazine article(s)
- [ ] Other (please specify)
ICEE Needs Assessment Survey

* Which of the following topics are you interested in (select all that apply)?

- [ ] How scientists know what they know about climate
- [ ] How the sun affects Earth’s climate system
- [ ] The causes and effects of rising temperatures on Earth
- [ ] Climate changes that are predicted to happen where I live
- [ ] How climate change affects life on Earth
- [ ] How we know human activities cause climate change
- [ ] Options for reducing or adapting to impacts of climate change
- [ ] None of the above

ICEE Survey

* Which of the following topics do you know a fair amount about (select all that apply)?

- [ ] How scientists know what they know about climate
- [ ] How the sun affects Earth’s climate system
- [ ] The causes and effects of rising temperatures on Earth
- [ ] Climate changes predicted to happen where you live
- [ ] How climate change affects life on Earth
- [ ] How we know human activities cause climate change
- [ ] Options for reducing or adapting to impacts of climate change
- [ ] None of the above
ICEE Needs Assessment Survey

* Which of the following topics do you currently teach about (select all that apply)?

- How scientists know what they know about climate
- How the sun affects Earth’s climate system
- The causes and effects of rising temperatures on Earth
- Climate changes predicted to happen where you live
- How climate change affects life on Earth
- How we know human activities cause climate change
- Options for reducing or adapting to impacts of climate change
- None of the above

ICEE Survey

What climate-related NASA educational and data resources are you already aware of? (please describe)

ICEE Survey
ICEE Needs Assessment Survey

* Which of these common misconceptions have you encountered in your students’ understanding? (select all that apply)

- Earth gets closer to sun in summer, and is further away in winter
- Gases do not have mass/weight
- Matter is destroyed when it is burned
- Plants build their bodies from water and nutrients from soil, not from CO2 in the air
- Fossil fuels are not formed from organic matter (the bodies of plankton, plants, and animals)
- Climate is basically the same as weather, so it’s difficult to predict
- If climate change is happening, it is due to natural cycles of the Earth
- Human activities are changing the total amount of carbon on Earth
- The greenhouse effect is bad and caused by humans
- Climate change is caused by the hole in the ozone
- Climate change is caused by water vapor, which isn’t related to human activities
- The atmosphere is so big that human activities can’t change climate
- Extra greenhouse gases in the atmosphere, like CO2, have not been proven to cause warming
- None of the above

- Other (please specify)

ICEE Survey

The ICEE project will hold a week-long workshop in June 2010 on climate topics, to include climate science, how to teach climate topics and how to include solutions information. The workshop will also be offered as an online course and portions will be made available to use as short self-directed modules.

* Would you be interested in attending the week-long in-person workshop at the University of Colorado, Boulder?

- Yes
- No

Comments:
ICEE Needs Assessment Survey

* Would you be interested in taking the online course?
  ○ Yes
  ○ No

  Comments:

* Would you be interested in using short, self-directed online modules on these climate education topics?
  ○ Yes
  ○ No

  Comments:

ICEE Survey

* From the perspective of your personal views, please indicate your level of agreement with the following statements related to climate change:

<table>
<thead>
<tr>
<th>Recent global warming is caused mostly by things people do.</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Somewhat Agree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is substantial agreement among climate scientists about the cause of recent global warming.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ICEE Survey

Please enter any further comments on these topics in the box below:

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ICEE Needs Assessment Survey

Please enter your name and email below to receive further information about this program. Your name and email address will not be used for any other purpose.

Please enter your name in the box below.

Please enter your email in the box below.

ICEE Survey

If you would like to be included in a list announcing climate change education opportunities, please enter your name and email address below. Your information will not be used for any other purpose than to notify you of opportunities arising from this program.

Please re-enter your email address below for confirmation.

Thank You

Thank you for your interest in the project.