



IPY/NSTA Symposium: Polar Science, Global Discoveries: IPY Research Update for Teachers Saturday, March 29, 2008

8:00 AM – 8:25 AM

Welcome, Introductions, Goals for the Symposium

Al Byers, Assistant Executive Director of Government Partnerships and e-Learning, NSTA

Flavio Mendez, Symposia and Web Seminars Director, NSTA

- About NSTA Symposia
- Agenda/Goals/Forms/Logistics/Introductions

Dr. Mary Albert, Senior Research Engineer, U.S. Army Cold Regions Research and Engineering Lab

Dr. Kathy Gorski, Albert Einstein Distinguished Educator Fellow, NSF Office of Polar Programs

Jo Dodds, Earth Science Teacher, O'Leary Junior High School, Twin Falls, Idaho

8:25 AM – 8:40 AM

Overview Presentation: The Importance of the Polar Regions in Global Climate Change

Dr. Mary Albert

Learning Outcomes:

After participating in the presentation,

- Participants will explain how climate science results led to the award of the Nobel Peace Prize this year.
- Participants will identify at least two discoveries from polar science that play key roles in Intergovernmental Panel on Climate Change (IPCC) conclusions.
- Participants will identify at least two impacts of climate change that will affect them.
- Participants will name at least two ways that their actions can help to mitigate climate change.

8:40 AM – 8:50 AM

Teacher Field Experience: IPCC Meets the Classroom

Jo Dodds

8:50 AM – 9:25 AM

Ice Sheet Forensics: Putting Current Climate Change in the Context of the Past

Dr. Mary Albert

Learning Outcomes:

After participating in the presentation,

- Participants will describe at least 2 different ways that evidence found in an ice core can be used to infer important indicators of recent and past climate.
- Participants will explain how we know that CO₂ levels are higher now than in the last 600,000 years.
- Participants will explain how we know that climate can change abruptly, in less than 10 years.



9:25 AM – 10:20 AM

Activity 1: Ice Cores: the Detective's Magnifying Glass

Jo Dodds and Dr. Kathy Gorski

Learning Outcomes:

After participating in the activity,

- Participants will demonstrate how to model snow accumulation to build a record of the environment.
- Participants will demonstrate how to retrieve an ice core from their model.
- Participants will describe how to analyze evidence in the core and explain what they found.
- Participants will describe how to access real ice core data to make their own graphs.

10:20 AM – 10:35 AM

Break

10:35 AM – 11:05 AM

Evidence of Current Climate Change in the Polar Regions

Dr. Mary Albert

Learning Outcomes:

After participating in the presentation,

- Participants will describe evidence that shows how we know that Arctic sea ice is decreasing.
- Participants will define albedo, and explain why it is important.
- Participants will explain the greenhouse effect, and why it matters.

11:05 AM – 12:00 PM

Activity 2: Ice Sheets: Modeling and Melting

Dr. Kathy Gorski and Jo Dodds

Learning Outcomes:

After participating in the activity,

- Participants will demonstrate how ice sheets form and flow.
- Participants will demonstrate the effect of melting ice on ocean salinity.
- Participants will describe the effects of changing ocean salinity on ocean currents.
- Participants will describe how changing ocean currents can affect local weather patterns.

12:00 PM – 12:10 PM

Continuing Conversations: Resources to Continue Classroom Studies once IPY Ends

Dr. Kathy Gorski

Learning Outcomes:

After participating in the activity,

- Participants will identify at least 2 new resources for classroom use.
- Participants will name at least 2 paths for the incorporation of IPY activities into traditional curriculum.

12:10 PM – 12:30 PM

Final Words

- Post-assessment form
- Evaluation form/Survey/Credit info
- NSTA Web Seminars
- Drawing of door prizes

National Science Education Standards Addressed: Content Standards, 5-8

Content Standard A:

Understanding about Scientific Inquiry

- Different kinds of questions suggest different kinds of scientific investigations. Some investigations involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.
- Current scientific knowledge and understanding guide scientific investigations. Different scientific domains employ different methods, core theories, and standards to advance scientific knowledge and understanding.
- Mathematics is important in all aspects of scientific inquiry.
- Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.
- Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories. The scientific community accepts and uses such explanations until displaced by better scientific ones. When such displacement occurs, science advances.
- Science advances through legitimate skepticism. Asking questions and querying other scientists' explanations is part of scientific inquiry. Scientists evaluate the explanations proposed by other scientists by examining evidence, comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations.
- Scientific investigations sometimes result in new ideas and phenomena for study, generate new methods or procedures for an investigation, or develop new technologies to improve the collection of data. All of these results can lead to new investigations.

Content Standard B:

Physical Science

As a result of their activities in grades 5-8, all students should develop an understanding of

- Transfer of Energy
 - A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A mixture of substances often can be separated into the original substances to form new substances (compounds) with different characteristic properties. In chemical reactions, the total mass is conserved. Substances often are placed in categories or groups if they react in similar ways; metals are an example of such a group.
 - Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.
 - Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.
 - Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection).
 - In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light, mechanical motion, or electricity might all be involved in such transfers.

- The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

**Content Standard D:
 Earth and Space Science**

As a result of their activities in grades 5-8, all students should develop understanding of

- Structure of the Earth System
 - Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans.
 - Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.
 - Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.
- Earth's History
 - The earth processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past. E
- Earth in the Solar System
 - The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.

**Content Standard E:
 Science and Technology**

As a result of activities in grades 5-8, all students should develop

- Understandings about Science and Technology
 - Scientific inquiry and technological design have similarities and differences. Scientists propose explanations for questions about the natural world, and engineers propose solutions relating to human problems, needs, and aspirations. Technological solutions are temporary; technologies exist within nature and so they cannot contravene physical or biological principles; technological solutions have side effects; and technologies cost, carry risks, and provide benefits.
 - Many different people in different cultures have made and continue to make contributions to science and technology.
 - Science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and technique. Technology is essential to science, because it provides instruments and techniques that enable observations of objects and phenomena that are otherwise unobservable due to factors such as quantity, distance, location, size, and speed. Technology also provides tools for investigations, inquiry, and analysis.
 - Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance.

- Technological designs have constraints. Some constraints are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety, and aesthetics.
- Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.

Content Standard F:

Science in Personal and Social Perspectives

As a result of their activities in grades 5-8, all students should develop understanding of

- Populations, Resources, and Environments
 - Causes of environmental degradation and resource depletion vary from region to region and from country to country.
- Natural Hazards
 - Internal and external processes of the earth system cause natural hazards, events that change or destroy human and wildlife habitats, damage property, and harm or kill humans. Natural hazards include earthquakes, landslides, wildfires, volcanic eruptions, floods, storms, and even possible impacts of asteroids.
 - Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.
 - Natural hazards can present personal and societal challenges because misidentifying the change or incorrectly estimating the rate and scale of change may result in either too little attention and significant human costs or too much cost for unneeded preventive measures.
- Risks and Benefits
 - Risk analysis considers the type of hazard and estimates the number of people that might be exposed and the number likely to suffer consequences. The results are used to determine the options for reducing or eliminating risks.
 - Students should understand the risks associated with natural hazards (fires, floods, tornadoes, hurricanes, earthquakes, and volcanic eruptions), with chemical hazards (pollutants in air, water, soil, and food), with biological hazards (pollen, viruses, bacterial, and parasites), social hazards (occupational safety and transportation), and with personal hazards (smoking, dieting, and drinking).
 - Individuals can use a systematic approach to thinking critically about risks and benefits. Examples include applying probability estimates to risks and comparing them to estimated personal and social benefits.
 - Important personal and social decisions are made based on perceptions of benefits and risks.
- Science and Technology in Society
 - Science influences society through its knowledge and world view. Scientific knowledge and the procedures used by scientists influence the way many individuals in society think about themselves, others, and the environment. The effect of science on society is neither entirely beneficial nor entirely detrimental.
 - Societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.
 - Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or

detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.

Content Standard G:

History and Nature of Science

As a result of their activities in grades 5-8, all students should develop understanding of

- Science as a human endeavor
 - Women and men of various social and ethnic backgrounds--and with diverse interests, talents, qualities, and motivations--engage in the activities of science, engineering, and related fields such as the health professions. Some scientists work in teams, and some work alone, but all communicate extensively with others.
 - Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity--as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.
- Nature of science
 - Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models. Although all scientific ideas are tentative and subject to change and improvement in principle, for most major ideas in science, there is much experimental and observational confirmation. Those ideas are not likely to change greatly in the future. Scientists do and have changed their ideas about nature when they encounter new experimental evidence that does not match their existing explanations.
 - In areas where active research is being pursued and in which there is not a great deal of experimental or observational evidence and understanding, it is normal for scientists to differ with one another about the interpretation of the evidence or theory being considered. Different scientists might publish conflicting experimental results or might draw different conclusions from the same data. Ideally, scientists acknowledge such conflict and work towards finding evidence that will resolve their disagreement.
 - It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists. Evaluation includes reviewing the experimental procedures, examining the evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Although scientists may disagree about explanations of phenomena, about interpretations of data, or about the value of rival theories, they do agree that questioning, response to criticism, and open communication are integral to the process of science. As scientific knowledge evolves, major disagreements are eventually resolved through such interactions between scientists.