

Utilizing GLOBE as an Inquiry-Based Teaching Strategy in the Shenandoah Valley

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ABSTRACT

The National Science Education standards state that, "Inquiry is a critical component of a science program at all grade levels and in every domain of science, and designers of curricula and programs must be sure that the approach to content, as well as the teaching and assessment strategies, reflect the acquisition of scientific understanding through inquiry." A focus group of science educators in the Shenandoah Valley of Virginia revealed that teachers wanted to incorporate more inquiry-based approaches but some felt they lacked appropriate lessons, class time, and equipment. Professors at James Madison University (JMU) recognized that Global Learning and Observation to Benefit the Environment (GLOBE), a hands-on science program in which students generate usable scientific data, could provide a potential solution, if introduced creatively and with the support of content education and equipment resources. The last week of June 2006, fifteen 4th-12th grade Shenandoah Valley educators attended a one week workshop on air quality, meteorology and the GLOBE protocols at JMU. The teachers were then tasked with incorporating GLOBE into their curricula in creative ways. The outcome is continuing introduction of the atmospheric and ozone GLOBE protocols in eight diverse ways in the Shenandoah Valley. Of particular interest are the schools who are introducing GLOBE to special needs groups, as a family extracurricular activity, and across the curriculum. This paper highlights the various implementations of GLOBE and discusses the anticipated benefits of inquiry-based learning in each application.



BACKGROUND

The SHENandoah Valley AIR Quality Initiative (SHENAIR) is a local government and university alliance which provides a science-based, regional response to air quality issues affecting the Valley. A team of scientists and planners is working to understand and improve overall air quality, not just localized ozone, by analyzing air as an intrinsic part of the Commonwealth's natural and economic systems. The needs of local governments drive SHENAIR. The Local Government Committee (LGC) is organized under the Northern Shenandoah Valley Regional Commission (NSVRC). The initiative is supported by both federal and local funding. A major objective of SHENAIR is to educate the general public, especially school children.

WORKSHOP

SHENAIR began by organizing a focus group of science educators in the Shenandoah Valley. The discussions revealed that teachers wanted to incorporate more inquiry-based approaches but some felt they lacked appropriate lessons, class time, and equipment. Professors at JMU investigated GLOBE as a potential strategy for efficiently introducing inquiry-based learning. The focus group indicated this would require the support of content education and equipment resources.



As part of GLOBE, K-12 students follow inquiry-based, hands-on protocols to make measurements of environmental parameters ranging from air quality to water to soils. The data are entered into and international database and then used by researchers, teachers and students. Implementation of the GLOBE protocols requires training and significant resources. Based on focus group input, SHENAIR elected to design a summer training institute for GLOBE and to introduce GLOBE as part of JMU's large pre-service teacher program.

In summer '06, SHENAIR supported fifteen northern and central Valley teachers to incorporate GLOBE lessons on chemistry of pollution, measurement of ozone and particulate, and impacts of air pollutants in the Shenandoah Valley. The participants were selected competitively based on essays submitted. They ranged from elementary school resource educators to high school science teachers from the areas of Harrisonburg City; Frederick, Rockingham, and Winchester Counties; and the Tidewater area. The teachers received continuing education credit and a stipend in exchange for participation.

COURSE OUTLINE

This workshop introduced the issues and science surrounding air quality and examined how this content can be used to bring an inquiry and problem solving focus to science instruction. Professors at JMU presented the content lectures in the morning portion of the workshop. Beginning with meteorology, teachers studied components of air and how air moves globally to transport pollutants. Studying the chemistry of air pollution included examining ozone and particulates in the Shenandoah Valley and what factors influence these pollutants. Indoor air, impacts of air pollution on human health, regulation of air pollutants, and the technologies used to monitor and control air pollution rounded out the course topics.

GLOBE instrumentation and protocols were introduced as tools for inquiry-based air and air quality instruction. Participants were certified in GLOBE atmosphere protocols by GLOBE trainer Irene Ladd from NASA. GIS, for which software was recently made available in all schools in VA, was introduced as a tool for analyzing scientific problems. Participants learned about exploring the use of spatial analysis in science instruction.

The following are schools who are introducing GLOBE to special needs groups, as a family extracurricular activity, and across the curriculum.

"By applying the GLOBE protocol across the curriculum, schools can enhance students' abilities and provide a more in depth look at how science really works."
Case 2 Educational Team

IMPLEMENTATION - Case 1

Science Family Night for Parents and Children
Chuck Heckman
Rockingham County Elementary School, VA

General Goals of the Evening: (1) Positive parent/school interaction (parents see, firsthand that school delivers functional and fun science activities), (2) Positive parent/child interaction with science emphasis, (3) Increase community awareness of environmental concepts/issues/science in an enjoyable community setting. There will be three stations each lasting a duration of 10 to 15 minutes. Parents and children can rotate through all three stations.



Station/Lesson 1: Smog City and the EPA "Energy Hog" Computer Simulations

Concept Statement/Goal: Introduce parents and students to on-line resources that are informative, fun to explore, and helpful in family decision making. Using the websites SMOG City and the EPA Energy Hogs activity, families will have the opportunity to experience the results of scientific investigation into local air quality and daily energy/environmental decision making.

Station/Lesson 2: Student Demonstration of Ozone Protocol

Content Statement/Goal: Students will have the opportunity to present the results of their work on recording ozone levels to their community. Parents will see their children doing needed research that impacts decisions by governments and businesses.

Station/Lesson 3: GPS Scavenger Hunt

Content Statement/Goal: Parents and students will get the chance to use the GPS system, following a pre-programmed path through 4 points to get the yearly "Trail Mix of Science" prize by using basic, beginner skills of the GPS system. A simple and active way to get our parents and students involved with some of the technology and with each other. Participants will understand how these orbiting satellites tie the world together with information they will be able to follow a simple pre-mapped set of steps to reach their prize, and interact with each other to find solutions to any problems along the way.

IMPLEMENTATION - Case 2

Ozone Across the Science Curriculum
Michael Jaycox, Russell Kohrs, Darrell Zook
Rockingham County Public High School, VA

By applying the GLOBE protocols across the curriculum, schools can enhance students' abilities and provide a more in-depth look at how science really works. The GLOBE ozone protocol involves a minimal time requirement for setup and implementation across a high school curriculum. By involving all levels of science classes from earth science to chemistry, the time commitment in any one class is minimal and the true interdisciplinary nature of science is revealed. Using the GLOBE protocols, each class will be studying a different aspect of surface ozone in order to produce a comprehensive picture of the impact of ozone on the local environment. Earth science students will study the effects of weather on surface ozone, chemistry students will examine the reactions involved in the formation of both surface and stratospheric ozone, and biology students will examine the effects of ozone on local flora. The end result will be a comprehensive picture of science as a whole; rather than seeing each discipline as a separate topic, students will see how all sciences work together to provide a clear picture of natural phenomena. These students will develop inquiry skills and also learn how science can be used to help understand and protect their local environment.



IMPLEMENTATION - Case 3

Special Needs Education
Janel Pidgeon
Frederick County High School, VA

The students have emotional disabilities and many are additionally identified as students with learning disabilities, so traditional learning modalities often do not succeed for these students. The opportunity for hands-on and real-life application of weather and air quality monitoring could spur the students on toward more involvement in the curriculum as well as lead to better understanding of the curriculum. The students are all members of an important subgroup for Standards of Learning, and every little edge students receive can make a big difference district-wide. With real-world data, students can make connections between the content of their courses and the news and issues that surround them in the community.

CONCLUSION

GLOBE is being adopted in the Shenandoah Valley as a vehicle for efficiently introducing inquiry-based learning. GLOBE protocols in particular are of great interest because they link students to their communities and to the global community. However, GLOBE requires equipment resources and in many cases content education of teachers. These can be provided through external funding, as they were in this case, but a focus group of teachers indicated there was still the challenge of limited classroom time due to multiple demands, especially those of the standards of learning exam. Fifteen teachers in a summer workshop developed creative implementation strategies, three are highlighted in this poster. JMU is tracking the success of implementation as it takes place in 2007.

