Environmental Health Sciences as an Integrative Context for Learning

Accomplishments, Impacts and Next Steps: Planning for Tomorrow

Annual Grant Meeting • June 22 & 23, 2006

NIEHS, Nottingham Hall Room 204 AB

NIEHS
National Institute of
Environmental Health Sciences

Environmental Health Sciences as an Integrative Context for Learning

Annual Grantee Meeting
June 22 & 23, 2006
Hosted by the National Institute of Environmental Health Sciences

Purpose of the Meeting

Welcome to the 6th annual meeting of the EHSIC Program grantees. As we begin the final year of this innovative seven-year program, we reflect on the impacts and outcomes of the past six years and plan for the future. The meeting is arranged so that day one is focused on presentations by grantees and from invited speakers. The purpose of the presentations is to (1) communicate the valuable contributions of the grantees, (2) understand the trends in science education policy and research, and (3) learn about other programs that focus on science education. Day two is meant to be a working meeting where grantees will share their ideas and identify attainable next steps for individual projects and for groups of projects. The focus of the discussions will be on strategies to further sustain the efforts initiated during the Environmental Health Sciences as an Integrative Context for Learning Program.

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NOTES:

Environmental Health Sciences as an Integrative Context for Learning

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Thursday, June 22, 2006 — Nottingham Hall, 204 AB

8:00 a.m. Load Shuttles and Depart for Meeting

8:30 a.m. Packet Pick-Up

9:00 a.m. Welcome — Anne Sassaman, NIEHS

9:10 a.m. Overview — Liam O'Fallon, NIEHS

9:15 a.m. Session I – Program and Project Impacts

Elementary School – Nancy Moreno, Baylor College of Medicine
Laura Hemminger, UMDNJ School of Public Health

Middle School – Jennifer Zoffel, Bowling Green State University

High School – Lisa Pitman, University of Miami

The purpose of this session is to highlight the key contributions and impacts of the EHSIC program and the nine projects that have been funded by NIEHS since 2000. The presentations are grouped by grade level.

10:00 a.m. Session II – Science Education Research and Policy: Change, Impacts, and Opportunities

(30 min presentations/presenter, followed by 30 min discussion)

Michael Kestner, U.S. Department of Education

Bruce Fuchs, National Institutes of Health

Susan Traiman, Business Roundtable

There has been considerable discussion taking place at the federal level regarding student performance and preparation in the science, technology, engineering, and math (STEM) fields. It has been well documented since 2000 that US student achievement as compared to their peers in other countries has not been the best. Recently there has been growing concern from the business and science communities about the ability of our students to compete in an increasingly global economy. The president has announced the American Competitiveness Initiative and acknowledged the importance of science education in his State of the Union address. But a major question remains – what is the best way of improving student achievement? What are the standards and how do you best evaluate impact of educational programs? In this session, presenters will discuss the various activities and changes taking place at the federal level, the possible impacts and opportunities that may present themselves.

12:15 p.m. Lunch at NIEHS cafeteria (on your own)

Participants will shuttle over to the NIEHS cafeteria for lunch.

1:45 p.m. **Session III – Educating, Exciting, and Encouraging the Next Generation of Scientists: Innovative Science Education Programs**

(20 min presentations/presenter, followed by 30 min discussion)

L. Tony Beck, National Center for Research Resources

David Campbell, National Science Foundation

Mike Humble, National Institute of Environmental Health Sciences

Debra Felix, Howard Hughes Medical Institute

Recognizing the changing landscape of science education and research, it is important to identify innovative science education programs. In this session, presenters will highlight current and upcoming programs, and their objectives. The presenters will also address how these programs fit into the evolving trends of science education research and policy.

3:30 p.m. Break

3:45 p.m. **Session IV – Creating Program Sustainability: Strategies to Avert Program Mortality after the Money is gone**

Introduction

- Brenda Hood, Washington State Department of Education

State Department of Education Perspective

- Brenda Hood, Washington State Department of Education
- Richard Dieffenderfer, Ohio State Department of Education
- Rebecca Bell, Maryland State Department of Education

A Master Teacher's Perspective on Sustainability:
Building with the Blocks you are Given

- Martha Adams

Synthesis of the day and plans for Day 2

- Liam O'Fallon

5:00 p.m. Adjourn for day & Load Shuttles

Return to Hotel

6:15 p.m. Meet in hotel lobby to go to dinner (Aurora)

Friday, June 23, 2006 Nottingham Hall, 204 AB

7:00 a.m. Load Shuttles and Depart for Meeting

8:00 a.m. Session V – NIEHS Strategic Plan and Vision for Science Education

The purpose of this session is to share with Dr. Schwartz the key highlights and impacts of the nine EHSIC projects over the last six years. In addition, the group will discuss with Dr. Schwartz the new NIEHS Vision and Strategic Plan and how science education can help attain the stated goals and objectives.

Session VI – Continued discussion on Sustainability

9:00 a.m. Project-by-project efforts

- Strategies each group has done to date: what's effective or not
- Role of State Dept. of Education
- Importance and role of evaluation

In this session, each project will briefly highlight the strategies they have used to begin sustaining their efforts. The discussions should address marketing and promotion of the curricular materials or models, especially in context of interacting with the State Department of Education. The purpose of this discussion is to identify successful strategies from lessons learned.

10:00 a.m. Marketing the Program as a whole

- NIEHS web space
- Promotion of one another's pages

This session will be an open, working dialogue with NIEHS web and communication staff. The purpose will be to identify the best strategies in which to promote educational materials developed by the nine projects within the EHSIC program. It will also address ways in which each project can promote the materials of the other projects. We should conclude this discussion with some actionable items.

11:30 a.m. Lunch (Box lunches)

12:00 p.m. Future possibilities/opportunities

- Individual projects
- As a collective
- Global environmental education

This session is to look forward toward future collaborative or individual projects. Based on discussions from the previous day and from recent interactions, what are some realistic next steps for sustaining individual and collaborative projects? We should conclude this session with a list of possibilities.

1:30 p.m. Publications (articles and book)

- Teachers
- Researchers
- Administrators

The purpose of this discussion is to focus on getting the word out on the successes of this program to the appropriate audiences through the appropriate venues. Teachers read certain journals/publications (electronic and print); principals/school administrators read others; and education researchers read others. An outcome will be to have a list of those publications/online resources, then have (groups of) people work to develop a plan of action to implement over the next 12 months. In addition, there appears to be a real opportunity for us to write a book on environmental health education. Therefore, other outcomes of this discussion will be deciding who would like to be a part of this book writing process, identifying who'll be on the editorial board, outlining major themes for the book, and setting a realistic timeline to commit to.

3:00 p.m. Wrap-up and Adjourn

3:15 p.m. Load shuttle and depart for airport

Special thanks to the meeting planning committee and all their hard work!

Jennifer Zoffel, Katie Frevert, Larry Johnson, Camille Martina

Speaker Bios

L. Tony Beck, Ph.D.
Dr. Beck received his Ph.D. in Molecular Biology and Biochemistry from the University of California, Irvine and Brookhaven National Laboratory and his postdoctoral training in Denver at both the University of Colorado Health Sciences Center on the molecular biology of brain development and the Eleanor Roosevelt Institute for Cancer Research on the posttranslational processing and nuclear targeting of hepatic and viral proteins. In

1990, he was hired by Life Technologies, Inc. (LTI), in Gaithersburg, MD to establish their Molecular Biology and Cell Culture Training Center. In 1992, he moved to Cellco, Inc., a hollow-fiber bioreactor company based in Germantown, MD, where he held managerial positions in Research Applications, Drug Discovery and Asia Pacific Business Development. In 1997 and 1998, Dr. Beck was a consultant for Walter Reed Army Medical Center and the American Registry of Pathology on protocol development for hollow fiber-based zero gravity cell culture experiments for NASA's Space Shuttle program. In 1998, he co-foundered Tissue Engineering Sciences (TES), Inc., where he served as VP for Research & Development. TES' R&D portfolio included bioartificial blood vessels, ex vivo arterial perfusion models and in vitro blood-brain barrier and pharmacokinetic systems.

In 2000, Dr. Beck joined the National Institute on Alcohol Abuse and Alcoholism (NIAAA) as a Scientific Review Administrator and moved to NCRR in 2002 where his programmatic responsibilities include the trans-NIH Human Embryonic Stem Cell Infrastructure awards, the Human Subjects Research Enhancement Program, General Clinical Research Centers and the Science Education Partnership Award (SEPA).

David Campbell, Ph.D.
David Campbell has been a Program Director in the Division of Elementary, Secondary, and Informal Education at the National Science Foundation since 2001. He works with several programs in the Education Directorate, including Academies for Young Scientists, Instructional Materials Development, Teacher Professional Continuum, Advanced Technology Education, and Information Technology Expereinces for Students and Teachers. In addition, David serves as the education representative on the Working Group for Environmental Research and Education, which coordinates the Biocomplexity in the Environment Program. David has a BS in Zoology, an MS in marine biology, and a PhD in Biological Sciences.

Debra Felix, MBA, M.Ed.
Debra Felix is the Program Officer for pre-college science education initiatives at the Howard Hughes Medical Institute in Chevy Chase, Maryland.

Felix earned her undergraduate degree in Biology and Education from Swarthmore College, and after teaching high school Biology, Earth Science and Psychology in New York City, completed MBA and M.Ed. degrees at Columbia University. Felix then spent time on Wall Street and five years as an Assistant Dean for Columbia Business School, followed by ten years as a consultant to universities, private firms, and international governmental institutions in the areas of post-secondary education, the recruiting and selection of students, international fellowship programs, financial aid, and graduate program development.

In addition to her position at the Howard Hughes Medical Institute, Felix is pursuing a Ph.D. in Education Policy and Leadership, serves on the Board of the National Science Resources Center, a collaboration between the Smithsonian Institution and the National Academies, and volunteers with Adventures in Science, a collaboration of the 4-H and NIH for children aged 8-11.

Felix lives in Kensington, Maryland with her husband, a neuroscientist, and their two children.

Bruce Fuchs, Ph.D.
Dr. Bruce A. Fuchs—an immunologist who did research on the interaction between the brain and the immune system— is currently the Director of the National Institutes of Health's (NIH) Office of Science Education (OSE). Dr. Fuchs directs the creation of a series of K-12 science education curriculum supplements that highlight the medical research findings of the NIH. The supplements are designed to meet teacher's educational goals as outlined in the National Science Education Standards and are available free to teachers across the nation. The office is also actively creating innovative science and career education Web resources that will be accessible to teachers and students with a variety of disabilities.

Prior to coming to NIH, Dr. Fuchs was an active researcher and teacher at the Medical College of Virginia, with grant support from both the National Institute of Mental Health and the National Institute on Drug Abuse. He has a B.S. in Biology from the University of Illinois and a Ph.D. in Immunology from Indiana State University. Dr. Fuchs has organized and participated in numerous science education outreach efforts directed at students, teachers, and the public. He believes that scientists should play an active role in communicating their research progress and findings with the community. Dr. Fuchs has organized more than a dozen "Mini-Med School" and "Science in the Cinema" programs for the public and the Congress since his arrival in Washington.

Michael Humble, Ph.D.

Mike Humble, Ph.D., is a Program Administrator in the Cellular, Organ, and Systems Pathobiology Branch, Division of Extramural Research and Training (DERT) at the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC. Dr. Humble oversees the extramural Fellowship program, as well as the research portfolios in skin disease, manganese neurotoxicity, obesity and the built environment, and circulatory/blood disorders. Dr. Humble is also a member of several teams of administrative staff overseeing the activities of extramural research consortia, including the Toxicogenomics Research Consortium (TRC), and the Collaborative Centers for Parkinson's Disease Environmental Research (CCPDER) consortium. Dr. Humble has performed research in skin cancer, as well as in the area of neurochemistry, and was a High School Chemistry teacher for six years. Dr. Humble has a BA in Chemistry from St. Olaf College, an MS in Chemistry from the University of Minnesota-Twin Cities, and a Ph.D. in Toxicology from the University of North Carolina at Chapel Hill. His favorite color is orange, favorite season is Autumn, favorite meal is a grilled cheese sandwich and a chocolate shake, and enjoys model railroading and playing his trumpet in his spare time. Go 'Canes!

Michael Kestner, Ed.D.

Professional Preparation
Ed. D. in Curriculum and Teaching, University of North Carolina-Greensboro, 1989
M.A. Ed. In Secondary Mathematics, East Carolina University, 1982
B.A. Ed. In Secondary Mathematics, University of North Carolina-Chapel Hill, 1973
High School Diploma, Terry Sanford H.S., Fayetteville, NC, 1969

Appointments
Program Specialist, Mathematics and Science Partnerships, U.S. Department of Education present

- Manage federal grants program
- Develop objectives, policies, and long range work plans
- Interpret and communicate program requirements, criteria, rules and regulations
- Provide authoritative leadership and guidance to department and state officials in planning, developing, and carrying out the assigned program
- Provide authoritative technical assistance in developing, planning, and evaluating programs
- Lead on-site monitoring teams and produce compliance reports
- Establish communications system with state coordinators and project managers
- Provide technical assistance to state coordinators regarding program implementation
- Initiate, plan, and provide leadership for national, state and local meetings, seminars, and conferences for the purpose of providing training to professional specialists on major program activities
- Research and develop program regulations and program guidelines
- Manage program analytical and evaluation contract
- Represent the agency at conferences and make presentations regarding federal programs
- Collaborate with external agencies to promote goals of the agency by serving on various committees
- Lead curriculum alignment review teams

Program Specialist Comprehensive School Reform, US Department of Education 2002-2003

- Manage federal grants program
- Establish system for grant reviews and serve on grant review panels
- Initiate, plan, and provide leadership for national, state, and local meetings
- Research and develop program regulations and program guidelines
- Hold roundtable discussions program officials and represents the Office in a variety of meetings and conferences

Susan Traiman, MS

Susan Traiman is Director of Public Policy at Business Roundtable where she oversees the Roundtable's work with chief executive officers of leading corporations interested in improving education performance and workforce competitiveness in the United States. Recently cited as "the most influential chief executive lobbying group in the U.S." by the Financial Times, Business Roundtable members are at the forefront of public policy, advocating for a vigorous, dynamic global economy. Prior to joining Business Roundtable, Ms. Traiman was Education Policies Studies Director at the National Governors Association and senior associate with the U.S. Department of Education's Office of Educational Research and Improvement where she served on the staff of the National Commission on Excellence in Education and contributed to the development of its landmark 1983 report, A Nation at Risk. Ms. Traiman has a B.A. in American Civilization and M.S. in Education from the University of Pennsylvania. She started her career as a seventh grade social studies teacher.

Science Education at the National Institute of Environmental Health Sciences: Environmental Health Sciences as an Integrative Context for Learning

The National Institute of Environmental Health Sciences supports an array of environmental health science education activities through a variety of extramural and intramural programs and activities. The purpose of these initiatives is to help individuals better understand the effects and risks to human health from physical and social factors. These initiatives stem from the NIEHS' recognition that the lay community requires greater knowledge about environmental health issues as they are increasingly challenged to make decisions on the risks and benefits of agents that permeate society. In addition, the NIEHS sees these programs as an investment in the future of our society and the environmental health sciences.

In 1993, NIEHS developed its first extramural program for ***K-12 Environmental Health Science Education***. Since then, there have been three initiatives within the program. The first, Instructional Material Development, supported the creation of instructional materials at all grade levels. These projects provided instructional materials that can be infused into existing curricula and to develop interesting and challenging materials for students. Grantees used a variety of media, appropriate for the intended audience, to address such topics as cell biology, toxicology, risk assessment, scientific process and methodology, and indoor and outdoor air pollution.

The second initiative, Teacher Enhancement and Development, supported projects to develop and implement teacher enhancement and development activities. The goals of this program were to:
1) enhance dissemination, utilization, and effective implementation of materials and curricula pertaining to environmental health science; 2) provide teachers with the disciplinary and pedagogical skills necessary for teaching environmental health science; and 3) link researchers in environmental health science with teachers at the K-12 level. Grantees within this initiative have trained more than 7,500 teachers around the U.S. to incorporate environmental health science education into their classroom.

Finally, the current and most innovative initiative, **Environmental Health Sciences as an Integrative Context for Learning (EHSIC)**, encourages partnerships among environmental health scientists, educators, and state departments of education with the goal of integrating environmental health sciences within a variety of subject areas (e.g. geography, history, math, art). Most importantly, all curricula are standards-based. The purpose is to improve overall academic performance as well as enhance students' comprehension of and interest in environmental health sciences.

The EHSIC program is multiphasic in implementation. The first phase included instructional material development and teacher enhancement and development components. The second phase has consisted of implementing EHSIC projects into classrooms. The third phase will be for evaluation of EHSIC impacts on student performance and development of plans to disseminate the EHSIC curriculum. Grantees are in Phase III.

In 2000, NIEHS made nine EHSIC awards that address elementary, middle and secondary school curricula, teachers, and students. The names of the nine Principal Investigators, their Institution and Project Title are shown in the table below.

Institution	PI Name	Grades	Project Title
Baylor College of Medicine	Nancy Moreno	K-5	The Environment as a Contest for Opportunities in School
Bowling Green State University	Charles, Keil	4-10	Project EXCITE
Maryland Public Television	Gail Long	6-9	Connections: A Collaborative Exploration of the Environment
Oregon State University	Nancy Kerkvliet	9-12	Learning Through Environmental Health Science Scenarios
Texas A&M University	Larry Johnson	6-9	Integrating Environmental Health Science in Rural Schools
University of Medicine and Dentistry New Jersey, School of Public Health	Audrey Gotsch	2, 5, 7	SUC2ES2
University of Miami	Lora Flemming	9-12	Atmospheric and Marine-Based Interdisciplinary Training (AMBIENT)
University of Rochester	Dina Markowitz	5, 7, 9-12	Problem-Based Learning for Environmental Health
University of Washington	David Eaton	6-9	Integrated Environmental Health Middle School Project

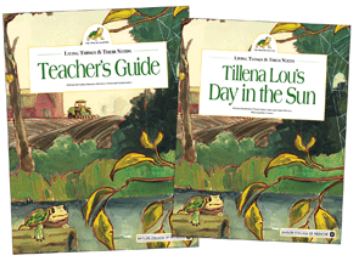
The accomplishments of the projects have been noteworthy.

1. Material development
   As a collective, the nine projects have developed seventy individual educational units (see Table of Materials). These materials address a range of environmental health science themes air, food, water, human diseases, science careers, research ethics and more. All of the themes are tied into two or more academic subject areas, and all are aligned to state and national education standards. Several projects have received awards or national recognition for their materials.
2. Teacher Professional Development and Impact
   The projects worked with teachers to train them on the materials or to help them develop and implement curricular materials in the classroom. The projects used different approaches. Some worked closely and intensely with a small cohort of teachers, whereas other projects elected a broader approach to a larger number of teachers, but with less time interacting with them. Teachers that were trained by the projects had significant outcomes in terms of their behaviors and understanding of environmental health. Projects evaluated these impacts using classroom observations, pre-/post-tests, and surveys. Projects showed that teachers using these integrative materials and problem-based lessons interacted with the students more. In addition, teachers increased their understanding of environmental health concepts.
3. Student Impacts
   The projects have shown interesting and significant preliminary findings from their evaluations. These impacts are captured through a variety of evaluation approaches including pre-/post-testing, surveys, student portfolios, and standardized testing. When possible, some of the projects compared student performance of intervention classes with control classes. What the projects have shown is that students who've been a part of an EHSIC class:
   - Possess an increased enthusiasm for science and learning
   - Perform better academically, especially Spanish-speaking and 'low achieving' students
   - Understand core environmental health concepts better
   - Possess greater confidence in academic abilities, especially problem-solving

The following section contains detailed descriptions of the nine projects and their key accomplishments over the last six years. In addition, at the end of this document, there is a complete listing of all the materials that have been developed by the projects.

The Environment as a Context for Opportunities in Schools (ECOS)

Grades Levels: K–5
Subjects Addressed: Reading, writing, communication, mathematics, science, social studies, health/fitness



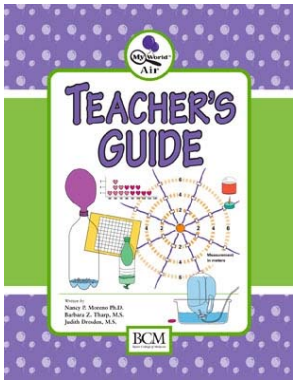
Baylor College of Medicine (BCM), Houston, Texas
Houston Independent School District ▪ Texas Education Agency
PI: Nancy P. Moreno, PhD

Project Description

Texas students are struggling to meet minimum expectations in science. In April, 2006, only 75% of fifth graders and 60% of eighth graders met passing standards on the statewide science assessment (Texas Assessment of Knowledge and Skills). The performance of African American and Hispanic students was even lower—only 59% of African American and 67% of Hispanic students met fifth grade standards and 32% and 39% respectively met eighth grade standards. Within the Houston Independent School District (HISD), which serves 210,000 predominantly minority and disadvantaged students—the situation is even worse. Not all 2006 scores have been reported, but only 65% of all fifth grade HISD students met minimum standards in science this year. Clearly, a growing city and statewide crisis exists in science education. The Houston Chronicle recently highlighted this local "crisis in sciences," and identified the improvement of elementary science as critical to ensuring that students have the foundation and enthusiasm to pursue advanced studies and careers in science, mathematics and engineering.[1]

The Environment as a Context for Opportunities in Schools (ECOS) project is a direct response to local and state needs for improved science teaching and learning in elementary schools. The ECOS project uses environmental health sciences themes to engage students and teachers in doing and learning science aligned with the Texas science standards (Texas Essential Knowledge and Skills). The project provides curriculum support, teacher professional development and all science materials for eleven HISD elementary schools. Six of these schools are organized into two study cohorts, where the project is investigating outcomes related to students' science learning and language use, and teachers' content knowledge development and classroom behaviors. The project has documented statistically significant gains in teacher and student content knowledge—with the largest improvements being observed among Hispanic students.

The ECOS project is based on the *My Health My World* and *My World and Me* science curricula, developed at Baylor College of Medicine (BCM) with funding from the National Institute of Environmental Health Sciences (NIEHS) and the National Center for Research Resources. Each integrated *My Health My World* unit covers an environmental topic from the physical, life and environmental health sciences perspectives. Each unit also includes an adventure story book (illustrated by T Lewis, co-creator of *Over the Hedge*), a reading/language arts component, mathematics extensions and an Explorations mini-magazine for use at home or in class. In *Mr. Slaptail's Secret*, the student storybook for the unit on indoor air and allergies—Riff and Rosie look forward to another fun summer together in Bright Water Corners. This adventure finds them observing their neighbor, Mr. Slaptail, dragging a big, dark bag down a moonlit road. As the mystery unfolds, the cousins discover that Mr. Slaptail's cluttered, dusty home is packed full of trash, recycled products and chemical products, like paint and glue. What makes Rosie sneeze? What does Mr. Slaptail do with all of his stuff? Students solve these and other mysteries as they progress through the adventure story and accompanying guided science inquiry lessons.



[1] Radcliffe J. 2006. Crisis in sciences. *Houston Chronicle*, Feb 7.

Project Implementation and Ongoing Evaluation

We are using a staggered cohort design to implement and investigate the effects of using integrated models for environmental health science instruction in elementary schools. Three schools participate in each cohort. The first cohort of three schools began using the ECOS-recommended curriculum in fall, 2003. The second cohort waited to implement the ECOS curriculum until fall, 2004, but did participate in student knowledge assessments during the 2003-2004 school year to provide baseline information. All six schools are in urban locations within five miles of one another. Demographics of the schools are given in Table 1.

Table 1. Student demographics of schools participating in the ECOS project study cohorts.

Cohort	*School*	*Number of Students*	*Percentage Enrollment of Underrepresent Minority Students*	*Percentage Enrollment of Economically Disadvantaged Students*
One:	A	370	94%	85%
	B	408	83%	82%
	C	621	25%	12%
Two:	D	712	54%	40%
	E	399	95%	76%
	F	614	24%	14%

The model was planned to involve teachers and students in grades 2–4 during the fall semester only at each of the schools. At the request of teachers, however, the implementation was expanded to include all grade levels at each school and to also encompass the spring semester.

The project curriculum consists of four *My Health My World* units (air, water, atmosphere and food) and two *My World and Me* units (living things and resources). Each unit consists of ten sequenced inquiry science lessons integrated with health, reading, mathematics social studies. In addition to environmental health science topics, the units cover science topics, such as the water cycle, required by the school district curriculum for each grade level.

Project related teacher professional development is ongoing. All teachers new to the program participate in two days of professional development in August before the start of the school year. The sessions consist of a general introduction and hands-on training on each of the activities in the units they will be using in their classrooms. Professional development also is provided for teachers already participating in ECOS and consists of two days of enrichment activities designed to further support their efforts to integrate reading/language arts and mathematics with environmental health science themes. A second full-day inservice is offered to all teachers each January. In addition, teachers met at least twice per semester with project faculty and staff.

Each of the schools now is beginning to customize its implementation of project-related units. Thus, units are being used at different grade levels than originally was proposed. In addition, even though we anticipated that each school would participate in the project for 6–9 weeks and involve grades 2, 3 and 4—now, all grades at all schools are participating and ECOS units are being used year-round as the primary hands-on elements of the science curriculum.

Project evaluation is focused on student science content learning and language skills, teacher content knowledge development, teachers' science teaching efficacy beliefs and teacher classroom behaviors.

Student science content knowledge is assessed through pre/post assessments for each unit. The assessments consist of 6–8 multiple choice questions and 1–2 open-ended questions (which are scored according to a rubric created by project faculty). Spanish versions of the tests are available. In addition, student standardized tests scores on the Texas Assessment of Knowledge and Skills (TAKS) fifth grade science assessment also are examined. Development of language skills by students is being documented through student writing samples. Three times per semester, all students write free-form essays in response to the questions, "What did you learn in science this week?" The writing samples are examined and the following categories of language usage are identified: statements of cause and effect; if/then statements; descriptions of processes (how something was done); explanation of science concepts; statements of facts; descriptions of observations; use of science-related words in an appropriate context.

Teacher content knowledge is measured before and after participation in a unit training. The teacher assessments consist of open-ended questions, which are scored by project staff. Teachers' science teaching efficacy beliefs are being examined using the Self-Efficacy Teaching and Knowledge Instrument for Science Teachers (SETAKIST). A subset of 20 teachers is being observed four times per year using the electronic version of the Stallings Observation Systems (SOS). The SOS allows a trained observer to log detailed information about classroom interactions and instructional behaviors, such as types of questions asked. These observations are expected to provide information about longer term changes in teacher behaviors.

Impacts (Students and Teachers)

Teacher Content Knowledge. Each cohort of teachers received professional development related to the units they would be teaching. In 2003, content knowledge of Cohort One teachers was measured pre/post during the summer professional development sessions using a different open-ended instrument for each unit. Overall, teachers' mean scores increased from 15.8 (53% correct answers) to 24.1 (80.3%) from pre- to post-test ($p < .001$, $df = 22$, $t = 11.219$, $d = 2.018$). In January 2004, teachers also completed pre/post content knowledge assessments on the individual units in which they were trained. Mean scores increased statistically significantly from 11.24 (37%) to 16.46 (55%) after the one-day workshop ($p < .001$, $df = 24$, $t = 9.074$, $d = 1.252$). In 2004, Cohort Two teachers achieved similar gains in content knowledge. Overall, teachers' mean scores increased from 13.8 (46% correct answers) to 21.1 (70.3%) from pre- to post-test ($p < .001$, $df = 26$, $t = 9.609$, $d = 1.471$).

Student Content Knowledge and Achievement in Science. Student content knowledge is examined pre/post for each unit implemented in classrooms throughout all years of the program. During 2003–2004, only the first cohort of three schools participated. Students in the second cohort of schools served as comparison groups. Students in both cohorts, however, completed pre- and post-assessments of content knowledge using instruments validated during the field tests of each unit. It is important to note that there were no statistical differences among Cohort One and Cohort Two schools on any of the pretests during 2003-2004. In addition, there was no statistically significant increase in student content knowledge scores among any Cohort Two schools during the baseline year of implementation. Among Cohort One schools, however, there were statistically significant gains in content knowledge at each grade level. During the 2004-2005 school year, student performance on unit-specific content examinations improved consistently in both Cohorts. The table below outlines specific gains by unit and grade level for the fall semester (similar patterns were observed in the spring semester) and provides an overall summary of student performance over all grades for the 2004-2005 school year.

Table 2. Student Content Knowledge Gains on Unit Specific Tests during fall, 2004-2005 (all schools).

Grade Level and Unit Taught (vary because of ongoing program customization by schools)	PreTest % Correct	PostTest % Correct	Gain	N	d
Fall Implementation					
Grades PreK-1 (Needs of Living Things) English	79.1	90.9	11.8 **	363	0.49
Grades PreK-1 (Needs of Living Things) Spanish	*75.4*	*87.7*	*12.3 ** *	*65*	*0.44*
Grade 2 (Water) English	40.4	62.7	22.3 **	204	1.25
Grade 2 (Water) Spanish	*32.7*	*69.3*	*36.6 ** *	*63*	*2.34*
Grade 3 (Air) English	49.7	73.2	23.5 **	299	1.08
Grade 3 (Air) Spanish	*34.7*	*46.2*	*11.5 * *	*23*	*1.01*
Grade 4 (Water) English only	55.6	77.8	22.2 **	115	1.27
Grade 4 (Global) English	34.2	47.5	13.3	12	0.77
Grade 4 (Global) Spanish	*34.0*	*46.0*	*12 * *	*15*	*0.89*
Grade 5 (Global) Spanish	*36.7*	*64.7*	*28 ** *	*15*	*2.68*
Grade 5 (Water) Spanish	*45.2*	*92.3*	*47.1 ** *	*13*	*3.36*
Summary of Student Performance (all units, all grades)					
All Grades, Fall and Spring semesters combined	55.5	74.8	19.3 **	2,349	0.77
All Grades, English, combined semesters	56.9	75.5	18.6 **	1,876	0.74
All Grades, Spanish, combined semesters	*50.0*	*71.8*	*21.8 ** *	*473*	*0.89*

Note: * - statistically significant at the .05 level; ** - statistically significant at the .01 level

As can be seen, Spanish-speaking students achieved slightly larger gains from the pre- to the post-tests than did the students in English-speaking classrooms. This outcome is consistent with results obtained from the unit-specific content tests and school-wide standardized tests in 2003-2004.

Data for the statewide tests administered in spring, 2005, showed a similar pattern in terms of improvements by Hispanic students. Minimum passing rates overall on the fifth grade science assessment were well above the district rate of 47%. In Cohort One schools, 75% of students achieved minimum standards, 66% of students in Cohort Two schools met or exceeded minimum standards. Even more importantly, Hispanic students' scores improved by six points to 63% in Cohort One schools and by ten points to 38% passing in 2005 in the Cohort Two schools. 2006 scores have not yet been released for individual schools.

These preliminary results suggest that the ECOS instructional approach, which emphasizes the application of reading and writing skills to real world environmental science topics, may have particular value for English-as-a-second language learners and Hispanic students.

Student Language Skills Development. Results from writing samples from Fall, 2004, have been coded. These results show increases in the numbers of science vocabulary words used in context and the numbers of if/then (cause and effect) statements, and a decrease in simple explanations of procedures followed.

F. Dissemination Strategies to Date

In addition to providing information about project research and outcomes through presentations, publications and workshops (see following section), we were able to add five schools to the original project design following requests by principals at each of the schools. These schools are participating in all project-related activities. However, the schools are contributing at their own expense by paying all teacher stipends and purchasing all necessary classroom supplies.

We are developing online teacher professional development workshops for each *My Health My World* and *My World and Me* unit. These "virtual workshops" will be made available on *BioEd Online* (www.bioedonline.org), BCM's peer-reviewed website for teachers. Three unit workshops have been videotaped and are in production to be delivered through streaming video synchronized to PowerPoint slides. *BioEd Online* werves approximately 3,000 unique users each day and was one of five nominees in the education category for a 2006 Webby Award ("Oscars" of the Internet).

G. Awards, Additional Funding, Publications and Presentations

Awards

2005 Texas Environmental Excellence Award Finalist, awarded to the Environment as a Context for Opportunities in Schools (ECOS) Project at BCM by the Texas Commission on Environmental Quality and the Governor of Texas (one of only two finalists statewide).

Additional Funding

Alcohol Education, supplement to *The Environment as a Context for Opportunities in Schools*, for the development of a fifth grade science and health unit; funded by National Institute of Alcohol Abuse and Alcoholism, 2003–2006.

My Home, Planet Earth, grant (R25 RR14576) from the National Center for Research Resources to the Children's Museum of Houston to develop a traveling exhibit on environmental health for children in partnership with BCM; the exhibit, currently at Lawrence Hall of Science, Berkeley, CA, has been hosted by Discovery Museum, Bridgeport, CT; Manhattan Children's Museum; Western Reserve Historical Museum, Cleveland, OH; The Children's Museum, Seattle, WA; Orlando Science Center; South Dakota Science Center, Pierre, SD; and The Science Place, Dallas, TX.

My Health My World Institute, one week teacher summer institute sponsored 2001–2005 by the NSF-funded Houston Urban Systemic Initiative of the Houston Independent School District; approximately 35 teachers attended annually and received stipends, training and materials corresponding to each of the My Health My World units.

Publications

- Moreno N, Tharp B. 2006. How do students learn science? In J. Rhoton and P. Shane (Eds.), *Teaching Science in the 21st Century*. National Science Teachers Association and the National Science Education Leadership Association. Arlington, VA: NSTA Press. pp 292–305.
- Moreno N, Denk J, Tharp B. 2006. An Interdisciplinary Approach to Teaching Food and Nutrition in Elementary Classrooms. *CESI Science, The Journal of the Council for Elementary Science International* 39(1): 15–21.
- Moreno N, Tharp B, Roberts J, Denk J. 2006. Using Integrated Curricula to Promote Science and Language Learning by Diverse Student Groups in Urban Elementary Schools. Proceedings, Hawaii international Conference on Education. Honolulu, Hawaii. ISBN 1541–5880, pp 4607–4616.
- Moreno N. 2005. Science Education Partnerships: Being Realistic About Meeting Expectations. *Cell Biology Education* 4: 30–32.
- Moreno, N. 2004. Health and the Environment. In *Decisions for Health*, Holt Rinehart and Winston, Austin, Texas, pp 528–551 (student and teacher editions).
- Tharp B, Moreno N, Cutler P. 2003. My World and Me: Evaluation of a K–2 Model for Integrated Science. Proceedings, Hawaii International Conference on Education. Honolulu, Hawaii.
- Moreno, N. 2002. Behind closed doors: Toxic hazards inside and out. *Citizen's Environmental Exchange Newsletter*. October. 2 pp.
- Moreno N, Griffin R, Denk J, Jones W. 2001. Real-World Science: Achieving Better Returns in Student Learning. *School Business Affairs* 67(8): 17–19.

Published Curriculum Materials and Project-Generated Resources

- Moreno N, Tharp B, Dresden J. 2006. *Air*: My World Teacher's Guide. Houston, TX: BioEd (Baylor College of Medicine). Third revised edition of My World Indoors Guide for Teachers.
- Moreno N, Tharp B, Dresden J. 2006. *Global Resources*: My World Teacher's Guide. Houston, TX: BioEd (Baylor College of Medicine). Third revised edition of My Home Planet Earth Guide for Teachers.
- Moreno N, Tharp B. 2006. *Food*: My World Teacher's Guide. Houston, TX: BioEd (Baylor College of Medicine). Third revised edition of Food and My World Guide for Teachers.
- X-Times Magazine. 2006. *The Science of Alcohol*: Student Reading Component. Houston, TX: BioEd (Baylor College of Medicine).
- Moreno N, Tharp B, Erdmann D, Rahmati-Clayton S. 2005. *The Science of Alcohol*: Teacher's Guide. Houston, TX: BioEd (Baylor College of Medicine). Field test version.
- Tharp B, Cutler P, Moreno N. 2003. *Resources and Environments*: My World and Me Guide for Teachers. Houston, TX: Baylor College of Medicine. Field test version.
- Tharp B, Cutler P, Moreno N. 2003. *Tillena's Big Adventure*: My World and Me Adventures. Houston, TX: Baylor College of Medicine. Field test version.
- Tharp B, Cutler P, Moreno N. 2003. *Tillena Lou's Day in the Sun*: My World and Me Adventures. Carolina Biological Supply Company, Burlington, NC, 30 pp.
- Moreno N, Tharp B, Saunders S, Cutler P. 2003. *Living Things and Their Needs*: My World and Me Activities Guide for Teachers. Carolina Biological Supply Company, Burlington, NC, 34 pp.
- Tharp B, Cutler P, Moreno N. 2002. *My World Indoors*: My Health My World MathLink. Burlington, NC: Carolina Biological Supply Co.
- Tharp B, Cutler P, Moreno N. 2002. *Water and My World*: My Health My World MathLink. Burlington, NC: Carolina Biological Supply Co.
- Tharp B, Cutler P, Moreno N. 2002. *My Home Planet Earth*: My Health My World MathLink. Burlington, NC: Carolina Biological Supply Co.
- Tharp B, Cutler P, Moreno N. 2002. *Food and My World*: My Health My World MathLink. Burlington, NC: Carolina Biological Supply Co.

Presentations and Published Abstracts

- Roberts JK, Moreno NP. 2006. Self-efficacy instruments as retrospective measures of change: Answering plaguing questions. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA. April.
- Moreno N, Thomson W, Tharp B. 2006. Models for Teaming Biological Research Institutions and K-12 Schools. American Association for the Advancement of Science Annual Meeting. St. Louis, Missouri, 16-20 February, A103.

- Moreno N. 2006. Closing Gaps in Hispanic Student Science Achievement. Invited presentation at Texas Superintendent's Leadership Institute. Harris County Department of Education and North Dallas Superintendents, Houston, Texas, January 12.
- Moreno N, Roberts J. 2005. Evaluation Approaches for Education Partnerships. Invited presentation at Virginia Polytechnic Institute and State University, Blacksburg, Virginia, December 8.
- Moreno N, Roberts J. 2005. Evaluation of K-12 Science Education Partnerships. Invited seminar at the Department of Veterinary Science, School of Veterinary Medicine, Texas A&M University, College Station, Texas. October 10.
- Moreno N, Tharp B, Roberts J. 2005. Does Inquiry Science Teaching Impact Teacher Behaviors and Student Learning? American Association for the Advancement of Science Annual Meeting, Washington, DC, February 17–21, A85.
- Moreno N, Thomson W, Tharp B, Erdmann D, Clayton S. 2005. Partnerships to Support Biology Education Across the K-12 Continuum. Poster presented at the K-12 Mini Conference, Four-Year College Section, annual meeting of National Association of Biology Teachers, Milwaukee, Wisconsin, October 5.
- Moreno N, Roberts J, Denk J. 2005. Evaluation Strategies for K-12/University Partnerships. National Science Teachers Association National Convention, Dallas, Texas, March 31.
- Tharp B, Moreno N, Erdmann D, Rahmati S. 2005. A Showcase of K–12 Curriculum Materials Created by Baylor's Center for Educational Outreach. Conference for the Advancement of Science Teaching, Houston, Texas, October 28.
- Tharp B, Cutler P, Clayton S, Moreno N. 2004. Implementing the Science Standards by Integrating Inquiry with Reading and Math. National Science Teachers Association National Convention. Atlanta, GA, April 3.
- Moreno N. 2004. Science Education Outreach: How K-12 School Partnerships Benefit Higher Education. Invited presentation at The Future of Education and Professional Development in the Molecular Life Sciences Meeting, American Society for Biochemistry and Molecular Biology IUBMB/ASBMB 2004. Boston, Maryland, June 12.
- Moreno N, Tharp B, Cutler P. 2004. An interdisciplinary, environmental health-based approach to improving science learning by elementary teachers and students. Poster presented at the Society of Toxicology, 43rd Annual Meeting and ToxExpo, Baltimore, MD, March 21-25, abstract number 1749.
- Roberts JK, Moreno NP. 2003. Teacher Self-Efficacy is NOT Enough! The Problem of Interpreting Measures of Teacher Self-Efficacy Apart from Other Measures of Teacher Performance. Paper presented at the 2003 annual meeting of the American Educational Research Association, Chicago, Illinois. April 22.
- Pitman L, Hemminger L, Johnson L, Mingo K, Moreno N, Mutryn C, Haney J. 2003. Introduction to NIEHS Interdisciplinary Environmental Health Projects. Panel presentation at National Science Teachers Association Annual Meeting, Philadelphia, PA, March 26-30.
- Roberts J, Moreno N, Henson R. 2000. Self-efficacy and knowledge instrument for science teachers (SETAKIST): A proposal for a new efficacy instrument. Annual meeting of the Mid-South Educational Research Association. Bowling Green, Kentucky. November.

National, Regional and Invited Workshops

- Tharp B, Moreno N, Erdmann D, Rahmati Clayton S. 2006. Science and Reading and Math…Oh My! 54th National Conference on Science Education, National Science Teachers Association, Anaheim, California, April 7.
- Erdmann D, Moreno N, Tharp B. 2006. Connecting All the Dots—Making Science and Literacy Mesh, 54th National Conference on Science Education, National Science Teachers Association, Anaheim, California April 7.
- Moreno N, Erdmann D, Rahmati Clayton S, Tharp B. 2006 Alcohol and Teenagers—What Are the Answers? 54th National Conference on Science Education, National Science Teachers Association, Anaheim, California, April 8.
- Tharp B, Moreno N. 2005. My Home Planet Earth: Water and Air. Invited workshop at the Orlando Science Center, conducted in conjunction with the traveling museum exhibit, My Home Planet Earth, Orlando, Florida, February 25.
- Tharp B, Moreno N, Erdmann D. 2005. Creating Meaningful Assessment in the K-2 Environment. National Science Teachers Association National Convention, Dallas, Texas, April 2.
- Tharp B. 2005. Science Concepts K–2: Living Things, Needs and Resources. Conference for the Advancement of Science Teaching, Houston, Texas, October 28.
- Tharp B, Moreno N, Erdmann D, Rahmati Clayton S. 2005. The Science of Alcohol. Conference for the Advancement of Science Teaching, Houston, Texas, October 27.
- Moreno, N., B. Tharp, S. Clayton and D. Erdmann. 2005. The Science of Alcohol. Workshop at the annual meeting of the National Association of Biology Teachers, Milwaukee, Wisconsin, October 7.

- Moreno N. 2004. Water and My World. Workshop at Teaching Across Disciplines Using Environmental Health. National Institute of Environmental Health Sciences, Research Triangle Park, North Carolina, October 18.
- Moreno N, Tharp B. 2004. My Health My World. Workshop sponsored by the Education Committee, Society of Toxicology (SOT), as part of the Paracelsus Goes to School Program, SOT Annual Meeting, Baltimore, Maryland, March 23.
- Cutler P, Moreno N, Tharp B. 2004. Teacher-Approved Integrated Science for K-2. Conference for the Advancement of Science Teaching, Corpus Christi, Texas, November 5.
- Moreno, N. and B. Tharp. 2002. Baylor Series National Trainer Workshops: BrainLink and My Health My World. Carolina Biological Supply Company, Burlington, NC, July 30-August 1.

NOTES:

Project EXCITE

Environmental Health Science Exploration Through Cross-Disciplinary & Investigative Team Experiences

Bowling Green State University
Co-Principal Investigators: Jodi J. Haney, Ph.D. and Charles B. Keil, Ph.D., CIH
Project Manager: Jennifer Zoffel
Collaborating Institutions: Ohio Dept. of Education; Ohio Environmental Protection Agency; COSI Toledo; Medical University of Ohio; Participant School Districts**Contact Information:** www.bgsu.edu/colleges/edhd/programs/excite

Project Summary:
Project EXCITE engages students in valuable learning experiences across disciplinary areas using locally relevant Environmental Health Science (EHS) topics. The project reflects current thinking about effective teaching and learning and is aligned with national and state education goals. Project EXCITE emphasizes critical thinking and problem solving skills, interdisciplinary connections, collaborative learning and the use of technology. Students investigate local EHS issues, explain fundamental conceptual understandings of these concepts, and apply the knowledge and skills generated to improve performance on standardized achievement tests.

Project EXCITE assists teacher teams (4th - 10th grade) in creating, facilitating, and disseminating interdisciplinary EHS units using problem-based learning (PBL) approaches. During each of the project's two-year Cohort cycles, 3-6 teacher teams participate in over 180 hours of Professional Development. Each team consists of 4-5 educators drawn from different academic disciplines who will work side-by-side with a school administrator, a university faculty member, and a community partner. To date, 3800 middle grade students and 63 teachers have been directly impacted by the 2-year Cohort Program.

A new dissemination format introduced this year allows Project EXCITE to reach an additional 60 teachers throughout the state of Ohio. By offering a two-day institute (15 hours, plus on-line discussions), EXCITE was able to spread our professional development model and curriculum to an additional 2300 school children.

Goals:
Project EXCITE aims to:

1) advance the awareness of local environmental health science (EHS) issues and generate social responsibility in students;
2) augment the range of inquiry-based teaching techniques and strategies for integrating both science and non-science concepts;
3) enhance both EHS content knowledge and inquiry skills needed for success on standardized tests.

2005-2006 Project Benchmarks:

- **EXCITE-ing Numbers:**
  - Schools to date = 44
  - Teachers to date = 117
  - Pre-service teachers to date = 15
  - Professional development hours per teacher in EXCITE Cohort = 180+
  - Professional development hours per teacher in Institute Projects = 16+
  - Students experiencing local EHS PBL units to date = 6100 (including 2300 students from Institutes)
  - Students to experience ZoOdyssey to date = 4400
  - Items in EXCITE loaning library = 366

2005-2006 Project Benchmarks (Cont'd):

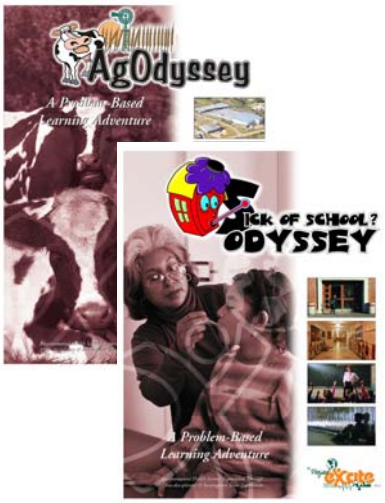
- EPA's 2006 Children's Environmental Health Recognition Award Recipient
- Planned and implemented the first year of Odyssey Institutes, recruiting 55 teachers from Northwest Ohio for 16 hours of Professional Development, including two one-day institutes and an on-line discussion board.

- Revised and field tested our EHS and PBL models with both teachers and students. Updated EHS model to make it more user-friendly and understandable.
- Publication and dissemination of ChemOdyssey, an interdisciplinary investigation of household chemicals
- Publication and dissemination of GermOdyssey, an interdisciplinary investigation of the spread of germs and communicable disease
- Coordinated comparison group study to determine the existence of an "EXCITE Effect" on development of student content knowledge for students participating in the program (see **Evaluation** for more details).
- Three project staff members were trained in the Horizon's Observation Protocol to document teachers' classroom practices. Pre/Post observations were conducted of two teachers at each Cohort 3 school.

Curriculum Development:

Completed

- ZoOdyssey: An introduction to Problem Based Learning and Environmental Health Science.
- FoodOdyssey: An exploration of food borne illness
- Sick of School? Odyssey: An indoor environment mold investigation
- AgOdyssey: "factory" farms v. small farms
- ChemOdyssey: safety concerns related to household cleaners
- Germ Odyssey: Investigating the spread of communicable diseases



In Development

- Mosquito Odyssey: Investigating problems and control of mosquito populations
- H2Odyssey: Water sanitation and quality and its effect on health
- Bacteria in the Cafeteria: Examining the health impacts of school cafeterias
- ETS Odyssey: Environmental tobacco smoke as a health issue
- River Odyssey: The effects of river pollution on health
- Cruise Odyssey: Investigating mystery illness on cruise ships
- Marsh Madness Odyssey: Investigating potential health hazards of wetlands and urbanization
- E-Odyssey: Exploring energy consumption and its effect on health
- Urbanization Odyssey: studying the health effects of urban sprawl

Evaluation:

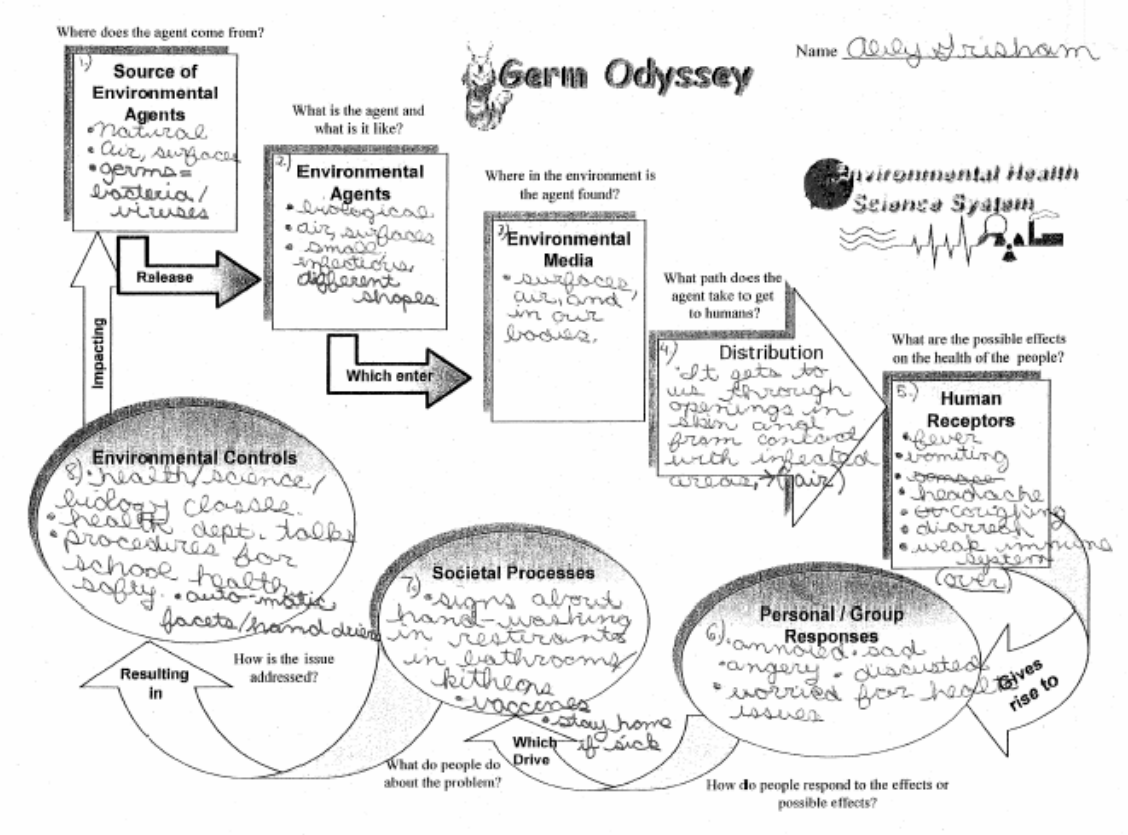
Students

Student goals are measured using a variety of methods, both qualitative and quantitative. Instruments used include portfolios, interviews, concept mapping, journaling, attendance records, and pre/post test on science process skills.

Analysis of interview data related to student motivation and enthusiasm for learning indicated that the integrated EXCITE unit, in comparison to other units studied during the year, lasted longer, was more engaging, allowed students to work in collaborative groups more often, required more student effort, was more interesting and offered a greater diversity of instructional strategies, student tasks and assessment opportunities. Moreover, students reported that the integrated unit was more likely to enhance the amount of material learned and how long this material would be remembered.

Initial analysis of the EHS System (an assessment of student environmental health science conceptual knowledge) showed that students possessed conceptual understanding of both the science and social science concepts and processes as related to the environmental health problem under study. The degree of their understanding varied amongst individuals and across schools. The factors that may impact this variability are currently under investigation. Figure 1 is an example of student work using the EHS System.

Figure 1. Student Work, GermOdyssey



Additional student successes, as reported by the external evaluator include:

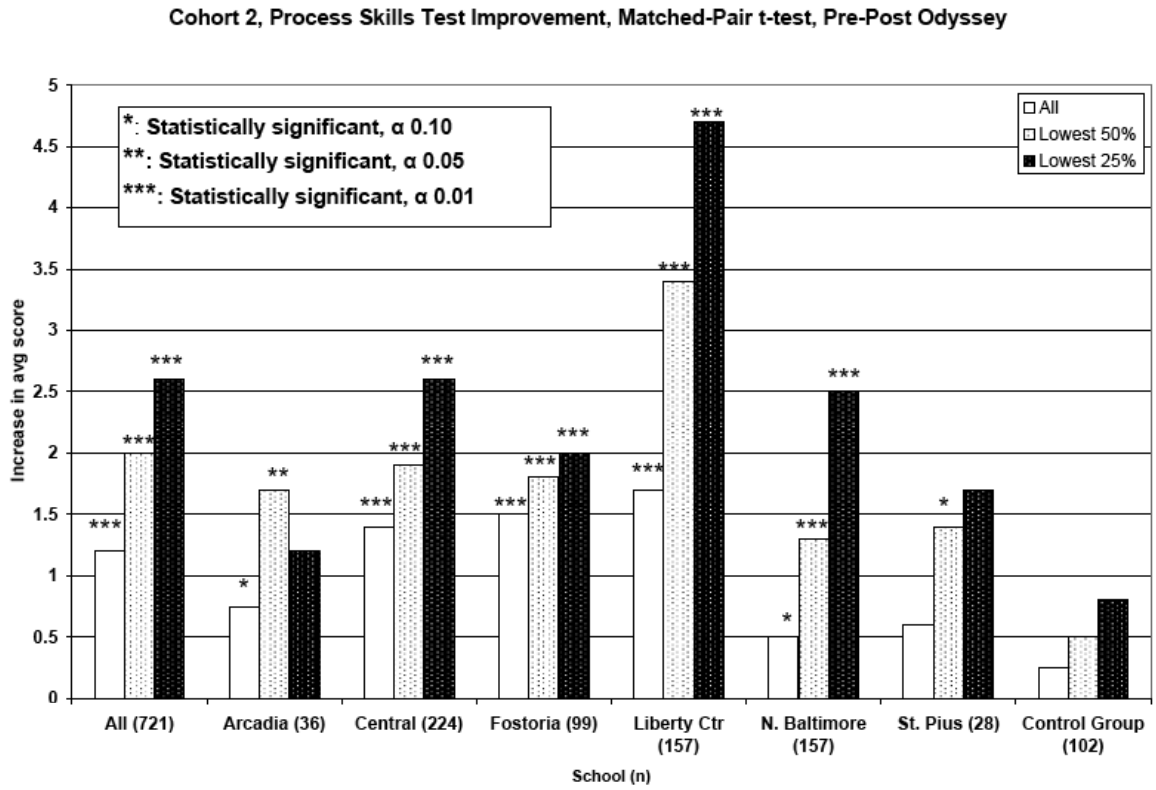
- Students enjoyed their EHS based classes and were motivated to learn.
- Students were pleased about the opportunity to work in groups and to be engaged in experimental work.
- Students' inquiry skills were enhanced.
- Students valued being able to consider real-life issues in their classes.
- Students valued being able to expose their work to significant others, particularly at COSI (Center of Science and Technology, Toledo).

Since the completion of our last evaluation report, an in-depth analysis and comparison group study of the Performance of Process Skills (POPS) pre- and posttest was completed. Findings demonstrated that (as with past years) Project EXCITE participant students demonstrated a statistically significant increase in the average scores between their pre- and posttests. In particular, the students scoring in the lowest quartile on their pretest increased their scores by 16%.

The same test was also administered in six non-EXCITE classrooms in two different middle schools. POPS was given three times: a pretest, after a period of instruction, and finally after a holiday season. The three tests were designed to look at for changes due to normal instruction and for changes during periods of limited instruction due to maturation. Three valid tests were collected for over 100 non-EXCITE students.

Looking at the non-EXCITE students as one group (not by pre-test performance) there was no improvement in POPS scores between any of the tests. When the data was analyzed by performance on the pretest, the first and third quartiles showed a slight increase in scores between the initial and middle test. This increase disappeared by the final administration of the POPS. None of the quartiles exhibited statistically significant increased scores from the initial to final test.

Figure 2 illustrates the trends described above.
Figure 2. Process Skills Test, Increase in Average Scores



Teachers

Teacher goals are also measure by a variety of quantitative and qualitative methods. The Instruments used included: Survey of best practices; EHS system model; Content Area Integration web; Social responsibility essay; State and National Standards correlation matrix; Curriculum unit developed (Odyssey); Interviews; Classroom Observations (2 per team).

Teacher successes, as reported by the external evaluator as as follows:

- Teachers can appropriately correlate EHS topics/skills to state and national standards
- Teachers possess solid EHS content knowledge
- Teachers are able to plan strong lessons/units that integrate PBL and EHS approaches
- Teachers use some reformed based instructional strategies
- Use correlated with self efficacy beliefs and highest degree earned
- Teachers possess positive attitudes about the use of PBL strategies and about using EHS as an integrative context; yet beliefs about support structures and control beliefs seem to act as barriers.

A summary of the teacher belief survey results is presented in Table I. The survey of indicated that teacher context beliefs about learning did not significantly change over the course of their participation. However, teacher beliefs for a related sub-factor (likelihood of occurrence) significantly decreased that by the end of their EXCITE participation ($p<.008$). The shape of this data over time is convex, indicated the scores peaked near the middle of the project when perceptions of the support for implementing the project were highest. Teacher efficacy beliefs were significantly enhanced ($P<.02$) as were the self efficacy sub-factor beliefs ($p<.003$). The shape of the efficacy data is linear, showing that teacher's continued to become more confident in their ability to be effective EHSIC teachers throughout the project. The beliefs about the classroom learning environment were also significantly enhanced ($p<.05$), as were the personal relevance sub-construct beliefs ($p<.04$). The shape of this data is concave, indicating that the teachers held more positive beliefs at the beginning and end of the project than during the middle, suggesting that beliefs about the

learning environment are moderated by difficulties in implementing complex change. The reported use of instructional strategies also changed significantly throughout the course of the project ($p<.04$) relating to the reported use of reform-based teaching strategies ($p<.02$). Represented by a linear increase, teachers more frequently used reform-based best practices throughout the course of their participation. Classroom observations provided evidence to the reported use of these best practices.

Table I. Changes in Teacher Beliefs During Participation in EXCITE

Measure		Change	P	Shape
Context Belief	Enabling	N	-	-
	Likelihood	Y	0.008	Convex
	Overall	N	-	-
Teacher Efficacy	Outcome	N	-	-
	Self	Y	0.003	Linear +
	Overall	Y	0.02	??
Learning Environment	Personal Relevance	Y	0.04	Concave
	Scientific Uncertainty	N	-	-
	Critical Voice	N	-	-
	Student Autonomy	N	-	-
	Subjective Norm	N	-	-
	Overall	Y	0.05	Concave
Instructional Strategies	Traditional	N	-	-
	Reform	Y	0.02	Linear +
	Overall	Y	0.04	Linear +

Teacher interview data examining teacher beliefs regarding the implementation of PBL and EHS in the classroom indicate that the teachers believe strongly in the use of both PBL and EHS as an integrative context for learning, yet several barriers were revealed that made them difficult to integrate within the existing curriculum. Such barriers included: an adherence to the traditional curriculum, pressures to teach to the test (and a distrust that the test actually measures problem-solving, critical thinking or environmental health content), difficulty in working as a teaching team and uncertain social support. Interestingly, all of the barriers seemed to be related to the culture of teaching itself and as a result, the PBL and EHS ideas were often viewed as "add-ons" to an already over-crowded curriculum, despite the program goal of infusing PBL and EHS as integrating contexts to enrich the existing curricula. Teachers identified the support from the principal, students and the university, as well as an unexpected peer support, to be strong enablers of the reform. Other enablers included regular team planning time, flexible scheduling and access to technology. Teachers revealed that after undergoing the EXCITE professional development experience, they were very confident in their ability to develop and implement an interdisciplinary unit in the future and that the task would be almost automatic.

Conference Presentations (Through April 2006):

- Zoffel, J., Alt, A., Haney, J.J., Keil, C.B.: "Project EXCITE Odysseys: A Voyage Worth Taking." National Science Teachers Association National Convention, Anaheim, CA, April 2006.
- Zoffel, J, Ash, B., Haney, J.J., Keil, C.B.: "Project EXCITE: Targeting Environmental Health Science through Adventures in Problem-based Learning." Science Education Council of Ohio, Akron, OH, February 2006.
- Haney, J.J., Keil, C.B., Zoffel J.: "Making The Case For The Integrated Curriculum Through The Lens Of Environmental Health Science." Hawaii International Conference on Education, Honolulu, HI, January 2006.
- Zoffel, J., Ash, B., Haney, J.J., Keil, C.B.: "Project EXCITE Odysseys: A Voyage Worth Taking." North West Ohio Symposium, Toledo, OH, November 2005
- Haney, J. J. , George, J., Ryan K, Zoffel, J. and Keil, C. B. "Examining the Beliefs of Teachers Participating in Reform-Based Professional Development About Implementing Problem Based Learning and Environmental Education in the Classroom: A pilot study." Hawaii International Conference on Education, Honolulu, HI, January 2005

- Haney, J.J., Boros, A. and Zoffel, J. "EXCITE Problem-Based Learning." Hawaii International Conference on Education, Honolulu, HI, January 2005
- Keil, C.B., Haney, J.J., Lumpe, A. and Boros A. "EXCITE-ing Successes Implementing a Problem Based Learning Model with Interdisciplinary Environmental Health Issues." American Public Health Association Conference, November 2004
- Haney, J.J. and Ash, B. "Project EXCITE Odysseys: A Voyage Worth Taking." National Science Teachers Association Regional Convention, Indianapolis, IN, November 2004
- Keil, C. B., Haney, J. J., Bisesi, M. and Boros, A. "A Model for Communication Environmental Health Issues To The General Public." American Industrial Hygiene Conference and Exposition, Atlanta, GA, May 2004
- Boros, A., Haney, J.J. and Keil, C. "Generating Student Excitement Through Environmental Health Science and Problem Based Learning." Environmental Educators Council of Ohio Annual Conference, Deer Creek State Park, OH, April 2004
- Haney, J.J. and Keil, C. "EXCITE Problem-Based Learning Odysseys: Integrating Problem Solving, Environmental Health and Technology into the Middle Grades Curriculum." Hawaii International Conference on Education, Honolulu, HI, January 2004
- Haney, J.J., Boros, A. and Keil, C. "EXCITE Problem-Based Learning."Hawaii International Conference on Education, Honolulu, HI, January 2004
- Boros, A., Haney, J. and Keil, C. "Project EXCITE: Environmental Health Science Explorations through Cross-Disciplinary and Investigative Team Experiences: A Professional Development Model for Educators." Hawaii International Conference on Education, Honolulu, HI, January 2004
- Boros, A., Haney, J. and Keil, C. "Introducing Environmental Health Science to the School Frontier." North American Association for Environmental Education Conference, Anchorage, AK, October 2003
- Haney, J. J. "Environmental Health Science Explorations Through Cross-Disciplinary and Investigative Team Experiences: A Professional Development Program for Educators." International Organization for Science and Technology Education, Williamsburg, VA, June 2003
- Boros, A., Haney, J. and Keil, C. "Effective Interdisciplinary Teaching Through Problem Based Learning." Ohio Middle School Association State Conference, Akron, OH, April 2003
- Haney, J.J., Boros, A and Keil, C. "Introduction to NIEHS Interdisciplinary Environmental Health Projects." National Science Teachers Association Conference, Philadelphia, PA, March 2003
- Boros, A., Haney, J. and Keil, C. "Generate Student EXCITEMENT with Problem Based Learning." Environmental Educators Council of Ohio Annual Conference, Toledo, OH, March 2003
- Boros, A., Haney, J. and Keil, C: "Meeting the Standards with Problem Based Learning." Ohio Technology Education Association Spring Conference, Toledo, OH, March 2003
- Boros, A., Silverman, G. and Morrone, M. "Environmental Health Science Programs." Science Educators Council of Ohio Conference, Dayton, OH, February 2003
- Keil, C.B., Bisesi, M., Haney, J.J. and Boros, A. "Project EXCITE: Environmental Health Science Explorations through Cross Disciplinary and Investigative Team Experiences. American Industrial Hygiene Conference and Exposition, San Diego, CA, June 2002
- Boros A., Haney, J.J. and Keil, C. "Targeting Environmental Health with EXCITE Problem Based Learning Odyssey." Environmental Educators Council of Ohio Annual Conference, Columbus OH April 2002
- Boros A., Haney, J.J. and Keil, C. "Uniting Technology with Problem Based Learning." School Net Technology Conference, Columbus OH February 2002
- Haney, J.J., Shafer, M., Keil, C. and Boros, A. "Reaching for the Standards with Problem Based Learning." National Science Teachers Association Midwestern Regional Convention, Columbus, OH, November 2001

Events/Workshops:

- Project EXCITE Colloquium, COSI Toledo, May 10, 2006
- Odyssey Institute, Wapakoneta City Schools, February 25, 2006 & May 6, 2006
- Odyssey Institute, Wood County, February 7, 2006 & May 13, 2006
- Odyssey Institute, Hancock County, January 21, 2006 & May 20, 2006
- Thresholds Testing, Women in Science Day, BGSU, November 11, 2005
- PRISM Teacher Training, BGSU, July 2005

- Project EXCITE Colloquium, COSI Toledo, April 25, 2005
- Project EXCITE Colloquium, COSI Toledo, May 27, 2004
- Project EXCITE Colloquium, COSI Toledo, May 28, 2003
- Problem Based Learning. 30 Diploma Teachers University of West Indies, Trinidad April 2, 2003.
- Uniting Standards, Curriculum and Students with Problem Based Learning. 75 teachers, Lima City Schools West Middle School, August 30, 2002.
- Project EXCITE Colloquium, COSI Toledo, May 1, 2002

Publications (2005-2006):

Project EXCITE. (2006). *Taking Action Newsletter* (Vol. 4, Iss.2). Bowling Green, OH (Circulation: ~450)
Project EXCITE. (2006). *Taking Action Newsletter* (Vol. 4, Iss.1). Bowling Green, OH (Circulation: ~450)

NOTES:

ENVIROHEALTH CONNECTIONS:
A Collaborative Exploration of the Environment and Human Health

EnviroHealth Connections is a collaborative project of Maryland Public Television (MPT), the Johns Hopkins Bloomberg School of Public Health (JHBSPH), and the Maryland State Department of Education (MSDE). The goal of the project is to develop, implement, disseminate, and evaluate tools for teaching environmental health content across multiple existing curriculum areas. One measure of the success of the partnership is the ongoing supportive relationship among the parties and the fact that both JHBSPH and MSDE have identified additional opportunities for potential collaboration amongst the three partners.

The EnviroHealth Connections project aims to provide teachers with the tools to easily and successfully integrate environmental health topics into their classrooms.
This is being achieved in a two ways: professional development and development of curricular materials. Currently in development are an online speaker's bureau and WebInvestigations.

Professional Development

I. The EnviroHealth Connections Summer Institute is a professional development opportunity for middle and high school teachers interested in integrating environmental health into their lessons in the subject areas of science, health, mathematics, language arts and social studies. On average, 60 teachers attend each summer, with a total of 180 teachers having attended over the last 3 years from every county in Maryland (as well as a number from out of state) This means that over 2000 students have benefited from their teachers' attendance. The main features of the Summer Institute are:

- Teachers hear directly from scientists doing cutting edge research in the field of environmental health at JHBSPH.
- Instruction is given in the use of technology useful in teaching environmental health. In the summer of 2006 teachers will learn about using Geographic Information Systems (GIS) in their classroom from a college professor and a high school teacher, both of whom use GIS extensively with students.
- Teachers are trained in the effective integration of technology into instruction, so infusing media leads to improved student interest and achievement.
- Select teachers attend a smaller gathering, the Winter Colloquium. These teachers have an additional opportunity to hear from the scientists from JHBSPH. They also collaborate with MPT staff to develop, revise, and teach environmental health lessons. These teachers then serve as mentors at the following Summer Institute where they present the lessons to the teachers in attendance.
- The value of these experiences is evident in the number of teachers who return to the Institute, despite no longer being eligible for continuing education credits. Among our mentor teachers this year are four who served as mentors last year. In addition many teachers come as a result of the recommendation of their colleagues.
- From the EnviroHealth Connections Discussion Board: "I've truly enjoyed this institute and look forward to sharing all this great information with my colleagues at school. I plan to encourage them to attend this institute next year! If the timing fits in my plans next summer, I plan to attend next year as well."

II. "Using Media in Your Classroom–Case Study: Environmental Health" is a video produced by MPT which instructs teachers in ways to effectively integrate media into lessons with environmental health subject matter. The video has aired 8 times since June 2005 as part of the Instructional Television programming of the station. Since production it has aired on MPT a total of 13 times.

- From the EnviroHealth Connections Discussion Board: "Media Utilization Strategies that really work at the middle school level!!! Interactive viewing with Before, During, and After activities that integrate the media into the overall learning experience. The purple Media Utilization worksheet is a good lesson plan for your class! 😉"

III. The EnviroHealth Connections Discussion Board provides a forum for continued interaction among teachers who have attended the Summer Institute and/or the Winter Colloquium. In this online community of educators, teachers exchange ideas, ask questions, and comment on current environmental health issues. Since its inception in July 2005 the discussion board has had over 400 postings responding to approximately 25 topics, with over 5000 combined views of the topics. At the teachers' request "Highlights" of the discussion board has become a page on Thinkport. The discussion board can be viewed by the general public, and anyone can request to be able to post replies.

- From the EnviroHealth Connections Discussion Board: "Using not only the site, but the posts and help from fellow teachers, helps me use it not only as resource, but a way to keep everything current and up to date."

Curriculum Materials

I. Lesson Plans

To date, over 60 environmental health lesson plans, student learning activities and projects have been developed in collaboration with Maryland educators. The lessons are tested in the classroom by the teachers and revised accordingly. The lessons have the following characteristics:

- Lessons are aligned with the Maryland State and National Standards. The philosophy has been to develop lessons that integrate environmental health topics into core content areas. Some examples are: using asthma statistics to reinforce mean, mode and median in a math class: environmental justice to solidify geography concepts; bioaccumulation of mercury to review food chains and food webs.
- A variety of content areas are covered by the lessons: For twenty one lessons written 2004-2006, nine are for middle school students, seven for high school students, and five can be used for either age group. All the lessons are aligned with state and national standards in one or more of the core content areas. Of the lessons written in the past two years, fourteen address science standards, nine address health standards, and three address each of math, language arts, and social studies standards.
- Lessons are technology-rich, often including a video and/or online component.
- Teachers can access lessons free of charge on Thinkport.org and can modify them to their needs using the tools on the site.
- From the EnviroHealth Connections Discussion Board: "Found this lesson very useful in teaching my sixth grade science class how to answer a BCR (brief constructed response) for the Maryland State Assessments. We reviewed the lesson with Brenda and Dara in the summer institute. Good articles that lead right into a BCR lesson with the kids!!!"

II. Breaking the Mold is one of two EnviroMystery videos produced by MPT, with consultation from Dr. Trush of JHBSPH and Rebecca Bell of MSDE. (The other enviromystery "Water + ? = Trouble" was produced under a previous NIEHS grant to MPT and its partners.) The video presents a mystery which centers on asthma and air pollution.

- This video is geared toward middle school level students
- There are online teacher's resources including lesson plans, ideas for activities, and sources for additional information.
- The EnviroMysteries website has received 197,000 page views in the past 10 months, with over 23,000 in April of 2006.
- The video aired on 146 PBS stations on Earth Day 2004 and won an Emmy for best local children's program, and several awards at film festivals. It has aired on MPT once since last June and a total of nine times since its production. The other PBS stations have the rights to air it 6 times over a period of 4 years.
- From the EnviroHealth Connections Discussion Board: "I just used in my class the enviro tape and book we received this summer. It was the tape about the oyster meal and the outbreak in the town. It came with a book that was like a teacher guide.The first page a question guide for the students to answer while the watched. this worked out really well. right now we are studying chem. but on Fridays i take one class and do something "extra" I am going to use my Fridays for enviro type studies. from the feedback I received about the tape the kids really liked that. They have even nicked named the old fisherman Santa. This weekend i am going to go over the rest of the book and plan out more uses."

In Development

I. On line Speakers Bureau is planned to be a dynamic multi-media presentation, making the expertise of researchers from JHBSPH in environmental health available to a wide audience online. Using questions often asked by middle school students, experts will be interviewed about a number of specific topics in environmental health. The result will be an interactive experience where students can choose questions they would like to hear answered.

II. **WebInvestigations** are online mini-mysteries based around environmental health topics. These high interest, interactive experiences will be aligned to Maryland State Standards and geared towards Middle Schools students. Using the same principles as the EnviroMystery videos, students will have to test hypotheses by gathering information and draw conclusions in order to solve the mystery presented.

Dissemination

I. Thinkport.org (www.thinkport.org **)** is MPT's education supersite and the central location for all the environmental health resources developed by MPT and its partners. There is a page on Thinkport devoted to environmental health. The page was redesigned early this year, and has received over 1300 page views in the last quarter. There are links to PowerPoint presentations the scientists from JHBSPH have presented at the Winter Colloquium and Summer Institute, and to the discussion board. Thinkport has recently received funding for six additional years. This means that the materials developed for the EnviroHealth Connections project will be available to teachers well beyond the term of this NIEHS grant.

- From the EnviroHealth Connections Discussion Board: " I am so excited! I'm still at school, it's after 5 on a Friday and I haven't been able to come up with a fresh set of data to interest high schoolers in Box and Whisker Plots on Monday. I conducted a search using Thinkport and found a site on tobacco and the deadly diseases it causes. Well, I was able to pull information not only for Monday's Box and Whisker introduction, but also Wednesday's (no school on Tuesday) creation of parallel box and whisker plots. Wow, I would never have thought of such an easy way to sneak in an anti-smoking lesson letting the statistics speak for themselves as it were, if I hadn't attended last summer's EnviroHealth Institute! Think I'll go home now-can't wait til Monday…"

II. The Regional **National Science Teachers Association** (NSTA) meeting will be taking place in Baltimore this fall. We will have a presence at the meeting to disseminate information about our EnviroHealth Connections project and the associated curricular materials and professional development opportunities. In addition, MPT and JHBSPH will be offering a "mini field trip" to the Hopkins campus and introduce teachers to environmental health issues and possibilities for its integration into the curriculum.

Evaluation

During 2005-2006, MPT conducted a Summer Institute and a Winter Colloquium and, in collaboration with the evaluators, launched a classroom study of Connections materials and professional development. As in previous years, both the Summer Institute and Winter Colloquium were very successful events.

Approximately 60 participants attended the 4-day Summer Institute, held in July 2005 at the Johns Hopkins University Bloomberg School of Public Health. About 86 percent were classroom teachers, and about 59 percent taught science. Overall, 94 percent of the participants rated the Institute as very good or excellent. As in previous years, the presentations by doctors and scientists received very high ratings, with all participants judging these presentations *overall* to be very good or excellent. Virtually all (97%) planned to share what they had learned at the Institute in their schools and districts. Finally, based on the results of the pre- and post-Institute questionnaires, participants made great gains in the following areas:

- Content knowledge needed to teach about environmental health topics
- Preparedness to design instruction based on environmental health content

- Skills needed to effectively integrate technology into the curriculum
- Understanding of how technology can be used to support project-based interdisciplinary instruction.

The 2-day 2006 Winter Colloquium was attended by 19 educators, most of whom attended as members of interdisciplinary teams from four schools. About half were science teachers, and about three quarters taught at the middle school level. Overall, 95 percent of the participants considered the event to be very good or excellent. Nearly all of the presentations by doctors and scientists received high ratings, as did most of the presentations by MPT staff and guest presenters. While many attendees began the event feeling that they were not prepared to teach on environmental health topics, at the conclusion of the Colloquium, all agreed or strongly agreed that they:

- Had sufficient content knowledge to review and teach lessons on the effect of the environment on human health
- Were prepared to implement interdisciplinary instruction
- Were prepared to collaborate with other teachers on their team
- Had a clear understanding of how technology can be used to support environmental health instruction.

During Spring 2006, ORC Macro, MPT's evaluator for the EnviroHealth Connections Project, launched a classroom study to ascertain the effects of Connections materials and professional development on student learning. In all, the study involved 7 schools, 16 teachers, and more than 1,000 students. The design of the study called for teachers who had received Connections professional development over the years to implement a lesson developed by MPT and also to develop and implement a lesson addressing the same objectives. Each of these teachers also identified a partner teacher in the same school who implemented the lesson developed by MPT, which makes use of many Connections resources, including the two EnviroMysteries videos. Students in all classes completed a pretest, posttest, and questionnaire. Data collection has been completed, and data entry is in process. Over the summer, the evaluators will analyze the data and prepare a report of their findings.

Our EnviroHealth Connections project has met with great success in integrating environmental health topics into classroom instruction throughout Maryland. Our professional development opportunities and videos, combined with our curriculum materials, allow teachers to integrate environmental health topics seamlessly into their instruction. Students across the state of Maryland have been given the knowledge to make informed decisions that will impact the environment and their health both now and in the future.

Learning through Environmental Health Science Scenarios: The Hydroville Curriculum Project

The citizens of Hydroville need your help!

Molly Bloomfield, Susan Helback, Sandra Uesugi, Naomi Hirsch and Nancy I. Kerkvliet
Oregon State University

Project summary and description

During the past 5 ½ years, the Hydroville Curriculum Project (HCP) has created problem-based curricula for high school students focusing on issues in environmental health science. The problems occur in the fictitious town of Hydroville, which has to deal with one of four environmental health scenarios: a pesticide spill, an outbreak of a mysterious illness, a problem with air quality at a local middle school, and a water quality problem. The Hydroville curricula are based on real-life case studies and use real data. The town of Hydroville could be a town anywhere in America.

The Hydroville Curricula feature hands-on activities designed to equip students with the concepts and skills they will need to recommend a solution to the environmental health problem. The goal of the Project is to help students develop knowledge in a wide range of disciplines, to help them meet nationwide educational standards, and to help them gain the scientific literacy they will need to negotiate the complicated problems of today's society.

Students participate in a series of background activities to develop a basic knowledge of the specific concepts and skills involved in solving these problems. The solution requires the integration of skills from several disciplines: science, language arts, social studies, mathematics, technology, and health. Students assume the roles of experts on a team brought in to solve the problem. As a team, they must develop and formally present a solution based on data collected through laboratory experiments, interviews, research, and interaction with experts. The curricula are structured to help students understand the complexity of environmental health issues and to emphasize that many real-world issues have no single correct answer.

The Hydroville Curricula are based on sound science and current educational research on effective teaching. The concepts and skills needed to solve the problems in Hydroville were first identified by an advisory group of scientists and professionals. Background activities were then developed around these concepts and skills by a team of master high school teachers in science, language arts, mathematics and social studies. Pilot school teachers were selected from across the state of Oregon and each team of pilot school teachers attended Summer Institutes to understand the focus and the problem-based approach of the curriculum. The pilot teachers taught the curricula in their high school classrooms and their feedback was used to revise the curricula for publication.

In addition to the curricula, the Hydroville Curriculum Project created a website (www.hydroville.org) to provide information about the project as well as provide supplemental information for teachers using the Hydroville curricula. Sample activities from each of the four curricula are available for downloading. Also, due to the dynamic nature of the web, resources and references directly related to the Hydroville activities are kept current and maintained on the Hydroville website In 2006, the Hydroville website received an average of 1200 visitors per month, and visitors downloaded an average of 650 documents per month.

With additional outside funding, an affiliated website was also created to provide more technical information about the analytical instruments and techniques used in the Hydroville investigations. Launched in January 2005, the Unsolved Mysteries of Human Health website (www.unsolvedmysteries.oregonstate.edu) contains interactive animations of a flow cytometer, gas chromatography mass spectrometer, and microarray technology. The website highlights the research and facilities of OSU EHSC investigators allowing students as well as the general public to contact investigators directly. In March 2005, *Unsolved Mysteries of Human Health* was named a Digital Dozen website by the Eisenhower National Clearinghouse. This **award** is given to exemplary websites that feature

current and accurate science content and have useful multimedia features. In 2006, the *Unsolved Mysteries of Human Health* website received an average of 7000 visitors per month.

Grade level (whole project) – The Hydroville Curricula have been developed for high school students, primarily in the 9th and 10th grades. They are best taught by a team of teachers but have been used successfully by single science teachers and by teams of teachers in alternative and magnet classrooms.

Subjects (whole project) – The Hydroville Curricula teach integrated science (biology, chemistry, physics, engineering, toxicology, environmental science), that also incorporates concepts and activities in health, language arts, mathematics, and social studies.

Evaluation type used (to measure impact)

Students

1. Pre and Post tests with six measurements scales*
    - Quality of Explanations
    - Information Seeking
    - Personal Involvement
    - Self-Protection
    - Value for Science
    - Perceived Risk
2. Reflection Papers
3. Science Journals
4. Videotaped presentations

Teachers

The primary mechanism for evaluation of the Hydroville Curricula from the teacher's perspective is through debriefing interviews of pilot school teachers. After their implementation of the curriculum in their classrooms, an extended, recorded interview is conducted with each teacher. These interviews will be analyzed and summarized for publication during the final year of the grant.

Impacts (students & teachers)

Results of student pre/post test analyses show that students who participate in the Hydroville curriculum become reasoned decision makers. They have learned about toxicology concepts and can discern that exposure doesn't always bring harm but depends upon individual susceptibility and the nature of the hazard. Students view themselves in a different way. They believe that they can work together with others to find solutions to environmental health problems. They feel more confident about their ability to design a scientific study, prepare a written report, and present an oral report to large audiences.
Thus, the overall success of the Hydroville curricula emanates from the effective melding of "school skills" (acquiring content knowledge) into a process of acquiring "real-world skills" (independent thinking, teamwork, high level problem solving, and written and oral communication) that will prepare students for success in the work world of the 21st century.

The true success of the Hydroville Curriculum Project is reflected most eloquently by feedback from the Hydroville pilot school teachers themselves:

> "*As teachers we are often guilty of telling kids that isn't the "right" answer. But it may be a piece of it. I think Hydroville did a really masterful job of getting kids to look at something, and the kids got to the point where they could say, "I got good evidence where this could be true"*
>
> *"The biggest effect on me was seeing kids take ownership for their own learning in a huge percentage. It made me feel really good. What I saw day after day was kids coming in and saying, "What do we get to do today,* ***not*** *"what do we have to do today". When you see kids getting excited about learning, that's what pumps you as a teacher."*

"The curriculum exceeded my expectations. All I was looking for was a new approach to environmental chemistry. What I got out of it was not only a new approach, but a way to teach process, making my kids feel good about them selves, learn a bunch of factual material in the process, and come to the other end and say, "Hey, I'm pretty smart". That was the pay-off. If I had told them in the beginning that when they got to the end they would stand up in front of 40 people and explain that they understood something and this is the process they went through and this is the way they see it, they would have said, "no, we are not doing this!"."

Dissemination: Strategies to date

The Hydroville Curriculum Project has used four main dissemination strategies:

- Teacher Professional Development at Summer Institutes in multiple states
- Hands-on workshops and presentations at professional meetings
- Publication of completed curricula (currently in review at National Science Foundation Press)
- The Hydroville and Unsolved Mysteries Websites

Future plans include additional publications in professional journals about the results of the research on impacts of the Hydroville Curricula on teachers and students, and the essential elements of professional development of teachers. We are also actively engaged in converting the HCP classroom activities into modules that are relevant to adult community education scenarios. To date, we have conducted three workshops that use background activities developed for the HCP to address indoor air quality. Healthy Air/Healthy Homes is a 2-hour educational workshop that has been presented twice. The first workshop was advertised in the local newspaper and was attended by 20 Corvallis residents from diverse backgrounds. The second workshop was presented as a part of a Gerontology Conference held at OSU and had 20 registrants. A similar program entitled "Promoting Healthy Air in Homes: Why, How, and With Whom?" was presented in conjunction with an OSU Extension workshop in Lake Oswego, OR and was attended by 30 people. Feedback on these initial workshops has been outstanding and we plan to expand our topics and venues for future community education forums.

Publications, presentations, workshops, awards

Awards (website award discussed above):

IAQ Curriculum Awards: In 2005, two Pilot school teachers and their students won the EPA Tools for Schools Special Achievement Award for their implementation of the HCP IAQ curriculum.

- The EPA funded Science Research Club advisors, Debbie Cooper and Mark Geren, Westview High School, Beaverton, OR, attended the IAQ Tools for Schools National Symposium in Washington DC on January 12-14, 2006, along with three high school students who were members of the research club (Jose Perez, Josean Perez, and Julio Montano). The Science Research Club received a Special Achievement Award and the students were also invited to present at a session, "Kids Making a Difference". The IAQ curriculum stimulated these students to undertake their research project, "A Study of the Effects of Thermal Comfort on Student Attention Spans"

- Kaye Martin, Springfield School District, Springfield, Oregon received a Special Achievement Award for her implementation of the IAQ Curricula in her Young Parent Program in the Springfield, OR school district. Kaye was also an invited speaker at the general session, "Kids Making a Difference". As a Pilot School teacher for all four of the Hydroville Curricula, Kaye eloquently described how the HCP has positively impacted her students. Kaye also wrote an article for the Washington State University Extension Energy Program: Indoor Air Quality in Northwest Schools Newsletter (Winter 2006) titled "Hydroville Curriculum Focuses on Environmental Health".

Presentations, Summer Institutes and Workshops:

During the past 5 years, the HCP professional staff has given numerous presentations and conducted workshops of 1- 6 hour duration at regional and national professional meetings of teachers and scientists relating to activities and modules of the Hydroville curricula. A total of **281 teachers** attended the workshops presented at regional and national teacher conferences.

- Oregon Science Teachers Association, Newport, OR, 2000; Portland, OR, 2001
- The Oregonian Teacher Resource Fair, Portland, OR, 2001
- National Association of Biology Teachers, Baltimore, MD, 2000; Montreal, 2001; Portland OR, 2003
- National Science Foundation International Convention on Air Quality, Miami, FL, 2001
- Society of Toxicology, San Francisco, CA, 2001; Salt Lake City, UT, 2003; Baltimore MD, 2004; San Diego, CA, 2006
- Conference on Problem-based Learning, San Francisco, CA 2001
- NIEHS EHSIC Grantees Meeting Houston TX, 2001; Baltimore, MD, 2004; Bowling Green, OH, 2005
- NIEHS Teacher Workshop, Research Triangle Park, NC, 2005
- National Science Teachers Association, regional meetings, Salt Lake City, UT, 2001; Portland OR. 2002; Seattle, WA, 2005
- National Science Teachers Association, national meetings, San Diego, CA, 2002; Philadelphia, PA, 2003
- EHSTEP meeting, Piscataway NJ, 2002
- Oregon Academy of Sciences, annual meeting, McMinnville, OR, 2003
- American Public Health Association, Washington DC, 2004
- Environmental Educators Association of Oregon and Washington, Vancouver, WA, 2005
- Association for Supervision and Curriculum Development, Orlando, FL, 2005
- Association for the Advancement of Science, Washington DC, 2005

HCP staff have also conducted 6 Summer Teacher Institutes that provide hands-on preparation for the teachers to implement the Hydroville curricula in their classrooms. One hundred and thirty five (**135) teachers** have been trained in the Summer Institutes, directly impacting **4821 students**. Additional Summer Institutes are planned for the 2006-2007 project period.

In addition to Summer Institutes, teachers affiliated with the Science and Math Investigative Learning Experience (SMILE) have been trained in workshops and their students have experienced Hydroville problem-solving activities in after-school clubs and at High School Challenge Weekends at Oregon State University. From 2001-2004, **224 teachers and 1309 students** experienced Hydroville Curriculum activities through the SMILE program.

Publications

Martin, K. "Hydroville Curriculum Focuses on Environmental Health" (www.energy.wsu.edu/projects/building/iaq_nl.cfm); Washington State University Extension Energy Program: Indoor Air Quality in Northwest Schools Newsletter (Winter 2006).

Beyond the Bench: Welcome to Hydroville! Environ. Health Perspectives 112(3): A166, 2004.

Kerkvliet, N. I., Mingo, K., and Bloomfield, M. Hydroville Curriculum Project: A Successful Toxicology Outreach Program for High School Teachers and Students in Oregon. Comments on Toxicology 8: 1-9, 2002.

Busse, R. Education spotlight: Hydroville. Teaching For Healthier Environments Newsletter 7 (1): 5, 2001.

Partnership for Environmental Education and Rural Health (PEER)

Grades: 6-8
Subjects: Science, Math, Social Studies, History, English Language Arts

Larry Johnson, James Kracht, William Klemm, Deborah Kochevar, Jon Hunter, K. C. Donnelly, Carmen Sumaya, Jimmy Lindner, Gary Wingenbach, Sabrina Akhtar, and Vince Hardy

Center for Environmental and Rural Health, Texas A&M University

Summary

The Partnership for Environmental Education and Rural Health (PEER) is a program for rural Middle School students and teachers aimed at improving student enthusiasm for learning, increasing overall academic performance of students, and encouraging teachers throughout the state across all subject areas to use environmental health science topics to motivate students and help them relate science instruction to real world situations. To meet these objectives, PEER provides engaging integrative curricular materials (online and CD based), professional development workshops for teachers, scientists' visits to rural public schools, e-Mentoring service for new and novice teachers, and access to a Distance Learning Community providing interaction between higher education and rural public schools including content mentoring and customized, searchable lesson plans in math, science, social studies, and English language arts.

Evaluation type used (to measure impact)

- Surveys
- Pre/post-tests for K-12 students and teachers
- Control (no curriculum) vs. curriculum
- Teacher comments

Impacts (students & teachers)

Scientists' Visits – Student Impact:

Of 1,725 students surveyed:

93% learned useful information.
90% learned something new.
60% changed the way they thought about the environment and health.
75% changed their beliefs about environmental education.
80% would recommend the PEER program to other students.
79% planned to share what they learned with others.

Schools of different academic status and with varied numbers of students had similar data regarding the usefulness of the information from scientists' visits and how the visits caused a change in the way they think about their environment and health. Scientist Visit Surveys revealed similar impact among students visited by various scientists.

Curriculum – Student Impact:

2004 Science Sleuths Summer Camp - Using our integrative unit, ***Texas: 1867***, in a two week summer camp for 7th and 8th graders, students ($n = 35$) showed a significant improvement ($p<0.01$) in post-tests over pre-tests in content of the material covered in math, science, social studies and English language arts.

2005 Science Sleuths Summer Camp - Using our integrative unit, ***Radios, Robbers and Raccoons***, in our summer camp for 7th and 8th graders, students ($n = 19$) had a significant improvement ($p<0.01$) in post-tests over pre-tests for both overall integrative curriculum (science, math, social studies, and English language arts) and toxicology concepts.

Field-testing in Public School - Using our integrative unit, *Three Rivers, Three Nations* , students receiving the instruction (n=210) showed significantly greater ($p<0.01$) gain scores on the content test than did the control group (n=107) for both integrative curriculum (science, math, social studies, and English language arts) and general toxicology concepts.

Summary of Impact:
There was no difference for two parameters evaluating scientists' visits to public schools (useful information or changed thought) among scientists compared or among schools that differ in number of students or academic status. Hence, scientists' visits are transportable activities.
Differences in pre/post-tests related to scientists' visits illustrated that students learned about their environment, exposure, dosages, and diseases.
Post-test scores were significant between schools in various parameters including family concerns for the importance of grades earned, the value of finishing high school, and students' plans to attend college.
Changes in students' achievement due to the PEER curriculum has been illustrated in a controlled camp and in field testing of the curriculum.

Professional Development Workshops – Teacher Impact:
2004 Workshops - A group of 166 teachers from 9 workshops throughout Texas scored significantly higher on post-tests (62%) than pre-tests (58%) on content material for all four subject areas (math/science/social studies/English) and toxicology.
2005 Workshops - A group of 160 teachers from 10 workshops throughout Texas scored significantly higher on post-tests (70%) than pre-tests (61%) on content material for all four subject areas (math/science/social studies/English) and toxicology combined. When teachers were surveyed six months after the workshops, 71% responded; and of respondents, 18% used the whole curriculum, 38% used materials from 1-2 different subjects, and 44% used some individual component of the curriculum. Additionally, 49% ranked themselves as having improved their PowerPoint skills following the workshop.
Illustrating the multiplying effect of training teachers, teachers attending PEER workshops shared the curricular materials with 423 teachers and 7,071 students.

Impact Summary
Scientist's Visits: There was no difference for two parameters evaluating scientists' visits to public schools (useful information or changed thought) among scientists compared or among schools that differ in number of students or academic status. Hence, scientists' visits appear to be transportable activities.
Integrative Curriculum: Both in public school classrooms and in summer camp settings, the integrative curriculum was effective in increasing the knowledge learned in various subjects by middle-school students.
Professional Development: Teachers attending workshops and working through the Integrative Curriculum increased their proficiency in technology and increased their content knowledge across the various subjects and shared their knowledge with other teachers and many students.

Dissemination strategies to date

- Online dissemination through website. From February, 2002 to December 2005, 1,866,381 pages with 6,236761 total hits of the PEER website has been viewed world-wide.
- Pre-service teacher training
- Direct mailings of 4,000 plus letters to rural middle school teachers
- Publication in journals and educational magazines
- Scientists' visits to schools
- Teacher workshops to promote curriculum (40 workshops with 777 teachers)
- Faxes to School Principals and Superintendents
- CDs sent to all 69 Colleges of Education of universities in Texas
- Dissemination of material at local, state and national meetings
- NSF GK-12 Program

- Direct via graduate fellows
- Teacher training meetings
- Regional GK-12 website for searchable materials
- NIEHS/NSF threaded discussion forums
- Graduate course in outreach

Rural K-12 teacher and student Impact measured by Solid Numbers for one year

- 751 in-service and 308 pre-service teachers received one hour or 2 days of information/training workshops
- Teachers shared curriculum with 423 teachers
- 3,000 letters mailed to teachers
- 270 letters faxed to principals & curricular coordinators
- 69 deans of COE each given 8 CDs for distribution
- 725 CDs given to teachers at schools, conventions, and meetings
- Scientists visited 7,552 students
- Workshop teachers shared curriculum with 7,071 students

Possible impact based on 25 students per teacher and that all avenues of dissemination were effective. 6,299 teachers and 161,523 students could have been impacted by PEER each year.

Publications, presentations, workshops, awards

Journal Articles

Schmidt, S., Holubec, B., Anderson-Trevino, M., Wingenbach, G. J., Lindner, J. R., Johnson, L., & Klemm, W. (submitted). Inquiry-based learning using integrated curricula for math, science, and reading. *Journal of School Science and Mathematics,* Submitted

Holubec, B., Schmidt, S., Anderson-Trevino, M., Wingenbach, G. J., Lindner, J. R., Johnson, L., & Klemm, W. (submitted). Scientists' visits and middle school students' decisions about science careers. *Middle School Journal,* Submitted

Rutherford, T. A., Wilson, S., Wright, K., Wingenbach, G. J., Lindner, J. R., Johnson, L., & Klemm, W. (submitted). Classroom observations of the PEER integrated curriculum. *Middle School Journal,* Submitted

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Lewis D., K. Lazo, F. Sohrabji, L. Johnson 2005. *Scientist for a Day.* Southwest Regional NSF GK-12 Meeting October 22, 2005. College Station, TX

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McNichols J., Klemm W., Kracht J., Hardy V., Yasskin P., Allen D., Donnelly K.C., Johnson L. 2005. *Distance Learning Community Internet Based Science Outreach to Middle Schools*. Southwest Regional NSF GK-12 Meeting October 22, 2005. College Station, TX

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Oehler L., P. Donald, V. Cassone, L Johnson 2005. *Integrating Science and Technology in the GK-12 Classroom through Project Based Inquiry Learning.* Southwest Regional NSF GK-12 Meeting October 22, 2005. College Station, TX

Pedrigi R, Albin R, Johnson L, 2005. *Fun with Physics.* Southwest Regional NSF GK-12 Meeting October 22, 2005. College Station, TX

Ramon M., L Buban, V Traweek 2005. *Folding in Scientific Method.* Southwest Regional NSF GK-12 Meeting October 22, 2005. College Station, TX

Traweek V., M. Kobiela 2005. *Architecture and Mathematics.* Southwest Regional NSF GK-12 Meeting October 22, 2005. College Station, TX

NOTES:

SUC_2ES_2

(Students Understanding Critical Connections between the Environment, Society and Self)
Grade level: Second-, fifth- and seventh-grades
Subjects:
Primary: science, health, math and language arts
Secondary: communication and social studies

University of Medicine and Dentistry of New Jersey-
School of Public Health
Grant No. R25 ES10697
Audrey R. Gotsch, DrPH, CHES (PI)

Project summary and description
Chick Chock™, the Johnson Family and the Sanchez Household – they are all experiencing health problems and need help to determine whether the cause of their health problems are related to the environment. Second-, fifth- and seventh-grade students in the Woodbridge Township School District (NJ) are investigating these health problems through the innovative SUC_2ES_2 (Students Understanding Critical Connections between the Environment, Society and Self) initiative. Students are engaging in exciting and challenging science, health, math and language arts activities over the course of 8-10 weeks to gain knowledge and skills about the environment and how the environment can affect health, improve their attitudes toward science and the environment and develop problem solving and decision making skills. Working as scientists, students collect, organize and carefully examine real-world information through experiments, case studies, games, simulations, role plays and storybooks to help solve Chick Chock™'s, the Johnson Family's and the Sanchez Household's health problems and the case studies encountered in the initiative's three curriculum guides' lessons.

Since 2000, educators and scientists from the school district, the University of Medicine and Dentistry of New Jersey-School of Public Health/Environmental and Occupational Health Sciences Institute (project managers), the New Jersey State Department of Education, the Graduate School of Education at Rutgers University and Rider University, have worked together to develop, implement and evaluate three curriculum guides for second-, fifth- and seventh-grades. SUC_2ES_2 is made possible with support from the National Institute of Environmental Health Sciences, National Institutes of Health (Grant No. R25 ES10697).

Using an innovative curriculum development model, teachers, scientists and education specialists worked collaboratively to develop three curriculum guides. These curriculum guides expand upon an existing award-winning curriculum series entitled ToxRAP™ (Toxicology, Risk Assessment and Pollution) and use environmental health sciences as an integrative context to improve student academic performance. Teachers who participated in the curriculum development process participated in hands-on workshops to familiarize them with the grade-level specific ToxRAP™ module, as well as curriculum integration strategies. Curriculum development occurred over 1.5 years, including all-day and after-school sessions during the school year followed by a writing summit in the summer. Scientists from UMDNJ were involved throughout the development process, to ensure scientific accuracy and to address teacher/student questions and concerns. As a result of participating, curriculum development teachers increased their capacity to design and use integrated curricula in the classroom.

Curriculum guides were pilot-tested in select district classrooms and then revised prior to district-wide implementation. Curriculum development teachers facilitated workshops to train their fellow teachers on the interdisciplinary curriculum guides. To date, all three curriculum guides are being implemented in all 16 district elementary schools and five middle schools.

A critical component to the SUC_2ES_2 initiative is the implementation of a comprehensive evaluation of the activities including the curriculum development model. One outcome being examined is the effectiveness of the curriculum to increase environmental health literacy and improve science attitudes among students. To date, student pre- and post-tests have been conducted in intervention and

comparison schools at each of the district's three grade levels. Student pre- and post-test scores are currently being analyzed; preliminary results for second- and fifth-grades show significant improvement in student learning.

Materials produced

Second-Grade: The Case of the Green Feathers (2003)
Two curriculum binders (two volumes), an oversized children's book and a curriculum kit
Fifth-Grade: What is Wrong with the Johnson Family? (2004)
Curriculum binder, card game (six sets) and a curriculum kit
Seventh-Grade: Mystery Illness Strikes the Sanchez Household (2005)
Curriculum binder and a curriculum kit

Content/Keywords/Exposures/Disease/Themes

All: toxicology, risk assessment, risk management, exposure assessment, inquiry-base, applied science, integrated, authentic, environmental health
Second-Grade: pollen, allergies, asthma
Fifth-Grade: carbon monoxide, indoor air quality
Seventh-Grade: lead paint hazards, indoor air quality

Evaluation type used (to measure impact)

A critical project component is the implementation of a comprehensive evaluation of the curricular materials. This outcome evaluation is determining the effectiveness of the curricula to increase environmental health literacy and improve science attitudes among students. SUC_2ES_2 employs a quasi-experimental research design with intervention and comparison schools. Project developed student pre- and posttests are conducted in intervention and comparison schools at the three grade levels. Pre-test and post-test reliability is measured using inter-rater and test-retest methods. Students are also tracked throughout the seven-year grant period to determine whether exposure to the SUC_2ES_2 curriculum guides over multiple years (i.e., in second-grade and then three years later in fifth-grade and then two years later in seventh-grade) has a greater impact than a single exposure at one grade level. The effects of gender, race, ethnicity, socio-economic status (as determined by student participation in the free or reduced lunch program), teacher length of participation in project, teacher years of experience, teacher degrees and extent of curriculum implementation are also examined for their influence on test outcomes. Test scores on standardized state assessments will also be examined and correlated with pre- and post-test results.

Full analysis of results for the three grade levels is underway. Preliminary results for second- and fifth-grades show significant improvement in student learning. For example, second-grade classrooms in the 2002-03 school year implementing the curriculum guide improved on the overall pre-/post-test scores significantly more than comparison classrooms ($F=4.15$, $p=.048$). Overall, students improved their scores by 9.66 points (out of 28) in the schools that had the curriculum. The increase was slightly better (10.88 points) in the second year of implementation in the 2003-04 school year. Use of the curriculum guide also showed similar test improvements across race, sex and lunch status (a measure of economic resources). The amount of improvement in intervention schools showed no significant differences between pre and post-tests when examined for these demographic variables (race: $F=.166$, $p=.919$), (sex: $F=.687$, $p=.409$) or (lunch status: $F=.072$, $p=.789$).

The curriculum development model developed for this project is being evaluated by semi-structured interviews of key project participants from the Woodbridge Township School District at each grade level. The process used to develop the curriculum was found to be an effective and valuable approach.

Impacts (students and teachers)

Since 2000, 3,995 second-grade students, 2,712 fifth-grade students and 2,191 seventh-grade students have been impacted by SUC_2ES_2. Approximately 60 second-grade teachers, 45 fifth-grade teachers and 27 seventh-grade teachers have participated in SUC_2ES_2.

Dissemination strategies to date

Project results have been disseminated through presentations at professional conferences. Ten presentations about the project have been completed and additional presentations are planned. Research papers are also under development for publication in peer-reviewed journals. The three curriculum guides developed specifically for the Woodbridge Township School District will be modified for general applicability and marketed to other school districts across the country as part of the ToxRAP™ Education Program.

Publications, presentations, workshops, awards

Publications

L. Hemminger, L. Waishwell, L. Copeland, B Schlegel, A. Gotsch. "Examining 2nd Grade Students Science Cognitive and Process Skills." (under development)

Presentations

L. Hemminger. "Developing Integrated Environmental Health Curricula" presented at the National American Association for Environmental Education Annual Conference, Anchorage, AK, October 11, 2003.

L. Waishwell, B. Schlegel, L. Hemminger, L. Weidner, A. Gotsch. "Success with SUC_2ES_2 (Students Understanding Critical Connections between the Environment, Society and Self)" presented at the American Public Health Association Annual Meeting, San Francisco, CA, November 19, 2003.

L. Hemminger and L. Rotella. "Integrating Environmental Health into the Curriculum" presented at the National Association of Elementary School Principals Annual Meeting, San Francisco, CA, April 18, 2004.

L. Waishwell, B. Schlegel, L. Hemminger, J. Campbell, A. Gotsch. "Success with SUC_2ES_2 (Students Understanding Critical Connections between the Environment, Society and Self)" presented at the 2004 EOHSI Research Day, Piscataway, NJ, May 13, 2004.

B. Schlegel, L. Waishwell, L. Hemminger, L. Weidner, A. Gotsch. "Leaving No Child Behind with Environmental Health" presented at the 2004 American Public Health Association Annual Meeting, Washington, DC, November 10, 2004.

L. Hemminger, B. Schlegel, L. Waishwell, L. Weidner, A. Gotsch. "Successes of Using Integrated Science Curricula for Elementary Grade" presented at the International Conference on Education, Honolulu, HI, January 6, 2005.

F. Darytichen. "Inquiry-Based, Integrated Curriculum: A Science Supervisor's Perspective" presented at the American Association for the Advancement of Science Annual Meeting, Washington, DC, February 19, 2005.

L. Hemminger, K. Frevert, K. Mingo, L. Pittman and B. Schlegel. "University-School District Partnerships for Curriculum Integration and Contextual Learning" presented at the Association for Supervision and Curriculum Development Annual Meeting, Orlando, FL, April 2, 2005.

B. Schlegel, L. Rotella and L. Hemminger. "Two Heads Are Better Than One: A School/University Partnership" presented at the Association for Supervision and Curriculum Development Annual Meeting, Orlando, FL, April 3, 2005.

L. Waishwell, B. Schlegel, L. Hemminger, L. Weidner, L. Copeland, A. Gotsch, "Partnering for Successful Curriculum Integration" presented at the International Conference on Education, Honolulu, Hawaii, January 7, 2006.

Second- Grade Workshops

January 24, 2001	SUC_2ES_2 Overview and ToxRAP™: The Case of the Green Feathers
February 28, 2001	ToxRAP™, Language of Risk and Allergy and Asthma Field Trip
March 12, 2001	Designing Concept-Based Units: Teaching for Deeper Understanding
April 25, 2001	Curriculum Development Planning
May 16, 2001	Curriculum Development Planning
May 22-23, 2001	Curriculum Writing Preparation
June 12-13, 2001	Curriculum Writing Preparation
June 26-28, 2001	Curriculum Writing
October 11, 2001	Curriculum Revisions and Enhancements
November 15, 2001	Curriculum Revisions and Enhancements
November 26, 2001	Curriculum Revisions and Enhancements
December 5, 2001	Curriculum Revisions and Enhancements

January 9, 2002 Curriculum Training and Pilot-Test Preparation
February 20, 2002 Curriculum Training and Pilot-Test Preparation
April 10, 2002 Pilot-Test Progress Meeting
May 29, 2002 Pilot-Test Wrap-up Meeting
June 26-28, 2002 Curriculum Revision after Pilot Test
August 22, 2002 Curriculum Guide Assessment Meeting
October 3, 2002 2nd Grade Teachers Plan the 2nd Grade Implementation Workshop
November 20, 2002 Initial Implementation Training, Lesson Introduction-Lesson Four
January 29, 2003 Second Implementation Training, Lesson Five-Lesson Conclusion
June 5, 2003 Implementation Follow-Up Workshop
November 11, 2004 Initial Implementation Training (remaining 8 elementary schools)
December 9, 2003 2nd Implementation Training (remaining 8 elementary schools)
June 8, 2004 Implementation Follow-Up Workshop
October 22, 2004 SUC_2ES_2 Program Supplemental Presentations
December 2, 2004 New Teacher Implementation Workshop-Part 1
December 13, 2004 New Teacher Implementation Workshop-Part 2
October 11, 2005 Initial Implementation Training for New Teachers

Fifth-Grade Workshops

October 2. 2002 Introduction to 5th Grade Curriculum Development
January 9, 2003 SUC_2ES_2 Overview and ToxRAP™: What is Wrong with the Johnson Family?
February 13, 2003 ToxRAP™: Risk Assessment, Carbon Monoxide and Language Arts and Math Education
March 21, 2003 Curriculum Development, Curriculum Integration and Addressing Standards: Your Thoughts and Experiences
April 10, 2003 Curriculum Integration with Holly Houston and Math Activity Ideas
May 8, 2003 Student Assessment, Curriculum Assessment and Lesson Organization
May 20-21, 2003 Curriculum Writing Preparation
June 3-4, 2003 Curriculum Writing Preparation
June 24-27, 2003 Curriculum Writing
September 30, 2003 Curriculum Revisions and Enhancements
October 2, 2003 Curriculum Revisions and Enhancements
October 30, 2003 Curriculum Revisions and Enhancements
November 13, 2003 Curriculum Revisions and Enhancements
December 11, 2003 Pilot Test Training #1
January 8, 2004 Pilot Test Training #2
May 6, 2004 Implementation Follow-Up workshop
June 23-25, 2004 Curriculum Revision after Pilot Test
September 21, 2004 Teacher Training Preparation
October 26, 2004 Initial Implementation Training
December 7, 2004 2nd Implementation Training
March 15, 2005 Implementation Follow-Up Workshop
September 14, 2005 Teacher Training Preparation with Working Group Teachers
September 29, 2005 Initial Implementation Training (remaining 8 elementary schools)
October 12, 2005 2nd Implementation Training (remaining 8 elementary schools)

Seventh-Grade Workshops

October 23, 2003 Introduction to 7th Grade Curriculum Development
January 26, 2004 SUC_2ES_2 Overview and ToxRAP™: The Mystery Illness Strikes the Sanchez Family Curriculum
February 10, 2004 ToxRAP™
March 16, 2004 Lead Risks, Curriculum Integration and Language Arts and Math Education
April 26, 2004 Curriculum Integration and Language Arts and Math Education

May 18, 2004 Curriculum Integration, Geographic Information (GIS) and Student Assessment
June 7, 2004 Curriculum Writing Preparation
June 14, 2004 Curriculum Writing Preparation
June 15, 2004 Curriculum Writing Preparation
June 28-July 1, 2004 Curriculum Writing
October 7, 2004 Curriculum Revisions and Enhancements
October 21, 2004 Curriculum Revisions and Enhancements
November 16, 2004 Initial Implementation Training
December 14, 2004 2nd Implementation Training
March 16, 2005 Implementation Follow-Up Workshop
June 27-29, 2005 Curriculum Revision after Pilot Test
November 20, 2005 Implementation Training

Dissemination Workshops

- SUC_2ES_2 Fifth-Grade Curriculum Guide, July 28, 2006, Austin, TX

Sixth-grade teachers and administrators from the Bastrop Independent School District, who are collaborating with the University of Texas M.D. Anderson Cancer Center to develop integrated environmental health curriculum, will participate in a workshop to learn about the successes and lessons learned regarding the SUC_2ES_2 fifth-grade curriculum guide.

Awards

- United States Children's Environmental Health Excellence Award, April 2006.

The SUC_2ES_2 initiative is an extension of the ToxRAP™ Education Program. The overall goal of the ToxRAP™ Education Program is to empower K-9th grade students, their parents and teachers to make informed decisions about environmental health problems. The program began in 1994 with the development of a three-part curriculum series that involved scientists, health educators and classroom teachers. The program now includes expanded curriculum guides (SUC_2ES_2), a middle school supplement and website activities that support parental involvement. In recognition of its commitment to protecting children from environmental health hazards, the ToxRAP™ Education Program including SUC_2ES_2 received the U.S. Environmental Protections Agency's 2006 Children's Environmental Health Excellence Award. The program was one of only 14 across the country to receive this year's award.

- Best Practices Award, New Jersey Department of Education (under review)

The second-grade curriculum has been submitted for a Best Practices Award in New Jersey and additional submissions are planned for Best Practices Awards for the fifth- and seventh-grade curricula.

NOTES:

AMBIENT

Atmospheric and Marine-Based Interdisciplinary Environmental Health Training

Lora Fleming, Lisa Pitman, Hilarie Davis, Lisa Regensburg, and Terry Pitman
University of Miami
Rosenstiel School of Marine and Atmospheric Science

Project Summary

The **AMBIENT Project** is a systemic approach to environmental health science education. Focused around the four environmental themes of air, water, soil and food, a health-science problem-based learning approach is delivered by trained educators to the ethnically diverse population of high school students in Miami-Dade County. Ethnic diversity is extensive, with a population that is 52% Hispanic, 34% African American, and 13% White. As with any community of this complexity, there are significant environmental health issues of concern to the community and government. The teachers work together to enhance understanding of environmental and ethical issues through a hands-on summer workshop with research scientists from the University of Miami, Florida International University, and County Department of Health. The AMBIENT curriculum modules are comprised of a number of segments. Some of these segments can be taught independently and others are meant to be used together in a certain order. All modules begin with a Teacher's Guide which contains the basic factual information necessary to knowledgeably lead class discussions and guide students' research efforts.

The **Air Contamination Module** has a core scenario comprised of several exercises that develop the concept of the class as an Environmental Consulting Firm hired by their school district. Their tasks are to present information on asthma and other respiratory ailments, investigate the prevalence of these problems within the community and their school, and to design an appropriate intervention in response to their findings. The **Water Contamination Module** focuses on an actual sewage spill and the potential impact to beach water quality after the spill. Various TV News reports of the actual sewer pipe break incident, resulting in microbial pollution of recreational waters, are used to introduce this module. Students generate questions, develop a research plan, read critically, and learn to organize research material as part of the scenario exercise. The **Soil Contamination Module** begins with a local news story on lead contamination and lead poisoning prevalent in inner city neighborhoods. This is the core of the unit and is comprised of several exercises that develop the story of three toddlers diagnosed with lead poisoning. When doing the whole case study, students are split into three groups (one for each toddler) and each group creates a "dossier" on their case with the exercises and research material they have gathered. The **Food Contamination/Nutrition Module** involves a cruise ship banquet as an opening scenario. The module begins with a video containing actual news clips of foodborne illness outbreaks on cruise ships in Miami. Students role-play as members of a Public Health Consultant Team on call to the cruise line company to deal with an outbreak of food poisoning on a cruise ship. The students provide advice and expertise on how to isolate the problem and prevent it from happening again. The students report their entire discovery process and recommendations to the Cruise Line board. The **Ethics Module** is designed to extend and enhance the other four content modules in the AMBIENT curriculum. The activities can also be used alone in Science, Social Studies, Law, or English classes to develop critical thinking, discourse, and presentation skills and strategies.

Future work involves the dissemination of AMBIENT, as well as the creation of additional modules with educator, community and scientific partners. There will also be the resubmission of a NIEHS Small Business Technology Transfer (STTR) Proposal to develop a prototype multimedia educational software package based on the high school level curriculum created by the AMBIENT Project.

Grade Level

The AMBIENT Project is targeted at High School teachers and students. The Miami-Dade County Public School (M-DCPS) System is the 4th largest district in the country with more than 350,000 students (over 93,000 are in grades 9-12). M-DCPS inner city High School classrooms are highly diverse and often overcrowded. An important emphasis of the project is to provide team teaching strategies for incorporating interdisciplinary activities into the large classes of more than 35 students at the high schools. Although the curriculum

has been designed to be implemented at the High School level, Middle School teachers have been encouraged to attend the AMBIENT Summer Workshops during Years 5 and 6. There has been a strong demand for science workshops available to Middle School teachers because of new professional development requirements for teachers of inner city schools. Additional curricular materials have also been created in Elementary Methods in Environmental Health for Pre-Service Elementary Teachers.

Subjects

The AMBIENT curriculum is based on four environmental themes with associated environmental health issues of: air (asthma), water (microbes), soil (lead), and food (foodborne illness & nutrition), as well as modules in toxicology, ethics, and environmental justice. Each module integrates language arts (creative writing and critical reading) with math, hands-on science lab activities and field experiences, and ends in a culminating experience (such as a debate or role play) which involves lessons in economics and government. The problem-based learning approach uses real life scenarios and data.

Evaluation

An External Project Evaluator prepares the AMBIENT Evaluation. The Evaluator has been involved in the project since its inception. Formative evaluation has continued throughout the six years of the project with summative evaluation planned at the end of the project in Year 7. A variety of methods were used to assess the progress toward project objectives.

Study: Development of effective curriculum modules

Pilot Testing of Curriculum

AMBIENT learning activities were presented to high school students in the Upward Bound Program. Feedback received from these students corresponds well with the average classroom environment. Scientists, Educational Specialists and the Project Evaluator presented the learning activities to students in the informal setting of The Miami Museum of Science. New materials are also pilot tested with our AMBIENT teachers, with continual revision and additions made to the AMBIENT curriculum in terms of activities and resources.

Peer Review of the Curriculum

Project modules were sent to various experts recommended by the Project Evaluator. The Curriculum Design Team discuss the comments from Peer Reviewers and incorporate changes to the curriculum.

Study: Effect of summer workshop on teacher's knowledge, attitudes and preparation to implement the modules in their curricula.

Summer Workshops

Teachers' pre/post knowledge gains in toxicology, air, soil, food, and water have been evaluated during the Summer Workshops. These tests were then refined and made available to teachers for use with their students. Content tests for each activity in the modules were used in the Summer Workshops.

The AMBIENT investigators assess which workshop sessions were the most effective by observing teachers in the culminating activities which include role-plays or debates.

Study: Implementation of AMBIENT modules in classrooms

Interviews with Teachers

Teachers attending the Follow-up Days during the academic school years are interviewed about their use of AMBIENT activities. Their responses are analyzed annually and videotapes created.

Surveys

A mid-year survey of implementation activities is conducted annually. Follow-up telephone calls are made to those teachers who do not respond.

School Site Observations

Ambient Investigators visit schools that implement our project in the classroom. All classroom visits are videotaped and student products are collected.

Case Studies

At least two teachers annually are chosen as case studies to interview in more depth due to their extensive use of AMBIENT materials in their classrooms. Videotapes are created annually based on interviews with them and their students.

Teacher Follow-Up Days

Teacher Follow-up days are held in October and March annually. Teachers have additional training and discuss implementation and planned activities for their classrooms. Teachers are encouraged to talk about their activities and collect results.

Project Rubric

A project rubric for environmental health has been developed, reviewed and revised by staff and disseminated to teachers.

Study: Degree to which dissemination and outreach has occurred.

National Conferences

Project Investigators and Teachers participate as Presenters and Exhibitors at various national conferences annually. All materials distributed and number of contacts with conference participants are tabulated.

Project Website

The website has the capability of tracking the total number of hits to the AMBIENT Website and which links sent them to our site.

Impacts

Student Data Analyses

How Many Students Reached
- 40,000 South Florida high school students
- 3,000 South Florida middle school students

Methods Used
- Pre and Post Test Comparisons
- Class to Class Comparisons
- Surveys and/or Case Studies

Trends Observed
- Emerging results from analyses of the data show the positive impact on students exposed to AMBIENT activities (in the classroom, in field competitions, and summer programs)
- Students were engaged and learned about key environmental health and environmental justice issues as a result of the interactions with environmental health scientists and educators
- Content tests indicate knowledge gains with results including lower achieving students
- Students at all levels made significant gains in their knowledge of how environmental health issues are decided (ethics)

Teacher Data Analyses

How Many Teachers Reached
- 300 teachers during summer workshops
- 300 teachers during presentations made at conferences

Implementation in the Classroom
- AMBIENT Investigators and Project Evaluator have made over 60 school-site visits to observe teachers implementing AMBIENT activities in their classrooms.

Development of Master Teachers
- A team of AMBIENT Master Teachers has been developed. These teachers aid in curriculum development and workshop activities.

Presentations at Professional Conferences
- The AMBIENT Project has sponsored 55 teachers attending National Conferences since the inception of the AMBIENT Project.

Teacher Follow-Up Days During the Academic School Year
- AMBIENT Teachers have the opportunity to interact with Environmental Health Scientists and Project Evaluator at various times throughout the school-year.

Dissemination Strategies

National Conferences – as Presenters and Exhibitors

Beginning with Year 1 of the project, AMBIENT Investigators and Teachers have annually been presenting at National Conferences and Professional Meetings. The teachers are chosen to attend based on their implementation of AMBIENT activities. Presentations include

stations of hands-on applications of the AMBIENT curriculum modules run by AMBIENT Master Teachers. Besides presenting workshops at the conferences and meetings, Ambient Investigators and Teachers participate in brief presentations at NIEHS Exhibitor Booths.

As Invited Speaker

For the past six years, AMBIENT Investigators have been invited to speak about K-12 Environmental Health Education and Outreach at numerous conferences and meetings. Investigators have attended Channel 6 ECOwatch Meetings, attended meetings with District Science Supervisors regarding the use of WLRN Educational TV, and attended Miami-Dade County Environmental Education Providers Meetings to present the AMBIENT Project. Investigators also make presentations describing The AMBIENT Project to various internal Miami-Dade and Broward County Public School groups and individual Principals as part of Teacher Participant recruitment at Miami-Dade and Broward County Public Schools. AMBIENT Investigators have been invited to collaborate with The University of Miami College of Education. The objective is to infuse environmental health topics into the UM pre-service elementary preparation program by adapting AMBIENT Project curricular materials.

Workshop

AMBIENT Workshops are publicized at state and national conferences and professional meetings and are open to teachers nationwide. The AMBIENT Program is also advertised in the Environmental Health Perspectives (EHP) Student/Teacher Edition. The AMBIENT curriculum has been correlated to the Sunshine State Standards and to the National Science Standards, making the activities more relevant to teachers nationally.

Project Website

The AMBIENT Project has a dedicated Web Master who maintains and continuously updates the website. Completed curricular materials are downloadable as an entire module or as stand-alone activities. All materials are teacher-friendly and free of cost. The Miami-Dade County Public School's Division of Mathematics and Science Homepage is linked to The AMBIENT Project Homepage.

Envirothon Competition

Since 2003, AMBIENT Investigators and Teachers have participated in the Regional Envirothon Environmental Science Competition – a contest among high school students of Miami-Dade and Monroe Counties. The competition takes place in Everglades National Park and involves over 30 high schools in the South Florida region. AMBIENT sponsors the Environmental Health Station. AMBIENT Investigators provide M-DCPS with packets of background materials (in Dec.) for students to read to prepare for the competition in March. The theme for the competition varies annually. AMBIENT Investigators assemble pertinent readings and websites involving the Basics of Toxicology, Lead and Food Poisoning, and Water and Air Contamination. This information is also posted on the AMBIENT Website. Investigators prepare tests (made up of hands-on activities and questions involving reading comprehension, and math skills) on which student teams are scored. Awards are presented to the team that scores the highest at the AMBIENT Environmental Health Station.

Sustainability

The AMBIENT Project continues to receive support from the District School System in expanding awareness of issues involving Environmental Health and Environmental Justice for teachers and students in the Miami-Dade County Public School System. This will be the second year that the school district will match NIEHS funding for teacher stipends.

The Florida Department of Education has recently reinstated Environmental Education Curriculum Support for the state. The AMBIENT Project has recently been approved by the Florida DOE and is in the process of being added to their Environmental Education Programs and Publications Website.

Polyhedron Learning Media, Inc. is resubmitting a NIEHS Small Business Technology Transfer (STTR) Proposal in collaboration with The AMBIENT Project to develop a prototype multimedia educational software package based on the curriculum created by the AMBIENT Project. Plans are to investigate opportunities for commercialization, upgrade audio/visual components, add interface software simulations throughout the modules, and create kiosks that will be set up at future town meetings, school meetings, science museums, nature centers, and libraries.

Publications, Presentations, and Workshops

Publications

Pitman L.,Fleming L., Stephan W, Solo-Gabriele H, Trepka MJ. **Envirothon High School Environmental Sciences Competition Materials**. NIEHS Marine and Freshwater Biomedical Sciences Center, University of Miami, 2003, 2004, 2005, and 2006.

Pitman L. **Structuring a Partnership Between University Researchers and the Public School System.** In Hasse D, Wojnowski B, and Schulze S. (Eds.), Linking the Science in the Classroom to Science in the Laboratory, The Science House, North Carolina State University, 2003.

Presentations

4/05 **University-School District Partnerships for Curriculum Integration and Contextual Learning,** Association for Supervision and Curriculum Development Annual Conference, Orlando, Florida.

2/05 **Breaking the Mold: Advancing Science Literacy with Inquiry-Based Curriculum,** Teaching and Learning in Science Symposia, American Association for the Advancement of Science Annual Meeting, Washington DC.

1/05 **First Annual Oceans & Human Health Science Symposium.** Rosenstiel School of Marine & Atmospheric Sciences, University of Miami, Miami, FL.

10/04 **The Audubon AMBIENT Environmental Justice (Poster).** NIEHS Center Director Annual Meeting, Research Triangle Park, NC.

3/04 **The AMBIENT Project: High School Environmental Health Sciences Curriculum (Poster).** SOT Annual Meeting, Baltimore, MD.

3/04 **The AMBIENT Project: High School Environmental Health Sciences Curriculum (Poster).** NIEHS-ARCH Science Symposium. Miami, FL.

3/03 **Introduction to NIEHS Interdisciplinary Environmental Health Projects,** National Science Teachers Association Conference, Philadelphia, Pennsylvania.

2/03 **Dissemination of the AMBIENT Project in Georgia,** Georgia Science Teachers Association Science and Leadership Conference, Jekyll Island, Georgia.

2/03 **Structuring a Partnership Between University Researchers and the Public School System,** Conference on K-12 Outreach from University Science Departments, The Science House, North Carolina State University, Research Triangle Park, North Carolina.

3/02 **Ethics in Science Education.** Miami-Dade County Commission on Ethics and Public Trust Meeting, Miami, Florida.

7/01 **Making Connections: Collaborations Between School Districts and Science Museums, Universities, and Government Agencies Presentation,** National Marine Educators Association Annual Conference, Victoria, British Columbia, Canada.

Workshops

6/06 **Sixth Annual AMBIENT Teacher Training: Soil and Food Contamination**, Rosenstiel School of Marine & Atmospheric Sciences, University of Miami, FL.

4/06 **Selected Activities from Water Contamination Module,** National Science Teachers Association (NSTA) Conference, Anaheim, CA.

7/05 **Selected Activities from the Water Contamination Module,** National Marine Educators Association Conference (NMEA), Maui, HI.

6/05 **Fifth Annual AMBIENT Teacher Training: Air and Water Contamination and Environmental Justice**, Rosenstiel School of Marine & Atmospheric Sciences, University of Miami, FL.

10/04 **Teaching Across Disciplines using Environmental Health,** NIEHS Centers Director Meeting, Research Triangle Park, NC.

6/04 **Fourth Annual AMBIENT Teacher Training: Ethics in Environmental Health** , Rosenstiel School of Marine & Atmospheric Sciences, University of Miami, FL.

4/04 **How the Environment Impacts Human Health,** National Science Teachers Association (NMEA) Conference - Atlanta, Georgia.

3/04 **Novel Approaches to Engaging Toxicologists in K–12 Science Education and Outreach** Society of Toxicology Meeting, Baltimore, MD

6/03 **Third Annual AMBIENT Teacher Training: Basic Toxicology** , Rosenstiel School of Marine & Atmospheric Sciences, University of Miami, FL.

3/03 **Introduction to NIEHS Interdisciplinary Environmental Health Projects Presentation,** National Science Teachers Association Conference, Philadelphia, Pennsylvania.

12/02 **EH-STEP Workshop - AMBIENT Water Module,** Rutgers University, Piscataway, New Jersey

6/02 **Second Annual AMBIENT Teacher Training: Air and Food Contamination**, Rosenstiel School of Marine & Atmospheric Sciences, University of Miami, FL.

8/02 **The AMBIENT Project,** North American Association for Environmental Education, Boston, MA

6/01 **First Annual AMBIENT Teacher Training: Water and Lead Contamination**, Rosenstiel School of Marine & Atmospheric Sciences, University of Miami, FL.

My Environment, My Health, My Choices

Grade Levels: Grades 5-12
Subjects: Science (biology/life sciences/ AP environmental science/chemistry); social studies; history; health; English as a Second Language, art, visual studies, computer-technology, English, special education.

University of Rochester
Problem-Based Learning for Environmental Health

Project Summary and Description:
My Environment, My Health, My Choices is an environmental health curriculum development project sponsored by the University of Rochester Environmental Health Sciences Center and the Center for Science Education and Outreach. The project involves teachers in public, private and alternative schools from the greater Rochester, New York area (as well as throughout New York State) who create interdisciplinary environmental health curriculum units with the support of University of Rochester faculty.
The curriculum units focus on specific environmental health questions or problems that are of local, regional, or national concern. Such problems include, for example, water pollution due to farm runoff, links between air pollution and asthma, and the health effects linked to pesticides. The *My Environment, My Health, My Choices* project is intended to help teachers introduce environmental health topics in a variety of subject classes - not simply science. The project also aims to increase student and teacher knowledge about the links between the environment and human health and to encourage both teachers and their students to take action to address environmental health problems.
My Environment, My Health, My Choices curriculum units:

- Have a problem-based learning or case study component
- Include student projects and presentations
- Include interdisciplinary lessons
- Align with New York State education standards

The following is a description of four web-based curriculum modules that are posted on our project website (http://www2.envmed.rochester.edu/envmed/EHSC/outreach/curriculum.html). We will be posting additional curriculum modules in Fall, 2006.

Asthma in the City
Written by Dan Sullivan, East High School, Rochester, New York
Grade level: high-school
Subject areas: environmental science, health, biology, social studies
Time: fourteen class sessions

This problem-based learning unit focuses on the health effects of poor air quality. The problem, *Separated at Birth*, introduces students to twins separated in infancy. Students are asked to explain why one twin has asthma and one does not. Can the environment make a difference in health problems? Students work in groups and research the issue by assuming one of the following roles: medical doctor, environmental biologist, epidemiologist and sociologist. They are challenged to explore the problem, research and answer the question, discover ways to evaluate the answers and then present them to other class members.

Environmental Health Concerns: From Problem to Public Policy
Written by Michael Fantauzzo, Rush-Henrietta High School, Henrietta, New York
Grade level: high-school
Subject areas: social studies, government, science
Time: eight class sessions

The focal points of the unit are five fictional letters from concerned citizens complaining about five different environmental health issues. Students are guided to research these issues, to interview local people with experience related to these issues, to evaluate sources used, and to write public policy statements. Students will also produce a public service announcement. During this unit they are involved in both policy-design and policy-making

Killing Killer Rain: Acid Rain and Environmental Health
Written by Andrew Ragan, Allendale Columbia School, Rochester, New York
Grade level: middle school or high-school
Subject areas: social studies, history
Time: eleven class sessions

This unit uses interdisciplinary problem-based learning to focus on acid rain: its sources, environmental effects, health effects, economic impact, political impact, and potential solutions in the United States and Canada. The introductory problem, *Killing Killer Rain*, asks students to research specific questions about acid rain in order to make recommendations to government officials about the future of coal-burning power plants, a major source of the acid rain. Students are challenged to define the problem, to work in teams to research questions related to the problem, and to present their reports and recommendations to the class. The class is divided into six research groups. Each student in the group adopts a different perspective to research and reports on the effects of acid rain. The group then uses this information to make recommendations for problem solutions and presents a report on their recommendations to the class.

Dangers Seen and Unseen: Water and Environmental Health
Written by Liza Steffen, Larisa Useda and Meike Sedor: Monroe High School, Rochester, New York
Grade level: middle school (grades 6 - 8)
Subject areas: English language arts, English for speakers of other languages (ESOL), health, science, social studies
Time: fourteen class sessions

This problem-based learning unit focuses on the impact of water pollution on human health. A problem-based learning scenario, *Dangers Seen and Unseen*, introduces students to the health effects of exposure to polluted lake water. Students gain research skills as they use books, web sites and Internet search engines to find information. They develop group process skill as they discuss information with peers. They are challenged to explore the problem, research and answer questions, discover ways to evaluate the answers and then present information to other class members via PowerPoint.

Evaluation:
We use a mixed-methods research design to measure teacher and student impacts of environmental health curricula:

Data tool	Type	Analysis
Teacher Survey	Quantitative	Descriptive statistics
Student Pre and Post test (pilot)	Qualitative	Descriptive statistics
Artifacts/Sample of students work	Document	Case-study
Classroom Observations	Qualitative	Qualitative
Teacher written-open-ended response	Qualitative	Qualitative

The *Teacher Survey* provides demographics and descriptive statistics of our teacher-participants and student impact. Information is collected in the following areas of interest: the year the teachers started the program, area of subject certification, years of teaching experience, school type (public, private or alternative school), if the teachers is tenured, grade levels and classes taught, the title of their curriculum unit they are implementing in the class, grade level appropriateness, subject areas of integration, how many class

sessions/time the curriculum is implemented, how many years they have taught the curriculum, total number of students they have taught the curriculum to, and if they will continue to teach environmental health curricula in their class.

Demographics/descriptive statistics of respondents

We sent an on-line survey via e-email with a web-link embedded in the text to thirty of our teacher-participants (n=30). We collected our data over a period of one week with a response rate of 70% (n=21). Of those teachers who responded, 76% are from years 2000-2003 who no longer receive project funding, and 24% are from the years 2004-2006 who receive some funding. Our teacher-respondent's primary subject certification areas are: 43% science, 10% elementary-education, 14% English as a Second Language, 5% health, 5% special education, 5% art, and 5% history and social studies, 5% English, with 7% of teacher-participants not claiming a subject certification area (private schools do not require teacher certification). Years of teaching experienced ranged from 2 years to 26 years with 71% of our teachers with ten years or more of teaching experience and 29% with nine years or less of teaching experience. 76% of our teachers have tenure, 24% are not tenured. 81% of our teacher–participants are situated in public schools, 14% in private schools and 5% in an alternative school. Eight teachers indicated that they have written and used other environmental health curricula that are not presently posted on our website.

Impacts (students & teachers)

Of the 70% of the teacher-participants who responded to our survey, they indicate that a total of 3,809 students have been taught environmental health curricula over the last 6 years. This number would possibly be greater if all of our teachers responded to the survey.

Sustainability

Data collected from on-line survey of participant teachers from the years 2000-2006 indicate that 95% (n=20) of the teachers who receive little or no funding support but have continued teaching their environmental health units. Teachers stated that the curriculum is sustainable without our support or funding for the following reasons:

- 44% the curriculum is written well/easy to use,
- 56% adaptable to my class curriculum,
- 44% engaging to my students,
- 50% important and appropriate knowledge,
- 61% integration of other subject area knowledge was useful to my students.
- 72% I created the curriculum and will continue to revise it to suit my students needs and interests.

Only one teacher (n=1) stated the curriculum **was not sustainable** for the **only one** of the following reasons:

- 100% **The lesson/unit took too much time out of my class curriculum**
- 0% Written poorly/difficult to follow
- 0% Did not adapt easily into my classroom curricula
- 0% Teaching a different course/grade level next year
- 0% My students were not interested in the lesson
- 0% Content knowledge was inappropriate for grade level
- 0% Integration of other subject area knowledge was inappropriate and/or uncomfortable.

That the teacher **did not** indicate any other problems with the sustainability of the curriculum might indicate time constraints are due to high-stakes standardized testing practices required by NCLB which have been problematic in implementing innovative curricula in New York State Regents courses[2].

[2] Martina, C. A., Hursh, D., Markowitz, D., Hart, K. & Debes, P. (2003). *Contradictions in educational policy: Developing integrated problem-based curriculum in a high stakes environment.* Paper presented at the annual American Educational Studies Association Conference. Mexico City, Mexico, October 30, 2003. (Peer reviewed)

Student Pre & Post tests (developmental)
Some teacher-participants wrote and piloted student pre and posttests. Initial reports show some significance, although the pre/posttest were not very academically rigorous and did not address all the learning objective of the curriculum units. Therefore pre and posttests will be revised to meet all learning objectives indicated in the curriculum and will be implemented 2006-2007.

Student artifacts
We have collected a variety of student work that has improved and become more sophisticated over the years of the project. This is in part due to teacher's revisions of their own curricula and having student view previous classes/students' exemplars of environmental health curricula projects.

Classroom observations
Several members of our team (curriculum consultants, evaluator) have visited the teacher-participant classrooms during implementation of the environmental health curricula to offer objective feedback, curriculum-building strategies and to informative collect data. To date teacher participants continue to revise and add more depth to their curriculum. Student projects are improving in complexity and knowledge.

Teacher open-ended responses
Themes of changes in instructional and pedagogical practices as a benefit from participating in this project are positive in a move toward teacher's initiating student-centered, integrated interdisciplinary methods of curriculum building and instruction practices across subject areas and not exclusive to science education. Such examples are:

- "Students take charge of their own learning and drive instruction. Teachers guide the direction in terms of core but allow students to become involved in learning to a depth that would not be possible without the PBL."
- "I am more likely to create authentic based assessments. I have also incorporated more health and environmental science in my history classes."
- "It was my first time writing a problem-based curriculum and I was very pleased with the students' interest and enthusiasm."
- "I have always utilized an integrated approach, however utilizing a problem-based approach has meant more small group and greater individualization of activities as I created and implemented student centered lesson plans."
- "It has made me more aware of this teaching strategy and the benefits of using it."
- "Use this model for other health problems."
- "I have grown more skilled at facilitating problem-based activities in the classroom."
- "I love the exploration and problem solving"
- "The AP curriculum mandates (rightfully so) the use of problem-based learning and integrating diverse content areas. It has always been a part of my instructional strategy. The integrated environmental curriculum is a great tool, and hopefully more educators will be receptive to enriching their classrooms by incorporating it into their lesson plans."
- "Certainly, I have grown more skilled at facilitating problem based activities in the classroom."
- "Use this model for other health problems"
- "I am now more likely to consider problem-based scenarios for teaching various aspects of history."
- "Sometimes it changes the way I approach my lesson structures and unit structures. I tend now to start with the end in mind rather than the beginning."

Dissemination strategies to date:

- Four curriculum modules are currently posted on our website (http://www2.envmed.rochester.edu/envmed/EHSC/outreach/index.html), and we will be posting additional modules in the summer and fall, 2006.
- Professional development workshops: We will host a 4-day Environmental Health Institute in July, 2006 at the University of Rochester. Participants will include 7 biology Mentor teachers and 7 chemistry Mentor teachers from the New York State Biology-Chemistry Professional Development Network (http://www.flcc.edu/biochem/). These Mentors will learn about our

existing curricula, and they will also spend 1 week at a follow-up workshop writing additional curriculum modules. The curricula will then be presented in October to approximately 100 Statewide chemistry and biology Mentors at their annual conference. Mentors will then host local workshops throughout New York State to introduce the curricula to other teachers in their own regions.

Publications, presentations, workshops, awards

Presentations

Martina, C.A. & Hursh, D. (2005). *We all live downstream: Transforming knowledge and thinking through teaching and learning about the relationship between the environment and human health.* World Environmental Education Congress (WEEC), Torino, Italy. October 2-6, 2005. (Peer-reviewed).

Martina, C.A. & Hursh, D. (2004). *Circumventing Barriers to Curriculum Implementation*, National Institute of Environmental Health Sciences annual site meeting, John Hopkins University, March 22, 2004, Baltimore, Maryland.

Martina, C. A., Hursh, D., Markowitz, D., Hart, K. & Debes, P. (2003). *Contradictions in educational policy: Developing integrated problem-based curriculum in a high stakes environment*. Paper presented at the annual American Educational Studies Association Conference. Mexico City, Mexico, October 30, 2003. (Peer reviewed)

Publications

Macdonald, G. & Hursh, D. (2006). Chapter 11. "For the Twenty-First Century: Teaching about the relationship between the environmental and human health: Pushing the boundaries." *Knowledge, Networks and New Economies*. Sense Publications. Rotterdam, Netherlands.

NOTES:

The Integrated Environmental Health Middle School Project
University of Washington and University of New Mexico

PIs: Dr. David Eaton, Dr. Tom Burbacher and Dr. Craig Marcus
Manager: Katie Frevert
Collaborators:, Dr. Anne Nicoll, Stefanie Hines, Lyle Rudensey, Kristen Bergsman, Chetana Acharya, and Jon Sharpe

This project is supported by grants 5R25-ES10738 and P30-ES07033, from the National Institute of Environmental Health Sciences, NIH.

OVERVIEW

The Integrated Environmental Health Middle School Project (IEHMSP) introduces middle school teachers and students in Washington State and New Mexico to the field of environmental health and facilitates the teaching of environmental health topics across the middle school (grades 6-8) curriculum. The IEHMSP has developed an interdisciplinary model of problem-based and contextual learning that uses 'environmental health' as the integrative theme across multiple subject areas. Project teaching materials have been welcomed by school districts across both Washington and New Mexico for their value in reaching students through personally-applicable, locally-relevant topics that apply directly to school district learning requirements.

The IEHMSP has reached over 200 teachers in seven subject areas, in Washington and New Mexico. Teachers in social studies, science, language arts, math, health, library/media and technology have participated every year. Teachers attend professional development workshops to learn about environmental health and to receive curriculum materials and links to local community resources. The project also offers ongoing support to continuing teachers from the resource teacher, for in-class presentations, tours of university labs and other environmental health materials. Five cohorts of teachers have been trained on project materials, with the majority remaining actively involved in the project from year to year. Since the 2001-02 school year over 12,000 students have studied math, language arts, science, social studies, library/media, technology and/or health utilizing environmental health topics. Project materials introduce students to seven environmental health core concepts: toxicity, exposure, dose/response, risk, individual susceptibility, environmental justice and community resources & actions. (See Figure 1.) Over 3,500 students were engaged in IEHMSP in the 2005-06 school year. The findings indicate that students engaged in the IEHMSP model for integrated learning, have enhanced problem-solving skills and developed a sense of personal involvement in societal issues.

Figure 1: EH Core Concepts Icons

MATERIALS

The IEHMSP has developed a variety of environmental health curriculum providing middle school teachers with multiple ways to bring environmental health (EH) concepts into their classrooms. Project materials are aligned to state and district educational requirements. Participating teachers from Washington consistently report great appreciation for the alignment to the Essential Academic Learning Requirements (EALRs). IEHMSP curricula are interdisciplinary and provide opportunities for problem-based learning. The IEHMSP materials include:

- *Student Introduction to Environmental Health*. Teachers use this one-page handout, with an accompanying PowerPoint, to introduce EH concepts to their students and to provide a foundation for all the IEHMSP materials.

- *Health and Environment Activities Research Tool (HEART).* This instructional manual provides teachers with the tools they need to incorporate environmental health into their curriculum by engaging students in locally relevant research projects.
- *The Quicksilver Question Web Module.* This is an innovate, interactive, computer-based curriculum designed to introduce students to environmental health. Students navigate through information contained in a virtual town and learn how to formulate questions and evaluate a local EH issue. *Quicksilver* introduces students to the connections between historic gold mining, mercury contamination, fish consumption and human health.
- *Environmental Health Fact Files: Lead, Asthma and Diabetes.* These interdisciplinary EH curricula contain subject specific lesson plans in social studies, science, language arts, math, and health/fitness. (Example: a language arts lesson invites students to write a travel brochure to ancient Rome after they learn about the health effects of lead in aqueducts and wine.) At least two lessons are provided for each subject, and each lesson is designed to meet subject area specific learning objectives. Resource materials are also included to help school librarians who are facilitating student research projects. The *EH Fact Files* are also valuable resources for school nurses, summer/after-school programs, and parents.

IMPACTS AND EVALUATION

Specific aims of the grant address evaluation and assessment for both teachers and students. Since the first year of IEHMSP, the effectiveness of training and support procedures, as well as the success of implementing project materials in the classroom have been measured. Student learning outcomes have been documented in 2004-05 and 2005-06 school years. Data collected from teachers in Washington and New Mexico from the 2004-05 school year measured the value of EH content related to their subject area teaching and the overall usefulness of the project materials. 80% of teachers from both states reported that EH materials as highly relevant to their curriculum. 78% reported that EH core concepts were easily incorporated into their subject.

The IEHMSP staff created a tiered model of EH curriculum integration, called the IEHMSP "integration pyramid" (see figure 2). This model differentiates between four levels at which EH topics can be integrated into classroom instruction. The *Student Introduction to Environmental Health* is a curricular component common to every level of the pyramid. These tiered levels provide teachers the ability to integrate around EH themes as they address subject area specific content. Teachers appreciate this flexibility so they can prioritize state requirements and district goals for student learning.

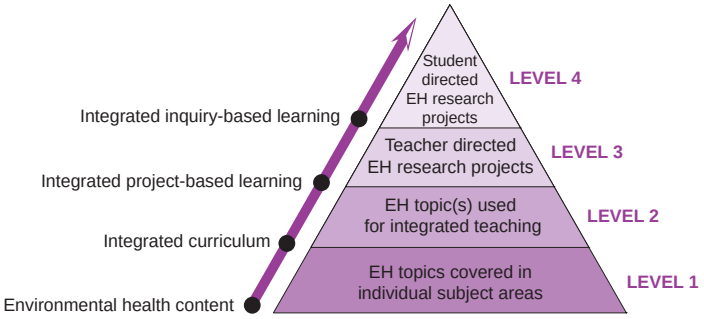

Figure 2: IEHMSP Integration Pyramid

At Level 4 of the pyramid, students work with teachers from a variety of subject areas to identify and research their own community-based EH projects. The Level 3 integrative approach includes researching an EH issue of concern while building skills across subject areas. Both Level 3 and Level 4 Integration included team teaching (2 or more teachers) and the inclusion of a research project. At Level 3 teachers choose the topic of research rather than the students, often focusing on school-related EH issues.

Level 3 and 4 students research one of these topics, meet experts, locate and graph relevant data, and draw conclusions. Students often write persuasive letters, practice interview skills with EH experts and, in some instances, students present their projects at a culminating 'Community Conversations' event. In Level 2, teams of teachers use EH topics as a context (theme) across multiple subject areas or involved instruction in at least two subjects areas (either by 1 or more teachers). Finally, Level 1 meets the needs of a teacher who is not in position to partner with peers. The focus of EH integration is within a single subject area.

Participating teachers have indicated that interdisciplinary curricula are among the best practices associated with positive student outcomes. But these teachers list many barriers to implementation, such as the silo design of secondary schools that separate subject areas, and the lack of planning time available for teachers to map out an integrated program. Therefore, this opportunity for

flexibility in implementation has been reported as very important to teachers and is fundamental to the sustainability of IEHMSP materials.

The IEHMSP student assessment involved pre testing all students prior to the introduction of any EH curriculum materials within the first month of the school year and post testing all students upon completion of EH instruction. The pre and post tests contained multiple choice and short-answer questions. A single extended response question asked students to apply their EH knowledge and vocabulary to an issue they selected from their community. The general format of the test was modeled after the Washington State Assessment of Student Learning (WASL). The pre and post tests measure students' understanding of EH core concepts, their ability to identify EH issues and their ability to apply critical thinking skills to a self-identified EH issue. Similar to the state test, the IEHMSP student test is a criterion-referenced assessment measuring student knowledge. The scoring rubric was developed by project staff and participating teachers. Inter-rater reliability scores were tested until an 80% or greater agreement ratings were achieved.

The IEHMSP student assessment was comprised of three subscores and a total score. The subscores were computed for the following areas:

1. Ability to define and identify EH issues.
2. Knowledge of EH core concepts.
3. Ability to address the important parts of the problem solving process related to an identified EH issue including identification of community resources related to the problem and key stakeholders who would benefit from their findings.

Analysis and findings are presented here of 1061 matched Student Surveys collected from participating Washington schools during the 2004-05 school year. Five hundred ninety-three (593) students were participants in a Level 1 Intervention, 225 of the students received Level 2 Intervention and 243 students received Level 3 Intervention. Initial testing of the three subscores revealed heterogeneity of variance and non normally distributed data. Subsequently, nonparametric tests were employed in the analysis of student score including Kruskal-Wallis tests for significance between levels of integration and postman Whitney post hoc tests.

FINDINGS

1. Ability to define and identify EH issues (See table 1)

This subscore category was comprised of four questions. The students were asked to define EH in one question and to provide examples of EH issues in three other questions. Table 1 shows the pre and post test scores. ANOVA results for pre test scores across integration levels showed no significant differences in students' ability to identify and define an EH issue.

Table 1: EH Issues Subscore

School	Data	Pre Test	Post Test
Level 1 Integration n = 593	Average Std. Dev. Median Max Min	3.51 2.31 3 10 0	4.38 2.45 4 14 0
Level 2 Integration n = 225	Average Std. Dev. Median Max Min	3.02 2.00 3 7 0	4.76 2.15 5 11 0
Level 3 Integration n = 243	Average Std. Dev. Median Max Min	4.07 2.20 4 10 0	7.00 2.62 7 12 0

EH Issues post subscores were significantly affected by the level of EH integration. ($H(2) = 166.34$, $p<.001$). Mann Whitney tests were used to follow up significant findings of the Kruskal-Wallis test. A Bonferroni correction was applied so all effects are reported at a 0.0167 level of significance. EH problem scores were not significantly different for students in Level 1 or Level 2 Integration ($U=60734$, $r= -0.07$), but they were significantly different for Level 3 students compared to both Level 2 students ($U=13330.5$, $r= -0.45$) and Level 1 students ($U=32758$, $r= -0.43$).

2. Knowledge of EH core concepts (see Table 2)

This subscore category was comprised of ten questions. The IEHSMP EH core concepts, as seen in Figure 1, include: dose, routes of exposure, individual susceptibility, risk, environmental justice, community resources and community action. Students were asked for the definition of dose, exposure and environmental justice, and were asked to apply dose, exposure and individual susceptibility in short-answer format questions.

Table 2: EH Core Concept Subscore

School	Data	Pre Test	Post Test
Level 1 Integration	Average	19.71	25.61
n = 593	Std. Dev.	7.64	8.56
	Median	20	26
	Max	40	44
	Min	0	0
Level 2 Integration	Average	18.57	28.95
n = 225	Std. Dev.	7.80	7.28
	Median	19	30
	Max	37	44
	Min	0	3
Level 3 Integration	Average	22.00	31.72
n = 243	Std. Dev.	6.63	7.01
	Median	23	33
	Max	36	44
	Min	0	3

The post test scores showed significant improvement in core concepts understanding within all the levels of integration. EH core concepts post subscores were also significantly affected by the level of EH integration. ($H(2) = 105.79$, $p<.001$) . Mann Whitney tests were used to follow up significant findings of the Kruskal-Wallis test. A Bonferroni correction was applied so all effects are reported at a 0.0167 level of significance. EH core concepts post scores were significantly different for students in Level 1 or Level 2 Integration ($U=51244$, $r= -0.07$), and were significantly different for Level 3 students compared to both Level 2 students ($U=20872.5$, $r= -0.20$) and Level 1 students ($U=40749.5$, $r= -0.34$).

While Level 2 Integration demonstrated slightly greater EH core concepts improvement pre to post test than Level 3 students, this maybe a result of more hours (direct contact) with IEHMSP materials which directly address core concepts.

3. Ability to address the important parts of the problem solving process related to an identified EH issue. (See Table 3)

This subscore category was comprised of three questions. Students were asked to identify an EH issue and name the important EH factors to consider in short-answer format questions. They were also asked to identify community resources related to the problem and key stakeholders who would benefit from their findings.

Again, the post test scores showed significant improvement in EH problem solving within all the levels of integration. Problem solving post subscores were also significantly affected by the level of EH integration. ($H(2) = 88.92$, $p<.001$) . Mann Whitney tests were used to follow up significant findings of the Kruskal-Wallis test. A Bonferroni correction was also applied so all effects are reported at a 0.0167

level of significance. While problem solving scores post scores were not significantly different for students in Level 1 or Level 2 Integration (U=65988.5, r= -0.009), they were significantly different for Level 3 students compared to both Level 2 students (U=16826.5, r= -0.34.20) and Level 1 students (U=44886, r= -0.31).

Students in Level 3 Integration nearly doubled their average problem-solving scores from pre test to post.

Table 3: EH Problem Solving Subscore			
School	Data	Pre Test	Post Test
Level 1 Integration n = 593	Average Std. Dev. Median Max Min	3.65 5.18 00 20 0	5.52 6.53 00 23 0
Level 2 Integration n = 225	Average Std. Dev. Median Max Min	3.09 5.12 00 19 0	5.60 6.19 3 22 0
Level 3 Integration n = 243	Average Std. Dev. Median Max Min	5.15 5.88 3 20 0	10.16 6.65 12 23 0

SUMMARY OF FINDINGS

- In Level 3 students were engaged in the problem solving process for a local EH issue and showed greatest improvement pre-post test in their problem solving ability.
- Level 3 Integration students improved in their ability to identify the processes for gathering resources and communicating their findings for any other EH issue.
- Level 3 students also showed greatest improvement in the identification of EH issues.
- In Level 2, EH was used as a context (theme) across multiple subject areas, while in Level 1 the focus of EH integration is within a single subject area. Level 1 and 2 Integration students showed significant differences pre and post test in their identification of EH issues and in their understanding of EH core concepts.
- While significant improvement in problem solving skills was noted for Level 1 and Level 2 students, mean post test scores showed room for improvement.
- Participating teachers have indicated that IEHMSP curricular materials are aligned with specific state and district learning benchmarks, and provide them with various ways to integrate environmental health into their own teaching plans. Additionally, the IEHMSP intends to continue to play a positive role in building a sustainable infrastructure by linking students to their communities, offering teachers planning time and resources, and supporting districts in meeting state goals.

DISSEMIMNATION STRATEGIES

The longevity of this NIEHS study has allowed IEHMSP staff to work along-side district and state partners as they generate and revise strategic plans. These partnerships provide an opportunity for project staff to participate as stakeholders in the planning process and help lay the groundwork for supporting integrated environmental health instruction after the life of the grant. For example, the IEHMSP model has been welcomed by the Office of the Superintendent of Public Instruction (OSPI, Washington state's department of education). IEHMSP staff participates in the Science test item writing and content review for WASL (the state assessment test). The project has been successful at demonstrating that environmental health topics can provide an engaging foundation for scenario-based assessments. Project staff contribute to statewide efforts to build the capacity to ensure that all students meet the standard in Science by 2010. Additionally, in Washington, the project works with OSPI departments in Health/Fitness and Social Studies. IEHMPS

materials are linked from the state's education website as 'bridging documents' to the Social Studies assessment. These documents help connect social studies with EH and engage students in creative activities that prepare them for the new middle school Social Studies Classroom Based Assessments. In New Mexico, the education department invited IEHMSP to present at two statewide conferences and is allowing curriculum to be submitted for adoption review.

PRESENTATIONS:

American Public Health Association Conference, 2004.
Association for Supervision and Curriculum Development Conference, 2005.
Celebration of Health Careers Middle School Conference, 2005 & 2006.
Environmental Education of Washington Annual Regional Conferences, 2002, 2003 & 2004.
Hawaii International Conference on Education, 2006.
New Mexico Public Education Department, School Health Education Institutes, 2005.
New Mexico Public Health Association, 2005.
Santa Fe Public School Nurses, 2006.
Science Teacher's Association, national and regional meetings, 2004 & 2005.
Washington Office of the Superintendent of Public Instruction, Summer Institutes and January Conferences, (in Social Studies and Health/Fitness), 2005 & 2006.

PUBLICATIONS:

Frevert, K., Nicoll, A., Acharya, C., Rudensey, L., Burbacher, T., and Eaton, D. (2006). *Environmental Health Curriculum in Washington State Middle Schools: A Tiered Model of Integration.* Proceedings from the 2006 Hawaii International Conference on Education.
Rudensey, L and Whidden, J. (2005). *Spill Sleuths- An Interdisciplinary Environmental Health Investigation.* Science Scope, 28(5).
EH Voices (2001-2005). Publication of the Community Outreach Education Program at the NIEHS Center for Ecogenetics and Environmental Health.

AWARDS & HIGHLIGHTS:

Recognition as an exemplary program by Washington State Environmental Education Association, 2006.
"Protein Puzzle" science lesson from the 'EH Fact Files: Diabetes' was selected for publication by McDougal Littell, the middle school division of Houghton Mifflin publishing company, for a New Mexico ancillary.
IEHMSP-New Mexico obtained over $14,000 of additional funding for IEHMSP activities and curriculum development, 2005.
IEHMSP-Washington was awarded $21,000 supplementary grant from the Seattle Biotech Legacy Foundation, 2004.

Material	Project	Grade Level	Date Created	Format	Subjects	Content/Keywords/Exposure/Disease/Theme	Brief Description
My World and Me: Living Things and Their Needs	ECOS	preK –2	2003	inquiry unit	1,2,3,4,5,6,11	Air, food, water and relationships to health	Living Things and Their Needs unit allows very young students to explore living and non-living things, and the basic needs of plants and animals (including humans). The unit consists of ten age-appropriate guided inquiry lessons. In the rhyming "big book" that accompanies the unit, the turtle, Tillena Lou explores her home and discovers interesting things about the animals that live nearby. Tillena Lou and all of the other characters in the My World and My Health My World series were created by T Lewis, illustrator of "Over the Hedge."
My World and Me: Resources and Environments	ECOS	preK – 2	2005	inquiry unit	1,2,3,4,5,6,11	Resources that fulfill human needs, ecosystems	Through guided inquiry activities, young students learn how resources from the environment help fill basic human needs for clean air, water, food and places to live. The accompanying "big book," Tillena's Big Adventure, focuses on the differences between natural and manmade environments. Tillena Lou and all of the other characters in the My World and My Health My World series were created by T Lewis, illustrator of "Over the Hedge."
SUC_2ES_2: The Case of the Green Feathers	SUC_2ES_2	2	1/23/2003	Two curriculum binders (two volumes), an oversized children's book and a curriculum kit	1, 2, 3, 4, 5, 6	Toxicology, risk assessment, risk management, exposure assessment, inquiry-base, applied science, integrated, authentic, environmental health, pollen, allergies, asthma	The goal of the SUC_2ES_2 (Students Understanding Critical Connections between the Environment, Society and Self) is to empower students in the second grade to improve their science knowledge, skills and attitudes so that they can make informed decisions about the environment and their health. Students become health hazard detectives and through a series of hands-on, inquiry-based, authentic activities, investigate effects of pollen on human health. Over the course of 10 weeks, students learn how to apply environmental health sciences using the ToxRAP™ (Toxicology, Risk Assessment and Pollution) Map and Framework to real world problems using data, experiments, stories, poems, books, puzzles, games, simulations, case studies and math activities.
My Health My World: My World Indoors	ECOS	2 – 4	1997, 2002, 2006	inquiry unit	1,2,3,4,5,6,11	gases, air, breathing/respiration, indoor air pollution, allergies, asthma, smoking pollution/cessation, science careers	In this unit, readers meet the main characters of the My Health My World series: two squirrels (cousins) named Riff and Rosie, an old beaver named Mr. Slaptail, and a grasshopper-Chirpen J. Wingfellow, III-who serves as a guide for students and teachers. My World Indoors explores air quality and related issues, including allergies, in the places we live, study and work. The adventure story finds Riff and Rosie observing their neighbor, Mr. Slaptail, dragging a big dark bag down a moonlit road. What could be in that bag? As the mystery unfolds, the cousins discover Mr. Slaptail's cluttered, dusty home is packed full of trash, recycled products and chemical products such as paint and glue. It turns out that he uses this trash to make toys! But this lifestyle creates a contaminated indoor environment. Riff and Rosie help Mr. Slaptail clean up his house, making it a healthier place to live.
My Health My World: Water and My World	ECOS	2 – 4	1997, 2002, 2006	inquiry unit	1,2,3,4,5,6,11	physical science of water, water in living systems, non-point source water polluntion, bio-accumulation, eutrophication, risks to human health from water pollution, wise use of water, science careers	Water and My World provides a fresh perspective on water and why it's important to the well-being of all living creatures. In the adventure story, Riff and Rosie are racing paper boats on Beaver Pond when they encounter many of their neighbors sadly leaving their homes. The marsh and creek have become murky, shallow and downright smelly! What is going on in Beaver Pond that the animals must leave? Riff and Rosie set out to discover the cause of pollution in their water environment. They find that the fertilizer making the nearby park beautiful also is creating a scummy swamp! The cousins work together with their neighbors to make their water livable again. This fun, educational book features colorful and informative science boxes. These highlighted areas discuss health related topics such as fresh water facts, water in the human body, pollutants and water runoff.

Materials developed with funding from NIEHS.

Material	Project	Grade Level	Date Created	Format	Subjects	Content/Keywords/Exposure/Disease/Theme	Brief Description
My Health My World: My Home Planet Earth	ECOS	2 – 4	1997, 2002, 2006	inquiry unit	1,2,3,4,5,6,11	solar energy, radiation, carbon cycle, atmosphere, global warming, ozone depletion, climate change, skin cancer prevention, alternative energy souces, science careers	My Home Planet Earth focuses on changes in the upper atmosphere, such as global warming, and how the changes may affect life on Earth. In this adventure story, Riff and Rosie can't wait to see what contraption Mr. Slaptail is masterminding now - on his rooftop! However, while helping him complete his solar water heater, an explosion occurs at the local coal mine. Community members rush to the site to find the owner, Beulah Diggerpaw, is trapped inside! How will they get her out? After Beulah is rescued, she announces she will close the mine which fuels most of the energy needs in Bright Water Corners. Now, what will they use for energy? Like all My Health My World story books, this one includes illustrated instructions for a toy used by Riff and Rosie during their adventure, as well as a glossary of health and science terms for student and teacher use.
My Health My World: Food and My World	ECOS	2 – 4	1997, 2002, 2006	inquiry unit	1,2,3,4,5,6,11	soil, photosynthesis, producers and consumers, food webs, food safety, bacterial contamination of food, pesticides, nutrition, food pyramid, safe food preparation, science careers	The latest My Health My World unit, Food and My World, examines food production, nutrition and food safety with unique activities for students and families. The story book places Curious Riff and Rosie in a new sleuthing situation with Mr. Slaptail. When they receive a strange, urgent note from him asking for their help, they know it must be big mystery, indeed! What could be happening that even Mr. Slaptail can't figure it out? While enjoying sandwiches made with vegetables from Mr. Slaptail's garden, the two cousins learn from their friend that leaves are disappearing from his lettuce plants. What could be happening to the leaves? Where are they going? And who-or what-is taking them? After a scary night in the garden, the secret is revealed. By the end of the story, Riff and Rosie learn some important lessons about food, plants, and good health.
SUC_2ES_2: What is Wrong with the Johnson Family?	SUC_2ES_2	5	12/9/2004	Curriculum binder, card game (six sets) and a curriculum kit	1, 2, 3, 4, 5, 6	Toxicology, risk assessment, risk management, exposure assessment, inquiry-base, applied science, integrated, authentic, environmental health, carbon monoxide, indoor air quality	The goal of the SUC_2ES_2 (Students Understanding Critical Connections between the Environment, Society and Self) is to empower students in the fifth grade to improve their science knowledge, skills and attitudes so that they can make informed decisions about the environment and their health. Students become health hazard investigators and through a series of hands-on, inquiry-based, authentic activities, investigate effects of carbon monoxide on human health. Over the course of 10 weeks, students learn how to apply environmental health sciences using the ToxRAP™ (Toxicology, Risk Assessment and Pollution) Map and Framework to real world problems using data, experiments, stories, puzzles, games, simulations, case studies and math activities.
The Science of Alcohol	ECOS	5–7	2006	inqruiy unit	1,2,3,4,5,6,11	alcohol as a chemical and as a toxin, role of genetics in alcoholism and alcohol abuse, appropriate decision-making and risk assessment, science careers	
ZoOdyssey	EXCITE	4 -- 10	2003	Binder/CD/Web	1,2,4,5,6,9,12	Communicable disease, hand washing, hygene, food born disease, animals	Project EXCITE Odysseys are interdisciplinary problem-based curricula focusing on real world environmental health issues. The ZoOdyssey unit includes easy-to-use implementation guides and lesson plans, field tested inquiry activities, PBL resources, duplication masters, assessments with rubrics and interactive CD-Rom materials. ZoOdyssey asks students to find the cause of the mystery illness after a zoo field trip.
Sick of School? Odyssey	EXCITE	4 -- 10	2004	Binder/CD	1,2,4,5,6,9,12	Indoor Environmental Quality, Air pollution, mold, bacteria	Project EXCITE Odysseys are interdisciplinary problem-based curricula focusing on real world environmental health issues. The Sick of School? Odyssey unit includes easy-to-use implementation guides and lesson plans, field tested inquiry activities, PBL resources, duplication masters, assessments with rubrics and interactive CD-Rom materials. Sick of School? challenges students to investigate the indoor environmental quality of their school.

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Material	Project	Grade Level	Date Created	Format	Subjects	Content/Keywords/Exposure/Disease/Theme	Brief Description
AgOdyssey	EXCITE	4 -- 10	2005	Binder/CD	1,2,4,5,6,9,12	Agriculture, family farm, CAFO, factory farm, farming	Project EXCITE Odysseys are interdisciplinary problem-based curricula focusing on real world environmental health issues. The AgOdyssey unit includes easy-to-use implementation guides and lesson plans, field tested inquiry activities, PBL resources, duplication masters, assessments with rubrics and interactive CD-Rom materials. AgOdyssey focuses on the impacts of family vs. large scale farming.
Food Odyssey	EXCITE	4 -- 10	2003	Binder/CD	1,2,4,5,6,9,12	Food born bacteria	Project EXCITE Odysseys are interdisciplinary problem-based curricula focusing on real world environmental health issues. The Food Odyssey unit includes easy-to-use implementation guides and lesson plans, field tested inquiry activities, PBL resources, duplication masters, assessments with rubrics and interactive CD-Rom materials. Food Odyssey focuses on food bourne illnesses.
Chem Odyssey	EXCITE	4 -- 10	2005	Binder/CD	1,2,4,5,6,9,12	Hazardous Household Chemicals	Project EXCITE Odysseys are interdisciplinary problem-based curricula focusing on real world environmental health issues. The Chem Odyssey unit includes easy-to-use implementation guides and lesson plans, field tested inquiry activities, PBL resources, duplication masters, assessments with rubrics and interactive CD-Rom materials. Chem Odyssey focuses on household hazardous chemicals.
GermOdyssey	EXCITE	4 -- 10	2006	Binder/CD	1,2,4,5,6,9,12	Communicable disease, hand washing, hygene	Project EXCITE Odysseys are interdisciplinary problem-based curricula focusing on real world environmental health issues. The GermOdyssey unit includes easy-to-use implementation guides and lesson plans, field tested inquiry activities, PBL resources, duplication masters, assessments with rubrics and interactive CD-Rom materials. GermOdyssey focuses on germ and disease transmission.
MosquitOdyssey (In Final Development Stages)	EXCITE	4 -- 10	2006	Binder/CD	1,2,4,5,6,9,12	Larvacide, pesticide, communicable disease, mosquito, vector	Project EXCITE Odysseys are interdisciplinary problem-based curricula focusing on real world environmental health issues. The MosquitOdyssey unit includes easy-to-use implementation guides and lesson plans, field tested inquiry activities, PBL resources, duplication masters, assessments with rubrics and interactive CD-Rom materials. In MosquitOdyssey, students learn how and why our communities spray chemicals to control mosquito infestations. Given the disease spreading potential, students way the pros and cons of controlling mosquitos this way.
Dangers Seen and Unseen: Water and Environmental Health	MEMHMC	6 -- 8	2005	web/print	1,2,3,5,11	water pollution, environmental health	This problem-based learning unit focuses on the impact of water pollution on human health
EnviroMysteries: Breaking the Mold- http://enviromysteries.thinkport.org/breakingthemold/	Connections	4 -- 10	2003	VHS/Online	5, 11	asthma, mold, air pollution, indoor air pollution, respiratory system, mystery, science, environmental health, health	This video and accompanying extensive online educational resources look at health and air pollution and empower students to take an active role in environmental issues that can affect their health today and in the future.
EnviroHealth Connections Lessons	Connections	4-- 10	2003-2006	Online	1, 2, 4, 5, 6, 8, 10, 11	air pollution, asthma, environmental justice, health, environmental science, food supply, evolution, weather, water, lead, urban development, genetics, obesity, food webs, global warming, cancer	These interdisciplinary lesson plans integrate environmental health topics into core content areas at both the middle school and high school level. The lessons are technology rich and effectively integrate media into the instructional process. Topics covered include: air pollution, asthma, environmental justice, food supply, evolution, weather, water, lead, urban development, genetics, obesity, food webs, global warming and cancer. Lessons online through www.thinkport.org.
Tut's Revenge	PEER	6	Mar 2001	CD/Hard Copy	1,2,4,5,6,7	Water Quality	*Tut's Revenge* is about water contamination during construction of King Tut's tomb in ancient Egypt.
The Jade Dragon	PEER	6	May 2001	CD/Hard Copy	1,2,4,5,6,7	Asthma and Smoking	*The Jade Dragon* is about air contamination and smoking in China that the adventurers encounter as they visit the Three Rivers Dam which is being constructed.
Hard River Escape	PEER	6	Dec 2001	CD/Hard Copy	1,2,4,5,6,7	Heavy Metals and Radiation	*Hard River Escape* focuses on industrial waste that induces abnormalities in wildlife of the Ukraine.

Materials developed with funding from NIEHS.

Material	Project	Grade Level	Date Created	Format	Subjects	Content/Keywords/Exposure/Disease/Theme	Brief Description
Kiss of the Assassin	PEER	6	May 2002	CD/Hard Copy	1,2,4,5,6,7	Chagas Disease	*The Kiss of the Assassin* focuses on pathogens and bacterial infectious diseases (Chagas disease in this case) that can be obtained from insects, like the "kissing bug," that harbor the bacteria and serve as vectors for the disease.
Congo Cry	PEER	6	Oct 2002	CD/Hard Copy	1,2,4,5,6,7	AIDS and Ebola	*Congo Cry* features viral infections (Ebola and AIDS) including both animal and human in Africa.
Midnight at the Marble Tomb	PEER	6	Feb 2003	CD/Hard Copy	1,2,4,5,6,7	Hepatitis	*Midnight at the Marble Tomb* focuses on the health consequences of raw sewage in streets, acupuncture, tattoos, body piercing (of the nose, ears, lips, eyebrows, and belly button), blood transfusions, and organ donations in India.
Texas, 1867	PEER	7	Jun 2003	CD/Hard Copy	1,2,4,5,6,7	Yellow Fever	*Texas: 1867* deals with the yellow fever epidemic in Texas after the end of the Civil War.
March Madness	PEER	7	Jun 2003	CD/Hard Copy	1,2,4,5,6,7	Influenza	*March Madness* focuses on the influenza epidemic surrounding World War I.
Raccoons, Robbers, and Radios	PEER	7	Jan 2005	CD/Hard Copy	1,2,4,5,6,7	Rabies	*Raccoons, Robbers and Radios* examines the causes and symptoms of rabies and is set in Depression-era Texas.
Connections	PEER	7	May 2006	CD/Hard Copy	1,2,4,5,6,7	Air Pollution	*Connections* examines problems with smog and air pollution in urban areas and is set in Houston.
Three Rivers, Three Nations	PEER	8	May 2004	CD/Hard Copy	1,2,4,5,6,7	Smallpox and Bioterrorism	*Three Rivers, Three Nations* takes a look at bioterrorism, focusing on the use of smallpox during the French and Indian War in the 18th Century.
The Waterfall Ghost	PEER	8	Apr 2005	CD/Hard Copy	1,2,4,5,6,7	Brown Lung	*The Waterfall Ghost* deals with the 19th-century textile industry and the byssinosis (brown lung) that many workers contracted.
Dark Poison	PEER	8	May 2005	CD/Hard Copy	1,2,4,5,6,7	Cholera	*Dark Poison* concerns a cholera epidemic in New York in the 1830s.
The Candlestick Treasure	PEER	8	May 2006	CD/Hard Copy	1,2,4,5,6,7	Lead Poisoning	The Candlestick Treasure centers on the subject of lead poisoning in a print shop in Philadelphia in 1789.
Kiss of the Assassin: Mini-Modules	PEER	6	Apr 2005	Web/CD/Hard Copy	1,2,4,5,6,7	Chagas Disease	*The Kiss of the Assassin* focuses on pathogens and bacterial infectious diseases (Chagas disease in this case) that can be obtained from insects, like the "kissing bug," that harbor the bacteria and serve as vectors for the disease. Twenty lessons including activities, handouts, worksheets, and testing materials in science, math, social studies and English/language arts.
Midnight at the Marble Tomb: Mini-Modules	PEER	6	May 2006	Web/CD/Hard Copy	1,2,4,5,6,7	Hepatitis	*Midnight at the Marble Tomb* focuses on the health consequences of raw sewage in streets, acupuncture, tattoos, body piercing (of the nose, ears, lips, eyebrows, and belly button), blood transfusions, and organ donations in India. Fourteen lessons including activities, handouts, worksheets, and testing materials in science, math, social studies and English/language arts.
March Madness: Mini-Modules	PEER	7	May 2006	Web/CD/Hard Copy	1,2,4,5,6,7	Influenza	*March Madness* focuses on the influenza epidemic surrounding World War I. Sixteen lessons including activities, handouts, worksheets, and testing materials in science, math, social studies and English/language arts.
Texas, 1867: Mini-Modules	PEER	7	Oct 2005	Web/CD/Hard Copy	1,2,4,5,6,7	Yellow Fever	*Texas: 1867* deals with the yellow fever epidemic in Texas after the end of the Civil War. Seventeen lessons including activities, handouts, worksheets, and testing materials in science, math, social studies and English/language arts.
Dark Poison: Mini-Modules	PEER	8	Oct 2005	Web/CD/Hard Copy	1,2,4,5,6,7	Cholera	*Dark Poison* concerns a cholera epidemic in New York in the 1830s. Thirteen lessons including activities, handouts, worksheets, and testing materials in science, math, social studies and English/language arts.
Three Rivers, Three Nations: Mini-Modules	PEER	8	May 2006	Web/CD/Hard Copy	1,2,4,5,6,7	Smallpox and Bioterrorism	*Three Rivers, Three Nations* takes a look at bioterrorism, focusing on the use of smallpox during the French and Indian War in the 18th Century. Seventeen lessons including activities, handouts, worksheets, and testing materials in science, math, social studies and English/language arts.
HEART(Heatlh and Environment Activities Research Tool) Manual for Interdisciplinary, Problem-based Environmental Health Education	IEHMSP	6 -- 8	2005	pdf download	1-11	Toxicity, Exposure, Dose/Response, Individual Susceptiblity,Risk, Environmental Justice, Community Resources & Actions	*The Health and Environment Activities Research Tool (HEART)* is an instuctional manual. It provides teachers with the tools they need to incorporate environmental health into their curriculum by engaging students in locally relevant research projects. The manual includes step-by-step guides for teachers, lesson plans, activities, rubrics and worksheets to guide students as they develop research projects. It also includes a list of additional resources for both teachers and students.

Materials developed with funding from NIEHS.

Material	Project	Grade Level	Date Created	Format	Subjects	Content/Keywords/Exposure/Disease/Theme	Brief Description
The Quicksilver Question Web Module and Extension Activites–	IEHMSP	6 -- 8	2004	on-line, pdf download	1-11	Mercury, Fish Consumption, Water Quality, Toxicity, Exposure, Dose/Response, Individual Susceptiblity,Risk, Environmental Justice, Community Resources & Actions	*The Quicksilver Question Web Module* is an online game that introduces middle school students to the connections between historic gold mining, mercury contamination, fish consumption and human health. Students explore the imaginary town of Quicksilver, WA, collecting key documents along the way that help them evaluate how much mercury is in the local lake, and the fish that live there. Printed extension activities in langauage arts, math, social studies, science, and health allow for more in-depth exploration of the issues raised by the narrative.
The Quicksilver Question Web Module-*New Mexico*	IEHMSP	6 -- 8	2005	on-line	1-11	Mercury, Fish Consumption, Water Quality, Toxicity, Exposure, Dose/Response, Individual Susceptiblity,Risk, Environmental Justice, Community Resources & Actions	*The Quicksilver Question Web Module - New Mexico* is an online game that introduces middle school students to the connections between historic gold mining, mercury contamination, fish consumption and human health. Students explore the imaginary town of Quicksilver, NM, collecting key documents along the way that help them evaluate how much mercury is in the local lake, and the fish that live there.
Environmental Health Fact Files: Asthma	IEHMSP	6 -- 8	2004	pdf download	1-11	Asthma, Toxicity, Exposure, Dose/Response, Individual Susceptiblity,Risk, Environmental Justice,Community Resources & Actions	*Environmental Health Fact File: Asthma* provides subject area specific lesson plans about asthma to teachers of social studies, science, language arts, math and health and fitness. At least two lessons are provided for each subject area. Additional resource materials are also included to help school librarians who are facilitating student research projects. The material is designed to facilitate teaching environmental health across multiple subject areas.
Environmental Health Fact Files: Lead	IEHMSP	6 -- 8	2004	pdf download	1-11	Lead, Toxicity, Exposure, Dose/Response, Individual Susceptiblity,Risk, Environmental Justice,Community Resources & Actions	*Environmental Health Fact File: Lead* provides subject area specific lesson plans about the hazards of lead to teachers of social studies, science, language arts, math and health and fitness. At least two lessons are provided for each subject area. Additional resource materials are also included to help school librarians who are facilitating student research projects. The material is designed to facilitate teaching environmental health across multiple subject areas.
Environmental Health Fact FilesToxicology Lesson: Yeast & Household Substances	IEHMSP	6 --12	2005	pdf download	5	Toxicity, Dose/Response	This lesson uses simple, readily available materials to introduce students to the concepts of dose/response and toxicity.
Environmental Health Fact Files: Diabetes	IEHMSP	6 -- 8	2005	pdf download	1-11	Diabetes, Toxicity, Exposure, Dose/Response, Individual Susceptiblity,Risk, Environmental Justice, Community Resources & Actions	*Environmental Health Fact File: Diabetes* provides subject area specific lesson plans about diabetes to teachers of social studies, science, language arts, math and health and fitness. . The material is designed to facilitate teaching environmental health across multiple subject areas.
SUC_2ES_2: Mystery Illness Strikes the Sanchez Household	SUC_2ES_2	7	11/17/2005	Curriculum binder and a curriculum kit	1, 2, 3, 4, 5, 6	Toxicology, risk assessment, risk management, exposure assessment, inquiry-base, applied science, integrated, authentic, environmental health, lead paint hazards, indoor air quality	The goal of the SUC_2ES_2 (Students Understanding Critical Connections between the Environment, Society and Self) is to empower students in the seventh grade to improve their science knowledge, skills and attitudes so that they can make informed decisions about the environment and their health. Students become health hazard scientists and through a series of hands-on, inquiry-based, authentic activities, investigate effects of dust from lead paint on human health. Over the course of 10 weeks, students learn how to apply environmental health sciences using the ToxRAP™ (Toxicology, Risk Assessment and Pollution) Map and Framework to real world problems using data, experiments, puzzles, games, simulations, case studies and math activities.
Water Contamination Module	AMBIENT	9 -- 12	2001	Module	1,2,3,4,5,6,7	Recreational Water Contamination - Microbes	Interdisciplinary module of activities on recreational water contamination that can be taught as "stand alone" or as a complete module. Based on authentic events.
Soil Contamination Module	AMBIENT	9 -- 12	2001	Module	1,2,3,4,5,6,7	Lead in Soil	Interdisciplinary module of activities on lead contamination in soil that can be taught as "stand alone" or as a complete module. Environmental Justice and Ethics issues involved.

Materials developed with funding from NIEHS.

Material	Project	Grade Level	Date Created	Format	Subjects	Content/Keywords/Exposure/Disease/Theme	Brief Description
Food Contamination and Nutrition Module	AMBIENT	9 -- 12	2002	Module	1,2,3,4,5,6,7	Food Contamination and Nutrition	Interdisciplinary module of activities on food contamination and nutrition. Activities involve seafood contamination in transport, storage, and handling. Includes issues of nutrition.
Air Contamination Module	AMBIENT	9 -- 12	2002	Module	1,2,3,4,5,6,7	Air Contamination - Respiratory Problems	Interdisciplinary module of activities on air contamination and environmental triggers contributing to respiratory problems. Activities can be taught as "stand alone" or as a complete module. Includes case studies and epidemiology issues.
Environmental Justice Module	AMBIENT	9 -- 12	2003	Module	1,2,3,4,5,6,7	Environmental Justice Issues	Interdisciplinary module of activities on environmental justice. Includes oral histories of those affected by environmental justice issues.
Toxicology Module	AMBIENT	9 -- 12	2003	Module	1,2,4,5,6	Basic Toxicology Issues	Module of toxicology activities, including basic terminology in toxicology.
Environmental Health Ethics Module	AMBIENT	9 -- 12	2004	Module	1,2,3,5,6,9,10	Ethics and Environmental Health	Critical thinking activities and case studies involving ethics relating to issues of environmental health.
Water Module - Elementary	AMBIENT	K -- 8	2005	Individual Activities	1,2,3,4,5	Recreational Water Contamination - Microbes	High School level activities modified for Elementary Pre-Service Teacher Training
Soil Module - Elementary	AMBIENT	K -- 8	2005	Individual Activities	1,2,3,5	Lead in Soil	Same as Above
Food Module - Elementary	AMBIENT	K -- 8	2005	Individual Activities	1,2,3,5	Food Contamination and Nutrition	Same as Above
Air Module - Elementary	AMBIENT	K -- 8	2005	Individual Activities	1,2,3,4,5	Air Contamination - Respiratory Problems	Same as Above
ENVIROTHON -The Land and Human Health	AMBIENT	9 -- 12	2003	Packet of Reading Materials	1,2,3,4,5,6	Soil Contamination - Lead and Arsenic Poisoning	ENVIROTHON Competition - Environmental Heatlh Station with a reading packet provided to students so that they will be prepared to answer competition questions on topics related to environmental health.
ENVIROTHON - Chemicals in the Park	AMBIENT	9 -- 12	2004	Packet of Reading Materials	1,2,3,4,5,6	Toxins in the Park - Lead, Arsenic, and Mercury	Same as Above
ENVIROTHON - Cultural Landscapes / Env. Justice	AMBIENT	9 -- 12	2005	Packet of Reading Materials	1,2,3,5,6,7,9,10	Environmental Justice Issues	Same as Above
ENVIROTHON - Water in a Changing Climate	AMBIENT	9 -- 12	2006	Packet of Reading Materials	1,2,3,4,5,6	Water Contamination	Same as Above
Pesticide Spill	HCP	9 -- 12	1/1/2006 3rd version	binder, online (Word, pdf)	1, 2, 3, 4, 5, 6, 8	pesticides, superfund, remediation, integrated curriculum, environmental health, problem solving curriculum, hydroville	Students involved in the Hydroville Pesticide Spill Curriculum act as members of the team of scientists and engineers that are sent to the site by Southerville EnviroClean. Their task is to remove the liquid, evaluate the risk posed to the citizens of Hydroville, develop a proposal for complete cleanup of the site, and make a presentation about their proposal to an open meeting of the Hydroville Town Council. http://www.hydroville.org/spill/
Mysterious Illness Outbreak	HCP	9 -- 12	pilot tested 2003, not revised		1, 2, 3, 4, 5, 8	mysterious illness outbreak, outbreak, epidemiology, pesticide curriculum, integrated curriculum, environmental health, problem solving curriculum, hydroville	Students form teams that take on the roles of the professionals on the Hydroville Health Department team involved in determining the cause and control of an outbreak. Students learn the steps of an epidemiology investigation. They interview Hydroville citizens (volunteer actors), develop a case definition, and form a hypothesis about the cause of the outbreak. They then learn data collection and analysis techniques used by such investigators, analyze simulated data, modify their case definition based on this analysis, and present their results in a press release and press conference format. What could be more current and real-life for students? They can see ways in which the material they are learning in the classroom relates to what they are seeing on TV and in the newspaper. http://www.hydroville.org/illness/

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Indoor Air	HCP	9 -- 12	June 2005, 1st version	binder, online (Word, pdf)	1, 2, 3, 5, 8	indoor air, air quality, indoor air in schools, iaq investigation, iaq in schools, integrated curriculum, environmental health, problem solving curriculum, hydroville	The local school board has received complaints of illness at the newly renovated Hydroville Middle School. Many people believe that this is due to poor indoor air quality. High school students participating in this problem act as a team of environmental consults to determine if there really is an indoor air quality problem in the school. Student teams present their findings at the next school board meeting. http://www.hydroville.org/air/
Water Quality	HCP	9 -- 12	pilot tested 2006	online (Word, pdf)	1, 2, 3, 5, 6, 8	water quality, water contamination, groundwater contamination, groundwater remediation, integrated curriculum, environmental health, problem solving curriculum, hydroville	The town of Hydroville is experiencing some of the social, political, and environmental problems associated with rapid growth and development. The city council has a lot of issues on their agenda, one of which includes the annual water report from the city water department. The report shows that certain pollutants in the water supply have increased significantly. By reading the information in newspaper clippings and talking with people in the community and various water quality professionals, the students investigate possible causes of the increase in contaminants in the water supply and work with the council to develop remediation options that will protect the drinking water from further contamination. Students report their findings to the city council through presentations and to the community through newspaper articles and public service television spots. http://www.hydroville.org/water/
Asthma in the City	MEMHMC	9 -- 12	2005	web/print	1,2,3,5,6,11	asthma, environmental health	This problem-based learning unit focuses on the health effects of poor air quality.
Environmental Health Concerns: From Problem to Public Policy	MEMHMC	9 -- 12	2005	web/print	1,2,3,5,6,9	public policy, environmental health	students create public policy statements based on complaints from town members about local environmental health threats
Killing Killer Rain: Acid Rain and Environmental Health	MEMHMC	9 -- 12	2005	web/print	1,2,3,5,6,7,8	acid rain, environmental health	This problem-based learning unit focuses on acid rain: its sources, environmental effects, health effects, economic impact, political impact, and potential solutions in the United States and Canada.
Using Media In Your Classroom- A Case Study: Environmental Health	Connections	Professional Development	2004	VHS/Online	12, 13	Professional Development, media utilization, environmental health integration	A case study for teachers on how to incorporate media with EHSIC themes sucessfully in any classroom. The video demonstrates effective methods of infusing technology into environmental lessons. Interviews and classroom footage of teachers and students show students engaged in learning about the environment and human health.

Subjects Addressed	
1	Reading
2	Writing
3	Communication
4	Mathematics
5	Science
6	Social studies
7	History
8	Geography
9	Civics
10	Economics
11	Health & fitness
12	Technology
13	Library media
14	Art

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