
SECONDARY EDUCATION THROUGH HEALTH— ENVIRONMENTAL HEALTH CURRICULUM: A SUPERFUND SCIENCE LITERACY OUTREACH PROJECT

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ABSTRACT Inner-city high school students are disproportionately affected by health problems that stem from environmental conditions. Also, they are not adequately prepared in Science—especially in the concepts, methods, and procedures of environmental-health science research—and are generally unaware of the career opportunities in this field. A Superfund program was developed to increase Science literacy and expand career knowledge in environmental health among a cohort of minority high school students from New York City. The year-round program features lectures, laboratory tours, seminars, investigations, and research taught by faculty and Superfund investigators at Mount Sinai's Environmental Health Sciences Center. The students made remarkable progress in terms of gaining environmental health knowledge, laboratory and scientific research skills, and awareness of environmental health careers.

KEYWORDS: environmental health, Superfund, Curriculum of the Practical, under-represented minority high school students

PRESENTATION

Inner-city high school students come from communities with higher-than-average incidence of medical and health problems, most of which are environmentally-derived: asthma, low-birth weight, obesity, high blood pressure, cancer, lead poisoning, fires, crime, and STDs. In these communities youth are beleaguered by teen pregnancy, under-achievement, persistent truancy and school drop-outs, a sense of hopelessness about the future, and a general feeling of helplessness to effect a change in their lives. A need to understand the urban environment and its role in health is one way to help youth gain control over risk behaviors, avoid risk-factors, and improve health and the overall quality of life in the community.

There is also a need to increase the science literacy of all Americans. In 1990, National Science Foundation data documented that

no African-Americans received doctorate degrees in biophysics, neurosciences, molecular biology, microbiology, or bacteriology. And, in general, the number of Ph.D.s awarded to African-Americans had dropped steadily from 1,000 in 1975 to under 600 in 1981. Since 1983, an increase to a little over 600 Ph.D.s has been noted. At the high school level, the picture is also a matter of concern: 72% of African-Americans complete high school, whereas 86 per cent of whites complete high school by age 20; and the gap between majority and minority who take and complete science courses continues to widen.

Aware of the weighty health issues and social problems in its East Harlem and South Bronx communities, the Mount Sinai School of Medicine established the Secondary Education Through Health (SETH) Program in 1975, through its Department of Community Medicine and in collaboration

with the New York City Public Schools. SETH is an on-site program that was designed to bolster the academic success in science, mathematics and language arts, as well as the career potential of NYC public high school students in communities that are proximal to Mount Sinai. The Superfund project is an offshoot of the SETH Program.

CURRICULUM OF THE PRACTICAL

Growing up in a post-modern world, the youth of today are adept at fast-paced information-gathering/processing, selecting what they want and need to know from environments saturated with electronic information, images, and de-constructed print. Their cognitive processes and structures, which have been molded in response to long hours of television viewing, are primed for more change—this time by the digital revolution that is in full swing. *Digital's* integration of audio, video, and computer technology now render the rhetorical mode of textbook-based classroom instruction all but obsolete and, to the student, simply boring. Today's student requires a totally new approach to curriculum: one that is practical, based on real-time problem-solving.

To meet the challenges presented by these changes in the intellectual and social conditions of youth, the SETH Program undertook to develop a modern approach to academic learning—one based on the student's interest or concern. The interest once framed becomes fractal-like branches of inquiry that strategically connect back to the fundamentals of science, mathematics, and language arts. This *practically-oriented* curriculum, or Curriculum of the Practical, is carried out as an instructional partnership among students and teachers as they pursue the desired knowledge. The pursuit moves

forward as a set of protocols or a *heuristic* that mimics more the apprentice or parent-child learning-teaching interaction than conventional classroom “chalk-talk.” In this manner the student builds personal knowledge. The Curriculum of the Practical is implemented by faculty trained to structure the environment in such a way that students attain the goals and objectives of learning environmental health. As planners/facilitators/coaches, the teachers structure regular meetings (seminars), establish the dyads as the simplest learning-teaching unit, require log books, reaction papers, oral presentations, and final papers—the focus of which is problem-solving through the process of continuous feedback with the students. This is the approach that was used in the Superfund environmental health project.

SETH ENVIRONMENTAL HEALTH CURRICULUM

The SETH Environmental Health (EH) Curriculum is based on a high school course developed at Mount Sinai early in 1970 in a collaboration between the SETH Program and the Division of Environmental and Occupational Medicine. The course drew from the work of Mt. Sinai scientists and from the authoritative publication by Hinkle and Loring regarding the effects of the man-made world on health and behavior, among others things. A few seminal concepts emerged during the genesis of the EH curriculum development. They are as follows (in no particular order of importance): The human ecosystem is represented by a number of components (inorganic and climatic, biologic, man-made, physical, nutrient, social factors), and each of these components in the system produce stimuli or stress upon the human organism—which in turn produces in the organism physiological responses, internal responses,

adaptive capacity (homeostasis or death), and external responses (behavior patterns): emotional and behavioral feedback, cultural behavioral usage, and contaminative behaviors.

In this context, health was no longer defined as an absence of disease or illness. Its definition became broader and at the same time more refined—reflecting Dubos’s notion that human health is a mirage of sorts—because our physical well-being is really in constant ebb and flow as the immune system takes on the moment-to-moment organismic and inorganic onslaught from the environment. Hinkle divides the condition of health into five sub-categories: the rate of mortality, the rate of morbidity, the effects on growth and development, constraints on behavior, and pleasure and satisfaction received. These two important ideas were incorporated into the *SETH Environmental Health Multiple Balance Construct* which is used as the reference for our curriculum development.

***SETH* MULTIPLE BALANCE CONSTRUCT (MBC)**

The MBC depicts the individual and the community in an environmental Quality of Life sphere in which methods of production and patterns of consumption result in “pollution.” Pollution affects individuals and communities. Three perspectives—the self, the small group (family), and the large group (community, nation, the world)—are viewed under three essential conditions: the physical settings in which one exists; the roles an individual takes in the various meaningful settings; and the sense of control one exercises or feels one has in each aspect of his/her existence. Coping behaviors result from the stresses experienced which, ultimately, can be assessed by the condition of one’s health.

***SETH*—SUPERFUND ENVIRONMENTAL HEALTH PROGRAM**

Almost four years ago, the Manhattan High School Superintendency established the High School for Environmental Studies and invited the SETH program to become involved with the school as a source of external educational experiences for its predominantly under-represented minority student population. An environmental health curriculum—which at that time was still undeveloped—was deemed an important element of the school’s environmental studies program. Superfund provided a golden opportunity to move the agenda forward in terms of bringing students into Mount Sinai to study environmental health.

The program was designed collaboratively, incorporating some previously-developed elements. The most significant new element was that of weaving into the program the mission of “Superfund”: meeting with scientists to learn about how their respective efforts addressed Superfund and environmental health issues and, more importantly, the incorporation of students into laboratories to work alongside Superfund scientists.

Recruitment was undertaken by the HSES faculty/SETH Environmental Health coordinator. The eligibility requirements were that the students should be from under-represented minority or disadvantaged backgrounds, they should have a minimum GPA of 85 (3.0 on a 4.0 scale), and a stated interest in learning about environmental health. The applicants each wrote a letter of interest expressing how the program would benefit them. Also required were a transcript plus one recommendation from the school. The grade level of a high school junior was

used more as a guideline than a criterion for selection.

The one-year program was designed in three inter-connecting phases: It started in the Fall with a definition of the Superfund mission and review of remediation studies, description of the urban ecosystem, definition of the human ecosystem and its relation to health, definition of health, and investigations into stress as a factor that affects the condition of health, establishing health connections to environmental events and substances. In spring, students met with Superfund scientists, studied environmental health hazards using library research, toured laboratories, and attended seminars led by Superfund scientists. During the academic year students attended the program at Mount Sinai one day a week. Every week that the students met, thirty minutes were set aside for each dyad to give a progress report on the project that the dyad was doing. At the conclusion of each semester, every dyad team gave an extended oral presentation and turned in a paper. All students who successfully complete the academic year portion of the course (20 took the course in 1995-96) receive a certificate and are automatically eligible for one of the coveted positions in the summer Superfund Environmental Health Research Program. The program is implemented by a teacher from the High School for Environmental Studies. That teacher spends an additional afternoon at Mount Sinai meeting with the outreach PI to discuss the progress of the course and to fine-tune and plan the coming sessions. During these teacher development meetings, the high school teacher is trained in how to use the Curriculum of the Practical methodology in the SETH Environmental Health Program.

Six students from the academic year program were selected for the six-week

summer research program (coordinated by the same HSES teacher who ran the academic year program). By then, the teacher and the students were fairly well-integrated into the Medical Center. They knew their way around the campus and they also knew the Superfund faculty and their respective research interests. The students were interviewed by a PI in order to match each of them with one of the Superfund projects that was best for the student. After an interview with a Superfund scientist, every student was matched (to the extent possible) with a project of his/her choice.

The students were assigned to five Superfund cores—Sources and Pathways of Urban Heavy Metal Exposure, Lead Mobilization During Pregnancy, Lead Mobilization and Menopause, Hormonal Activity of Chlorinated Hydrocarbons from New York Harbor Sediments, and Effects of Polychlorinated Biphenyl-Containing River Sediments on Carcinogen Metabolism in Normal Human Mammary Epithelial Cells. Each student was interviewed by an investigator based on the student's interest in a particular project, and a match was quickly achieved between student and mentor. In the laboratories, students learned to separate substances chemically and to store, maintain, and analyze sediment cores, run gels, use the microscope, and enter data—to name a few. They learned library research skills using the Medical School Levy Library—how to write a paper and keep a log book and how to make an oral presentation of their paper. A very important component of the program is the weekly seminar. The seminar *drives* the process of learning in which knowledge, gained as part of their practical experience, becomes formalized into academic knowledge. In the seminar, *each student is required to give an oral progress report in front of the group. The resulting interaction with peers and the*

faculty leader of the seminar gives the student valuable feedback; it also gives the instructor a timely opportunity to conduct instruction or a mini-lesson to clarify misconceptions and/or fill in the gaps—at the moment when it counts—as the student is making his/her presentation. The progress-reporting seminar is attended by all participants and by the PI, the coordinator, and the students' mentors. Students receive feedback on their progress and their logbooks and also assistance with the formulation of a theme and with the organization and writing of the paper.

Two enrichment components were added to the Superfund program: one was an Ecology Awareness Workshop about the Hudson River conducted during a Hudson sail on-board the "Clearwater," an environmental education sloop. The second component that was added was a weekly seminar given by faculty from the Environmental Health Sciences Center in which the high school students, undergraduate students, and residents all participated. Both of these components will continue to be offered to the extent possible under the Superfund Environmental Health Outreach Project.

The students, the faculty, and the students' parents all responded enthusiastically to the Superfund Environmental Health Program. (The program syllabus as well as a paper on the Curriculum of the Practical are available for distribution.) In an awards day ceremony at the close of the summer program, the students each received a certificate noting the level of their progress.

The Superfund Environmental Health Program bears witness to the Chinese proverb: I hear and I forget; I see and I remember; I do and I understand—and have fun, too, we add.

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