EDUCATION

The Bronx River: A Classroom for Environmental, Political and Historical Studies

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I hear and I forget. I see and I remember. I do and I understand.
—Confucious 551 BC - 479 BC

Only in education, never in the life of the farmer, sailor, merchant, physician, or laboratory experimenter, does knowledge mean primarily a store of information aloof from doing.
—John Dewey

When I came to the Bronx in 1997, typical of many lifelong New Yorkers, I had never heard of the Bronx River; yet it coursed less than 100 yards from the school where I was to teach. The Bronx River flows north to south, and it divides the Bronx approximately in half. It took me the best part of a year to realize that my school, Fannie Lou Hamer Freedom High School, a small New York City public high school, is located, as many schools are, in a historically and ecologically rich area, an area readily useable as a classroom for my students.

A Classroom Philosophy

Students learn best when they are asking and answering questions that concern them. Where better to start than to inquire about their own neighborhood? This is inquiry-based learning. The idea is to help students answer their own questions by encouraging "reading, writing, speaking, listening, measuring, estimating, calculating, seeing…and the basic modes of imagining and of reasoning [that] should be at the core of high school work." However, knowing that students should be asking questions about issues that concern them has not helped me to figure out how to get students to ask questions in the first place. Students (not to mention many adults) are not trained in the art of asking questions, much less answering them. It becomes even more difficult when the answers to questions are multiple and contradictory.

Ron Berger tells the story of his students testing drinking water in his school's community. Students assisted in the design of the testing protocol, performed the testing, wrote and published the results.

> The project took months. … [We could not cover] fifty or sixty of the hundreds of new state requirements (*standards*) and memoriz[e]… facts for tests. … I [do not] regret sacrificing the shallow coverage of countless facts in order to have students craft something of excellence and importance.

Berger's students gained confidence that they could perform scientific research by solving intellectual problems as they encountered them. By leading my students to learn about and monitor the Bronx River, I am encouraging them to learn about their community, its history

and its environment. Studies of a community, within a community, may not cover all the details of the history or science curricula required for a state test, but they do offer history, historical method, and applied science. More importantly, they prepare students for life.

I use the area around our school as something my students can write about. I ask students to write about everything they do. I ask them to be reporters about what they see, experience, and read. I help them revise their work to improve their writing skills as well as to help them think about the issues they encounter. Writing and thinking are among the most important skills I can help students with, and the community provides ample real world material as an alternative to conjured up in-school assignments.

The School

Fannie Lou Hamer Freedom High School opened in 1994 as part of a joint undertaking of the Coalition of Essential Schools and New York City Board of Education to restructure a failed large-neighborhood high school. In 2005, we celebrated our eleventh year. Our school serves the educational needs of 480 students in the South Bronx. Our students' families are predominantly from lower income strata; over 90 percent of our young people are eligible for free or reduced-cost lunch. The student body is 75 percent Latino and 25 percent African-American. Our mission is to work with a high school population comprised of the neediest and most underserved students in the New York City high schools. We are building a school centered on literacy, research, and critical thinking. To this end we emphasize a small school size with maximum contact between small groups of students and their teachers. In two-hour blocks of time, our classrooms focus on an innovative curriculum developed by an energetic staff.

A typical entering class is 40 to 50 percent over age. Entering high school already having been left back in earlier grades is a statistical predictor for dropping out. For 25 percent of our students, English is a second language, while 19 percent of our students have been classified as Special Education students. We graduate approximately 50 percent of our incoming classes after four years, and a sizeable share of students graduate after five years. About 90 percent of our graduates go to college.

Since its inception, we have been a performance-based assessment school. Students have had to prepare graduation portfolios containing comprehensive essays in literature, math, science, social studies, and art. Once completed, students present their portfolios to a committee composed of their adviser, a teacher, a family member, and another student. This intensive cognitive and writing experience has served our students well as they move on to college.

Fannie Lou Hamer Freedom High School is a staff-run school. While the school has a principal and an assistant principal, teachers actively participate in much of the day-to-day organizational work that running a school like ours requires. The resulting lower administrative overhead permits smaller classroom sizes.

I was not specifically hired to bring environmental or community studies into the school. My only guidance was to "teach what you want to teach," which for me led to both environmental and community studies. This is an important aspect of the philosophy of our school: a teacher enthusiastic about the subject being taught is in a good position to share that enthusiasm with students, leading to high quality education.

First Steps: the Garbage Course

The first course I taught at the school was "the Garbage Class." Starting in the fall of 1997, students and I examined the complexities of solid waste management, an issue I had previously studied. We looked at the composition of the residential solid waste stream from a recycling perspective (paper, food and other organic materials, plastic, glass, and metal). Students collected samples of excessively packaged goods, which helped them learn about the contradiction between manufacturing commodities designed to be discarded as garbage and the conservation of natural resources.

We evaluated the school's recycling program, a multidisciplinary activity. Measuring recycling rates required us to collect information about how much waste the school threw out. Students recorded how full the school's backyard containers were just before the city's Department of Sanitation emptied them. The containers were large cubes with one edge cut off; this irregular shape required careful measurement and the use of geometry to determine the container's volume. Two of the three large containers were designated for materials headed for a landfill, while the third contained recyclable materials. Over the period of our observations, our school's recycling rate increased from around 30 percent to around 45 percent. Recycling measurements by subsequent students showed similar increases. When students start measuring recycling, the school's recycling rate seems to go up. On one occasion students compiled their results into a report that they submitted to the Bronx Borough President's office, and in 1999, the Bronx Borough President awarded them a prize for their recycling program. During the award ceremony in Bronx Borough Hall, the students exhibited unbounded pride for their achievement.

As part of our examination of a major urban infrastructure, we went on an excursion to the city's then only remaining landfill. At the time, 1998, the Freshkills Landfill was receiving most of the city's 13,000 daily tons of residential garbage. Freshkills had already become a 150-foot mound of waste piled in the center of a 3000-acre wetland. It was a complex engineering project that required covering each daily addition of garbage, as well as continual attempts to prevent liquid runoffs and to control odors from the decaying garbage. As part of our trip up the hill of garbage, we learned about the city's composting efforts and landfill gas recovery programs.

Teachers often cannot know how class work or school trips will impact their students over time. My experience indicates that carefully chosen, out-of-school trips are effective teaching moments. Our trip to the landfill had a long-term influence on at least one student. Several years after he graduated, he returned to let us know that he was graduating from college. Not only was this student able to recall our class trip, he had stayed current with events concerning the landfill, and he is now in graduate school. However, even in its

most positive light, the Garbage Class had too narrow a focus, and many students were turned off by the title of the course, often stating, "garbage is nasty."

In its place, I decided an environmental policy class would offer students a wider variety of potential questions. We could examine where our drinking water comes from and the history of the development of New York City's drinking water supply, while continuing to look at aspects of recycling and other municipal solid waste issues.

Finding the Bronx River

You cannot see the Bronx River from our school, because an automobile used parts lot blocks the view. This scrap yard's bulkhead channels the river several feet below ground level. The Bronx River is often hidden and channeled as it flows through the South Bronx, but there it was—out of sight and just a stone's throw from the school.

The Bronx River has special qualities and is estuarine in front of our school. The estuary is where the river's fresh water meets and mixes with the ocean's salt water, and like all estuaries, it is tidal. As the tide comes in and the river flows up stream, the fresh and saltwater mix in complex ways. Since the saltwater moving up stream is heavier than the freshwater moving down stream, it sinks and flows under the fresh water trying to move down stream. The incoming tide covers vegetation, rocks, and debris such as dumped tires, which are exposed with the outgoing tide.

The Bronx River, a short river only 23 miles long, is New York City's only freshwater river. Originally a meandering river flowing in a relatively narrow river valley, it has been straightened to suit the needs of builders and communities around it. It flows from Valhalla, New York southward bucolically through Westchester County north of New York City and then into the Bronx. There it becomes part of the Bronx Botanical Garden and then the Wildlife Conservation Society's Bronx Zoo, together called Bronx Park. Moving south from the Zoo it becomes hidden in urban sprawl, finally spilling into the East River, which is a tidal straight connecting the Hudson River Estuary to Long Island Sound.

The Bronx River, as my students have learned, has a rich social and cultural history. It was a food source (fish and shell fish) and transportation route for Native Americans prior to the arrival of the Europeans. It is named after Jonas Bronck, the first European known to have established a farm on its banks in 1638. George Washington's army used the river valley in its escape after being defeated in the Battle of Brooklyn in 1776. The Bronx River marked the political border between the two northern annexes of New York City in the late 1800s, while railroads and industry flourished along its banks. As part of a major river cleanup in the early 20th century, while building the nation's first limited access Parkway, the Bronx River Parkway Commission significantly channeled and straightened the river.

After many years of neglect, the South Bronx community has again begun to lavish attention on the hidden treasure that the river is. It has recently become a location of environmental restoration and public recreation for communities along its entire length. In this context, in the fall of 1998 we decided to start testing the quality of the river's water. At

that time, the nearest access point was behind Starlight Park, located directly opposite our school but blocked by the Sheridan Expressway running between the park and the school. Students and I walked to the nearest overpass at Westchester Avenue and back to the park where we tested river water for dissolved oxygen and pH.

Students and I started collecting samples of river water using a compound bucket (supplied to us by the school's custodial staff attached to a clothesline). Our testing location was at a heavily channeled part of the river. Large boulders (rip rap) comprised the riverbank. At that location there is a weir, a low dam, which is covered and uncovered by the tide. Because the water level differed depending on when we went to the test site, students learned about tidal changes.

We had to climb over the riverside rocks to get our water sample. Through trial and error, students and I were able to collect enough water to test. We began keeping logs of our test results. These records have, over time, helped us understand the river's usual parameters. The pH reading usually is 7.5 (7 is "neutral"—neither basic nor acidic). The dissolved oxygen reading usually (but not always) is greater than 6 parts per million (readings above 6 ppm mean there is enough oxygen dissolved in the water to support aquatic animal life). When these parameters are different, we know something is happening. Once, when the dissolved oxygen was unusually low, we learned that the previous day's rain had flooded the river with sewage, causing dissolved oxygen levels to drop.

Each group of students became proficient at these chemical tests of Bronx River water quality. One particularly cold day—a day I might have chosen not to go to the River—is instructive. Icicles were hanging on tree limbs, and the students complained. "It's too cold to stay here." But they stayed and finished the testing. From earlier tests they conducted, the students knew data from a particularly cold day would add to their data set. The readings that day taught them that dissolved oxygen increases as water temperature decreases.

Students took pride in being able to evaluate whether fish could survive in the river. As our dissolved oxygen test results were usually above 6 parts per million, we concluded fish could survive in this part of the river, which was confirmed by seeing some. Sharing our test results with community groups also monitoring the Bronx River increased the kids' level of pride and self-confidence, as their work—authentic research valued by organizations outside of our school—was being made public in a way that was rare for a class.

An Idiosyncratic Example of Industry on The Bronx River

During the summer of 2000, the maple leaf symbol of the Department of Parks appeared on a rusted-out, long-unused tower of an abandoned South Bronx concrete plant. We were told that the Department of Parks took over the property located along the river from the state Department of Transportation. Transportation retained ownership of another part of the site and of a road that ran through it. The Department of Parks assumed responsibility for the clean-up of this land. Now that the property was government-owned, a

series of public policy questions arose. What should be done with this new waterfront property?

Community groups began to argue that the property should be used for a park rather than an access road to the Hunts Point Food Market as some were proposing. My students along with the larger community participated in asking these questions and grappling with this issue. They wrote essays expressing their positions on the matter. A park would provide needed space for recreation, while a road would remove heavy trucks from residential streets in Hunts Point. As the community designed sensible alternative routing for the trucks, the park concept gained ascendancy. The issue for both students and the community became "what should the park and its limited access look like?"

Students also read about the Bronx River. Community groups distributed position papers, politicians made statements, and the *New York Times* published articles about the Bronx River. Seeing a prominent write-up about Bronx River history and recent efforts at restoration gave students a sense of the importance of the water quality monitoring and restoration that we had been doing at the Concrete Plant Park.

The plant is just three blocks away from our school and more clearly located along the estuarine section of the river than the Starlight Park site that we had been using. No longer did we have to scamper over boulders. We started to collect samples of river water at the cement plant's bulkhead, which was formerly used to secure waterborne deliveries of sand, gravel, and cement.

One bright, sunny day, Dr. Julie Mankiewicz of the Gaia Institute on City Island in the Bronx, met one of our classes at the cement plant to help us understand the functioning of the Bronx River estuary. Julie had an electronic test probe that students helped drop over the side of the bulkhead to take twelve readings at one-foot intervals from the surface to the estuary's bottom. "Look how the salt levels all of a sudden increase as you move further down," Julie remarked. "You can almost see the salt wedge." For some of my students, the qualities of an estuary became clearer. The salt water really does move in under the fresh water—at least in the relatively calm Bronx River Estuary.

I knew that the bucket method of collecting water was not sufficient to sample the waters of the estuary. The bucket merely managed to grab a sample of surface water and could not examine deeper layers of the estuary the way Julie's test probe did. Fortunately, I had just received funding from the Catskill Watershed Corporation to buy a device that would enable us to collect water samples from the surface of the water and several layers below.

I also acquired a digital camera so we could record our activities. Students used the digital images to supplement their reports and graduation portfolios. One of the images we captured on our new camera was of the concrete plant's tower containing an old, rusted sign reading "Transit Mix Concrete." This sign gave us the opportunity to perform additional authentic research. One student called the phone number on the sign and discovered it was a private residence. No one could tell us when the company's operations had ceased. A

student excursion into the rusted, exposed, and weatherworn structures returned with a great deal of now meaningless office paper. No clues here about the operation of the disappeared business, but we would not have known this without the efforts of these proud students.

During the spring of 2001, we arrived at the cement plant to see a large fence built in the middle of the tarmac. Weeks later large squares made of lumber had been constructed on the ground, each square covered with plastic. The Department of Parks' Natural Resources Group (NRG) was constructing a nursery. The project director, David Caplin, invited students to help plant a cord grass, *spartina alterniflora*, in the cocoanut mats that occupied the large squares. Even the most reluctant students enjoyed getting their hands involved in the real-world activity of preparing plants for their eventual placement in the river bank erosion control and pollution abatement project. "I helped improve the environment," many students would express, in one way or another, in their papers.

Community Resources and Connections Further the School's Goals

For me, useful connections were established through continued networking. Through the Bronx River Restoration organization, I found the Bronx River Working Group that met periodically in the Bronx Department of Parks headquarters, which led me to NRG. The Bronx River Working Group was a forerunner of the Bronx River Alliance, a remarkable new community organization involved in the restoration of the Bronx River. The existence of the Bronx River Alliance, an amalgam of some 70 Bronx community organizations, has benefited my students. The Bronx River Alliance's founders designed their organization to receive maximum direction from members of the community. Since 2001, I have been the co-chair of the Alliance's Education Team and as such, I am a member of the board of directors. Team members are usually active participants in their community who are concerned with various aspects of the Bronx River's environment. As part of the Alliance's bottom up structure, team chairs, chosen from the team itself, automatically become board members.

Members of the Alliance's Education Team come to my class to speak with students, adding information they have been unable to grasp from their classroom teacher. Several participants have provided my students with internships, giving them experience and information to write about in their graduation portfolios. Additionally, my participation in the Education Team's activities has kept me current about activities on and around the Bronx River.

Expanding the Bronx River Program: An Interdisciplinary Curriculum

During the spring of 2002, the school's administration and I decided to expand our Bronx River program. The course I was teaching only gave the students social studies credit. Since good environmental education requires social studies *and* science, why not facilitate their getting science credit as well?

We placed the Bronx River class, a social studies class, opposite a science class also focused on the Bronx River. I work with students in the morning; my colleague, Frank

Pandolfo, a science teacher, works with them in the afternoon. Frank and I check with each other about our daily activities. Sometimes we are in each other's class actively commenting on and participating in the work of that day. Students have enthusiastically called me over to see what they have found when Frank showed them how to observe tiny animals (plankton) under a microscope in the water samples we brought back from the Bronx River. The arrangement of our class schedule made it possible for us to spend entire days together at the Bronx River where we fish, test the water, plant, sometimes canoe or row, and discuss improvements we would like to see in the environment.

We have taken joint day trips to locations remote from our school. One was to the Bronx River headwaters—23 miles away. There, students see the Kensico Dam completed in 1915. The Kensico Reservoir, which holds 30 billion gallons of water, is one of New York City's 19 drinking water sources. Students learn that neither the Bronx River water near the school nor the fish that live in it are fit for human consumption. At its headwaters, the river provides just under 2 percent of the city's drinking water. The reservoir also functions as a holding point for water from the upstate Catskill and Delaware watersheds, making it a "terminal" reservoir rather than a "collecting" reservoir. Ninety percent of the city's drinking water passes through the Kensico Reservoir. On our trips to Kensico, naturalist Jeff Main, an employee of the Westchester County Department of Parks, described the architectural history of the dam and escorted us to the Cranberry Lake Preserve where we saw a small watershed and experienced a guided walk through the woods. There Bronx River ecology and social policy become real nature for our often noisy, urban students.

We also visit the Hudson River, where a day sail on the river provides a comprehensive, yet compressed, view of this large river estuary that most New Yorkers know so little about. The 108-foot sloop, Clearwater, and its crew provide an exciting out-of-class experience rich in science, social studies and history. Students learn about navigation and get a chance to steer the boat and help set its sail. They test the water for pH and dissolved oxygen enabling them to compare the results to their Bronx River data. They again examine plankton and help fish for samples of river life using a trawl net. They learn about life on board a working Hudson River sailing vessel as it exists today. On the Clearwater, students learn that they can accomplish amazing things by working together, as exemplified by their success in setting the 3,000-pound sail. Finally, they learn that the problems of the Bronx River are similar to the problems of other rivers but that the Bronx River is also unique.

As of this writing our school's Bronx River program is expanding even further. We have opened a middle school, Fannie Lou Hamer Middle School. Its sixth and seventh grades will in part focus on Bronx River studies. For them, this valuable nearby resource is too rich to pass up. In addition, the high school's ninth and tenth grades also began to use the river as a resource for its science program. Thus new levels of students will benefit from studying the rich cultural and social history of the Bronx River, and they, too, will have the benefit of practicing authentic science and social studies research outside the confines of the school.

A Classroom in the Community

The Bronx River provides a classroom unique to my school and the other schools near it. The possibilities of creating classrooms outside of schools abound, just as local real world issues abound. At a seminar I once attended, participants were asked to see how their school's neighborhoods could provide them with landmarks representing important moments in American history. Everyone was able to find such a landmark. The Bronx River is merely one good example of how one might use the community as an environmental classroom. It is one of many rivers in the U.S. being rescued by the efforts of local community activists.

The history of the environment in the community surrounding Fannie Lou Hamer Freedom High School continues to evolve. There are local industries that pollute the environment to learn about. One local community organization, Sustainable South Bronx, has created a tour of the neighborhood that visits locations emitting toxic materials. There is the continuing remediation of Starlight Park, the local brownfield that requires community monitoring and vigilance. And there is a great deal more history to learn about the Bronx River—a wonderful opportunity for students to gain real world research experience and to improve their academic skills. Not only will they gain in the endeavor, so will the community—their community.