



# City-as-Lab: Using Brooklyn's Urban Spaces to Enact Place-Based Environmental Science Studies

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**Abstract:** Brooklyn College GK-12 "City-as-Lab" program has turned Brooklyn, a city of neighborhoods and diverse culture, into the richest of science classrooms. GK-12 Fellows, students, and teachers collaborate on place- and inquiry-based experiments in public high school classrooms. Fellows foster an understanding of complex ecological and social issues existing in the students' neighborhoods while simultaneously developing their own leadership and communication skills as scientific researchers. Students design and implement experimental projects, use GIS programs to strengthen their spatial orientation skills, and present their findings to their communities. Multiple datasets have been collectively generated while simultaneously achieving program goals. First, high school students have benefited from exposure to authentic scientific experience facilitated by collaboration between their teachers and the GK-12 Fellows. Second, the sustainability of these collaborations and the projects developed therein provides resources to the partner schools that last beyond the duration of the Fellow's involvement with the schools. This project has proved mutually beneficial to students, teachers, and Fellows alike: students are exposed to exciting, relevant science experiences within their own communities; teachers receive assistance in science curricula planning and implementation; and Graduate Fellows gain experience with new pedagogical methods, improved communication and teamwork skills, and mentoring by teachers and GK-12 Principal Investigators.

### Brooklyn Academy for Science and the Environment (BASE)


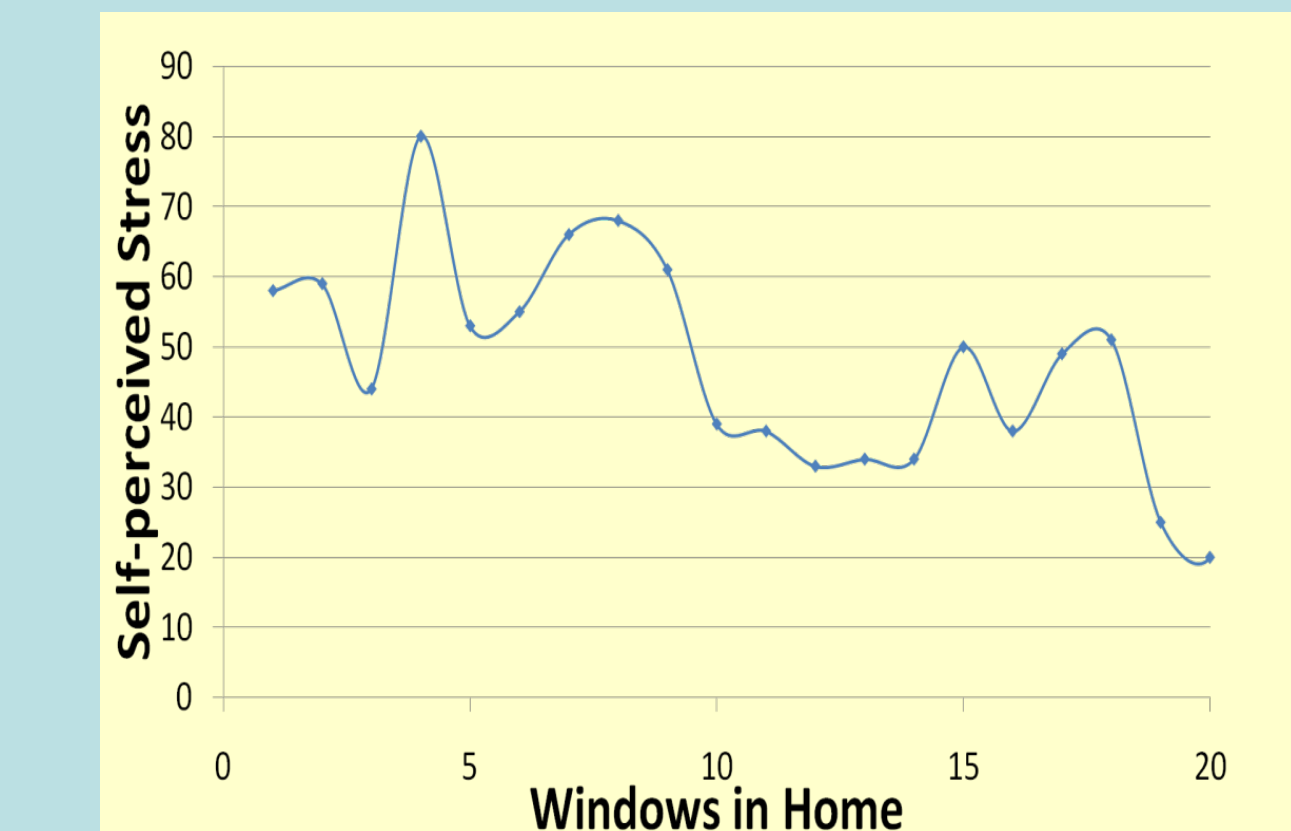
**Projects:** Students are exploring the relationship between green space, students' self-perceived stress, and physical health data corresponding to various neighborhoods within Brooklyn.

**Class:** Sophomore science research class

**Methods:**  
Students are

- Developing their own scales to measure green space exposure and self-perceived stress
- Integrating other students within their school as participants
- Using mapping and spreadsheet software (My World/GIS, Excel) to examine health levels across different Brooklyn neighborhoods and comparing them to the green space levels indicated in each corresponding neighborhood

**Results:**  
Data reveal that participants who are exposed to more green space have significantly lower stress levels compared with those who are not exposed to green space. Students who commute through green space and/or have many windows in their homes possess some of the lowest stress levels. Contrary to the students' hypotheses, mapping software data show that neighborhoods with higher levels of green space have poorer overall health levels than neighborhoods with lower levels of green space.

### Academy of Urban Planning (AUP)

**Projects:** Water Quality Testing at Newtown Creek, a 3.5 mile estuary separating the boroughs of Queens and Brooklyn considered one of the countries most polluted bodies of water.



**Class:** 11th Grade Urban Ecology and Urban Geography

**Methods:**  
Working in two elective classes, students are learning about environmental issues and the history behind these issues that affect the health, well being and political decision making within their communities. In the classroom, students learn about water quality of the New York City area and water testing techniques, and in the field, students construct their own overview of the current water conditions of Newtown Creek and compare these results to previous years' work.

Students are

- Testing dissolved oxygen, pH, and coliform bacteria levels in the creek
- Collecting and counting zooplankton and other macroscopic organisms in the creek
- Collecting and counting terrestrial plants and bird species
- Measuring water turbidity using secchi discs

**Results:**  
The data collected by the students show that the current year's test location is substantially healthier than that of the work done the prior year. Students are identifying the differences in localities from their site, near the mouth of the East River, compared to the prior classes' site, a land-locked locality with no tidal influence. Students are drawing connections between the results and geographic differences in order to make accurate predictions of levels of pollution throughout the creek's system.

### Teachers Preparatory School

**Projects:** To identify hazards that exist in the air of their school, home and places of recreation.

**Class:** 9th Grade Living Environment

**Methods:**  
Students are researching pollutants and other substances that could exist in the air, and what specific problems are associated with these substances. Using a combination of pre-purchased kits and homemade "detectors", students are testing their air for ozone, particulates, organisms, and hazardous vapors.

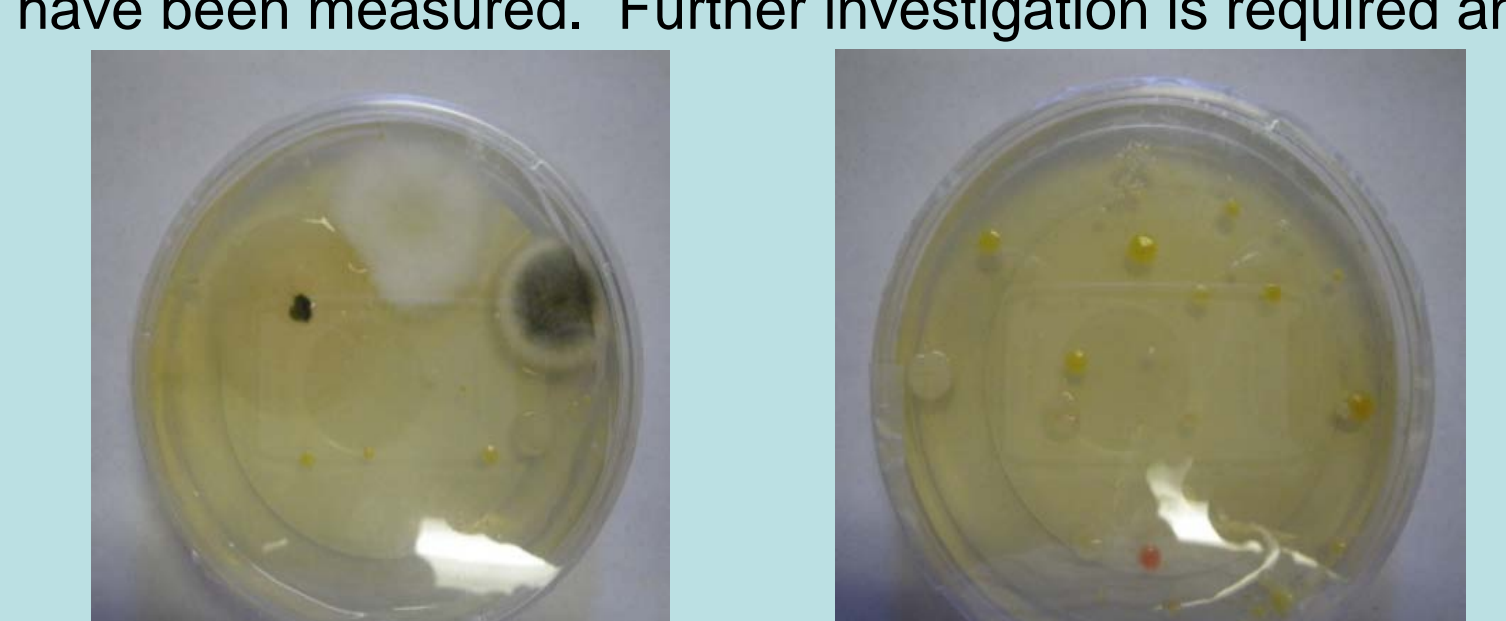
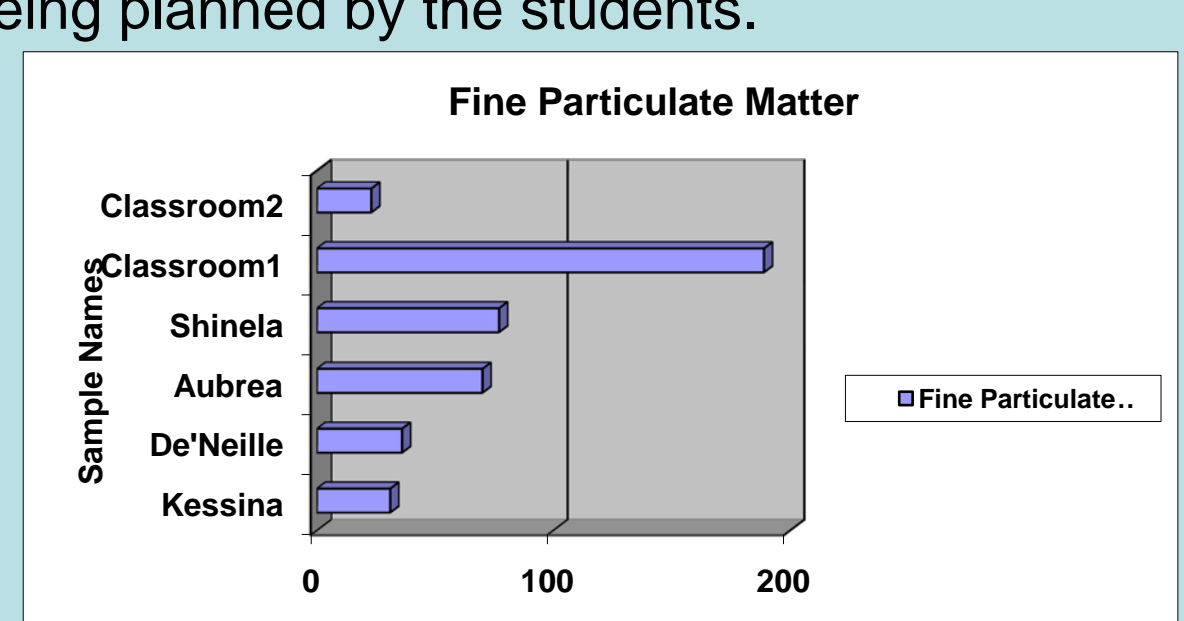
**Ozone:** Students are using test strips to test indoor and outdoor air for dangerous ozone levels

**Particulate Matter:** Particle collectors placed in students' homes measure particulate matter

**Organisms:** Cultures of air inside classrooms are taken and are incubated for several days. Growth of bacterial and fungal colonies in Petri dishes are analyzed

**Vapors:** Dangerous chemicals such as Carbon Monoxide, Carbon Dioxide, Formaldehyde, and Nitrogen Dioxide are measured in classrooms using dosimeter tubes

**Results:**  
Students identify differences between particulate samples from different locations in Brooklyn, micro-photographed their detectors, and graphed their data. Ozone counts have been low for all areas tested. Students have identified several bacterial and fungal colonies that could have an adverse affect on health in their classrooms. Potentially dangerous levels of Carbon monoxide have been measured. Further investigation is required and being planned by the students.

### Science, Technology, and Research Early College High School (STAR)

**Projects:** Characterization, pH, and fertility of soils

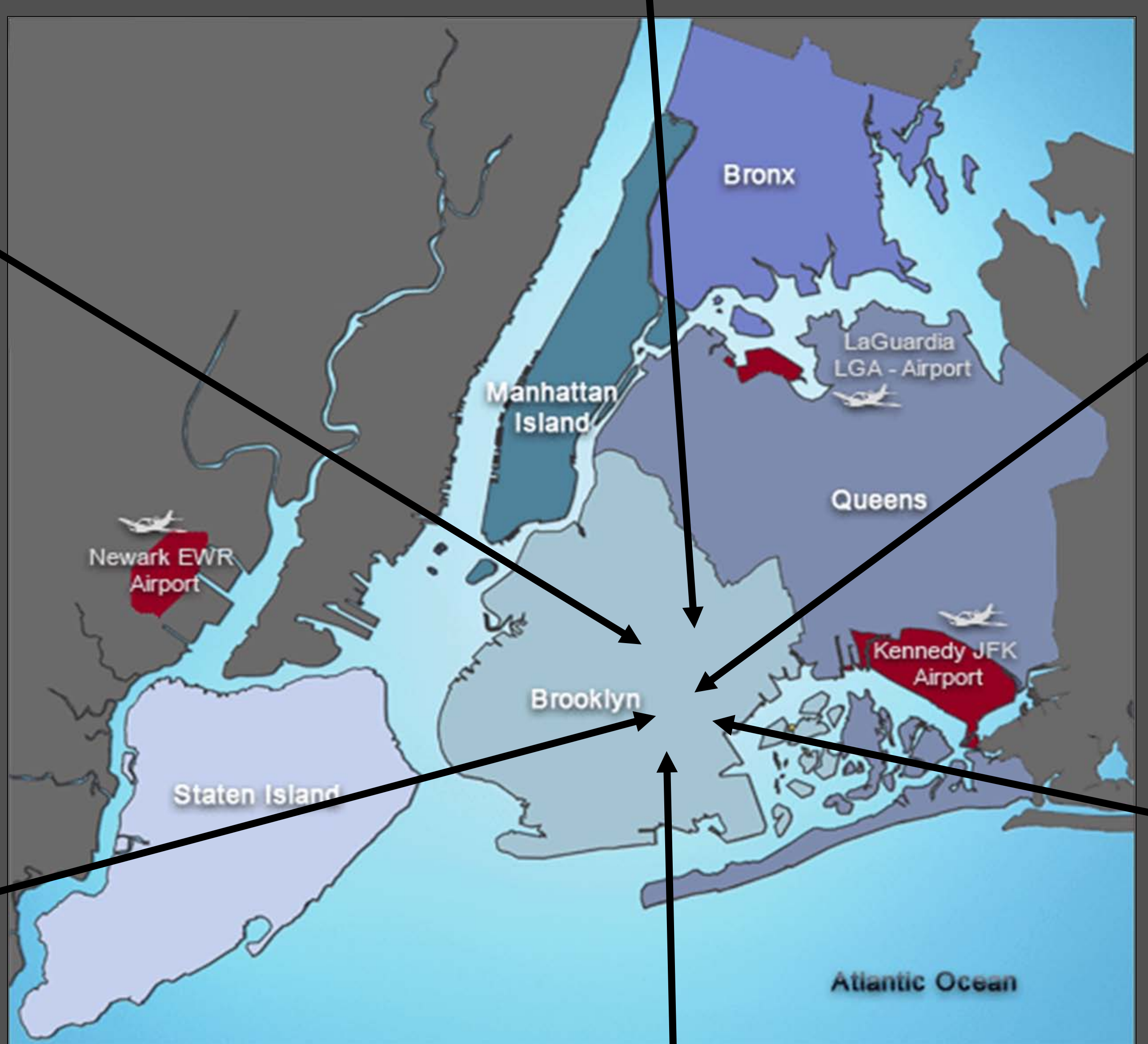
**Class:** Earth Science Regents, Grades 9-12

**Methods:**  
Prospect Park serves as a nearby, accessible laboratory for hands-on investigation of natural processes in the urban environment of Flatbush, Brooklyn. Furthermore, research in the park reinforces STAR's vision to foster a new generation of scientists by invigorating the New York Earth Science curriculum, making Earth Science topics more interesting and relevant to students' lives.

Students are

- Analyzing soil samples taken from various locales around Prospect Park for physical characteristics, pH, and nutrient content
- Understanding how soils interact with biotic communities by examining their physical and chemical properties
- Tracking temporal and spatial changes of soil properties
- Using GPS units in the field and GIS software in the classroom to measure latitude and longitude, and to relate maps to real-world locations



### Brooklyn College - City University of New York

**Summary:**  
Collectively, these projects have enabled the GK-12 Fellows to develop their communication and leadership skills that will benefit their future research careers. Drawing from their diverse scientific backgrounds, Fellows have generated projects that incorporate a variety of technologies and methodologies. These projects represent student driven, inquiry-based styles of instruction that utilize students' relevant neighborhoods as research laboratories; the experience of these engaged pedagogies will make the Fellows better teachers themselves.



### It Takes a Village Academy (ITAVA)

**Projects:** Following several weeks of building knowledge base about various aspects of air pollution, the students designed a research project to assess what the other people in the community knew and felt about air pollution, as well as how air pollution might be directly affecting them. The project comprised two parts: The design and administration of the Air Pollution Attitudes & Knowledge Survey and assessments of Forced Expiratory Volume in the 1st second (FEV1) levels.

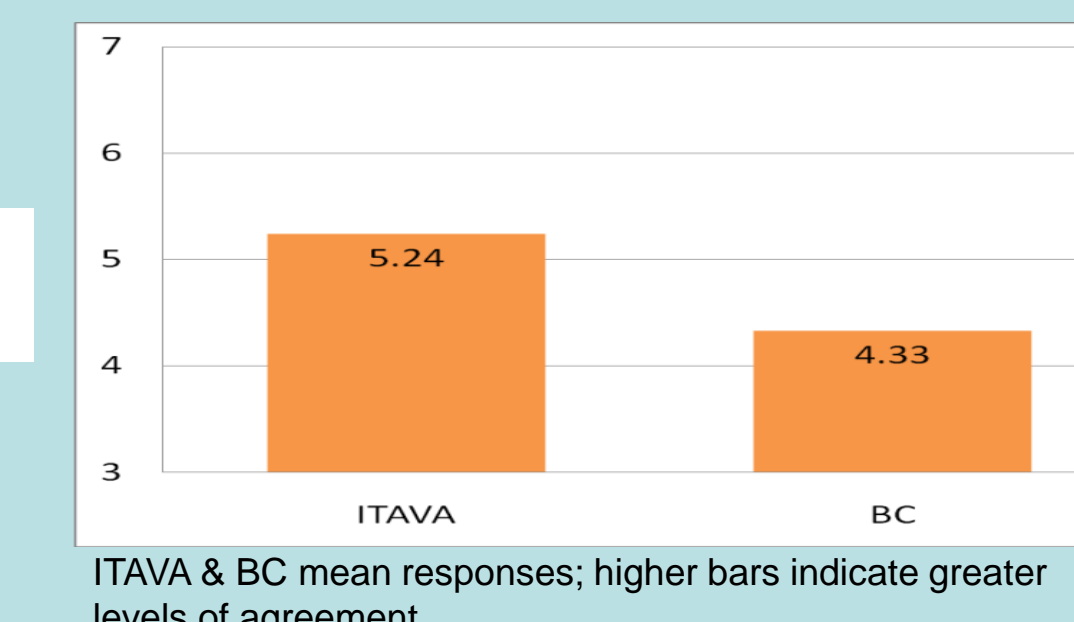

**Class:** 10th and 11th Grade Science

**Methods:**  
Students are

- Administering surveys to 232 ITAVA and Brooklyn College students
- Analyzing survey data by comparing the results of both samples
- Collecting FEV1 values for 181 ITAVA students
- Comparing measured and experimental FEV1 values
- Plotting norms and differences according to participants' addresses using My World GIS software

**Results:**  
Students want to know if attitudes concerning air pollution of their peers are significantly different than those from the students attending Brooklyn College, who are older and have higher levels of education. Preliminary analysis reveals that the ITAVA students are significantly more optimistic with regard to their ability to help solve the air pollution problem than are the Brooklyn College students. Plans are underway to administer the survey to other participating GK-12 schools.

**A sample statement from the Air Pollution survey:**  
*There are many things that I can do to help solve the air pollution problem in my community.*

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