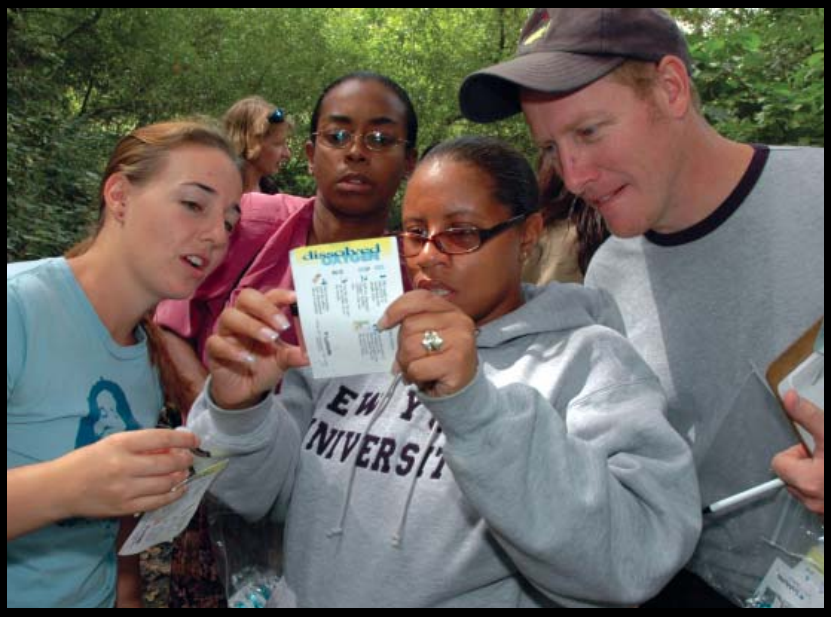
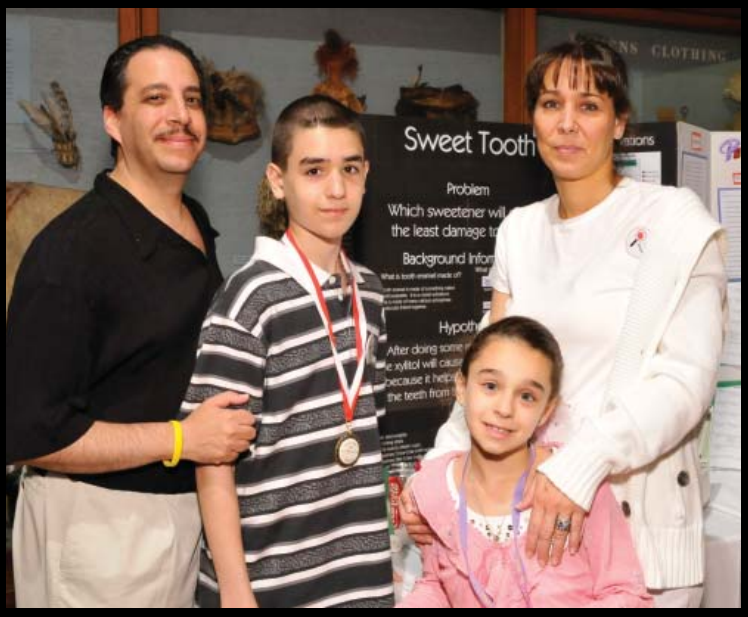
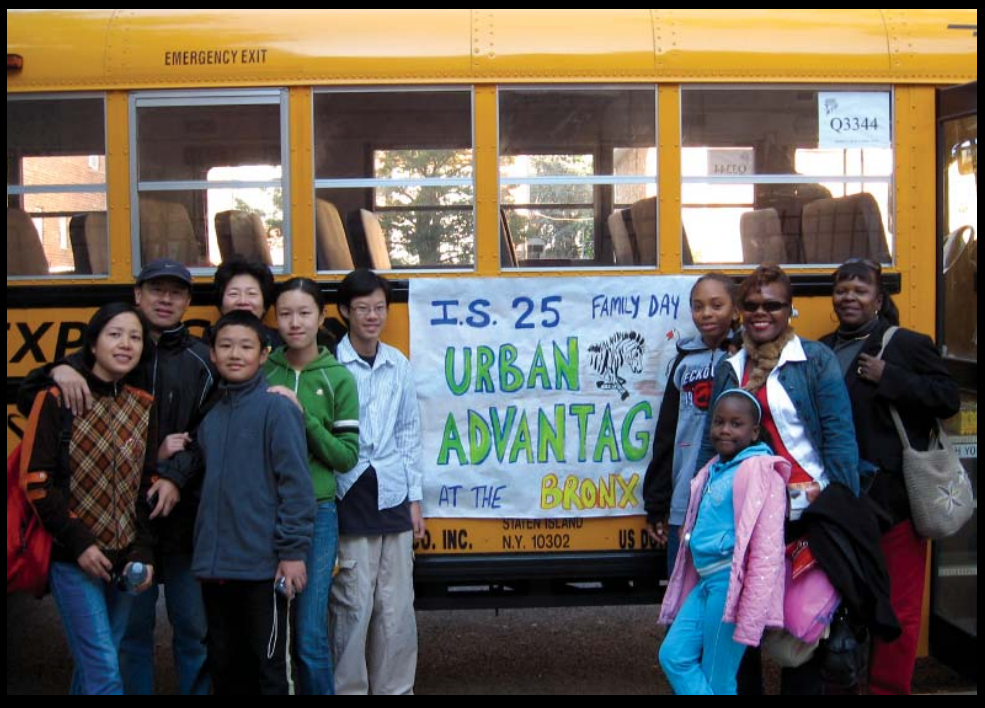
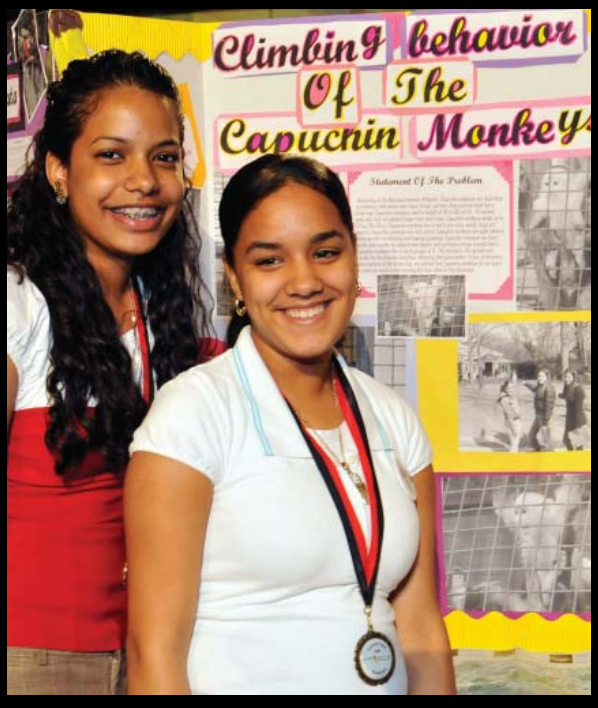
urban advantage

middle school science initiative





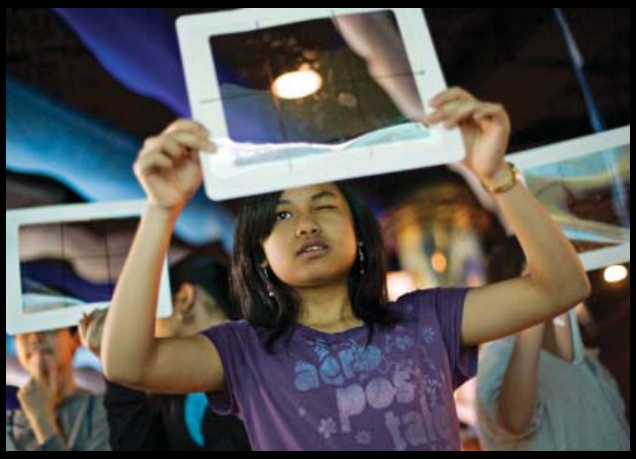




urbanadvantagenyc.org

What Is Urban Advantage?

Urban Advantage (UA) is a standards-based partnership program designed to improve students' understanding of scientific inquiry through collaborations between urban public school systems and science cultural institutions such as zoos, botanical gardens, museums, and science centers. We believe that their extraordinary scientific and cultural resources convey a true "urban advantage." Traditionally, these institutions have supported formal science education goals only indirectly. UA involves institutions outside the formal education system that support the science-specific goals of the public school system.



UA student maps fish habitats at a partner institution.

The National Research Council's recent report *How Students Learn Science in the Classroom* (2005) indicates that a deep understanding of science is grounded in doing science. To this end, Urban Advantage partnerships give students opportunities to conduct hands-on investigations that engage them in science as a way of thinking and investigating rather than simply as a body of knowledge.

Urban Advantage was launched in 2004 in New York City by the American Museum of Natural History (AMNH) in collaboration with the Brooklyn Botanic Garden, the New York Botanical Garden, the New York Hall of Science, the Queens Botanical Garden, the Staten Island Zoo, the Wildlife Conservation Society's Bronx Zoo and New York Aquarium, and the New York City Department of Education, with leadership funding from the New York City Council.

Partner institutions work collaboratively to develop a shared vision of effective programming that emphasizes scientific investigations. Each partner institution commits to: designing and conducting high-quality professional development that promotes the teaching and learning of inquiry and investigations through programs that support teachers over multi-year periods; honoring admission vouchers; partnering with one or more UA "demonstration schools"; and visiting a variety of schools each year to support UA implementation.

UA Framework: Six Components

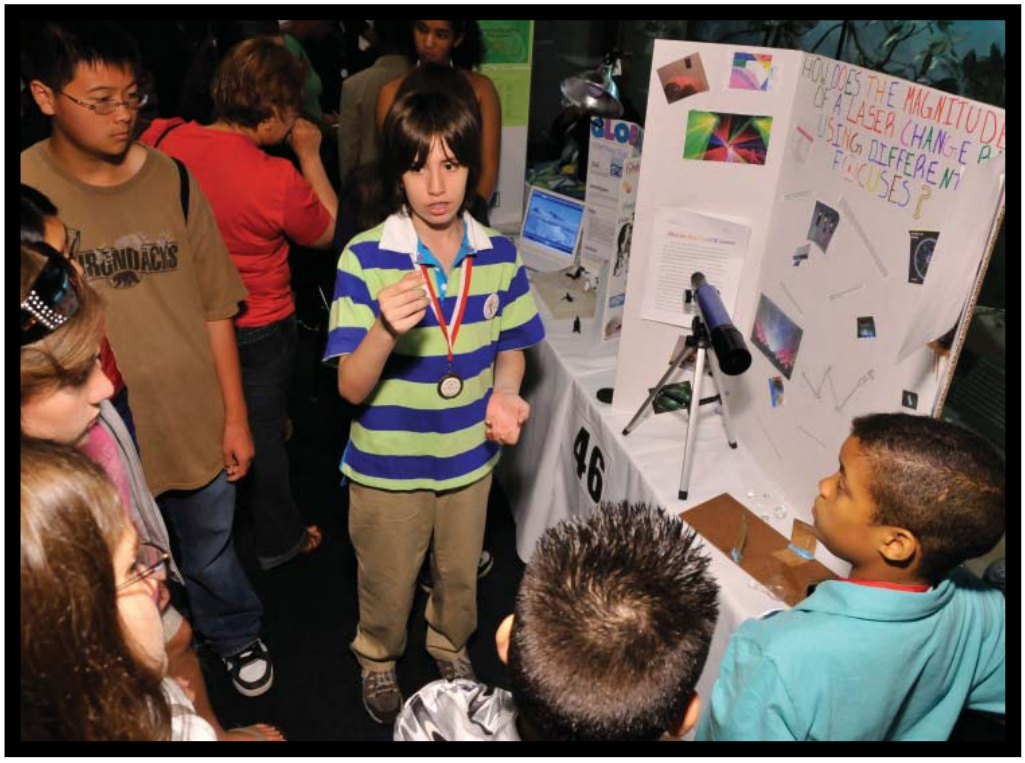
Urban Advantage includes six research-based components designed to support schools, principals, teachers, students and families. They are:

1. High-quality professional development for teachers and administrators
2. Classroom materials and equipment that promote scientific inquiry and authentic investigations
3. Access to UA Partner institutions through free school and family field trips
4. Outreach through family events, celebrations of student achievement, and parent coordinator workshops
5. Capacity-building and sustainability structures, including a network of demonstration schools and support for the development of lead teachers
6. Assessment of program goals, student learning, systems of delivery, and outcomes

"When our City's leading cultural institutions work together with the Department of Education, our students win. The Urban Advantage Middle School Science Initiative has not just increased our students' access to science, it has laid the foundation for a career in innovation …"

–New York City Council Speaker Christine C. Quinn

Meeting a Need — Long-Term Science Investigations



UA students explain their investigations at UA's annual Science EXPO.

Five Essential Features of Scientific Inquiry

The central features of scientific inquiry in the classroom include:

1. Engaging in scientifically oriented questions
2. Giving priority to evidence
3. Formulating explanations from evidence
4. Evaluating explanations in light of alternative explanations
5. Communicating and justifying proposed explanations

From *Inquiry and the National Science Educations Standards,* National Research Council, 2000

UA began by assessing and responding to the science education needs of NYC middle schools. Assessment results showed a severe shortage of qualified science teachers. At the same time, a new city-wide mandate required all eighth grade students to complete long-term scientific investigations (known as "exit projects" in New York City). This provided the program with a clear focus: eighth grade student exit projects.

In its Performance Standards, the NYC Department of Education defines four types of science exit projects:

(1) Controlled Experiments; (2) Field Studies; (3) Design Projects; (4) Secondary Research (in which students use scientific data sets obtained by others). Aligning UA objectives with objectives specifically identified by the formal education system is intrinsic to the Urban Advantage framework. This intentional alignment was novel for the partner institutions.

Exit projects support the New York State Learning Standards for Mathematics, Science, and Technology, specifically Standard 1: Analysis, Inquiry and Design, which identifies the key features of scientific inquiry as: developing explanations of natural phenomena in a continuing, creative process; testing proposed explanations using conventional techniques and procedures requiring ingenuity; proposing, and analyzing explanations; and providing new insights into natural phenomena.

"We go from the Bronx to Brooklyn.... We take the subway to the aquarium ... and we observe the sea otters."

–UA Student

UA Partner institutions lend themselves to different subject area expertise within the sciences—life, Earth, or physical—and the different types of exit projects they can best support. For example, zoos and aquariums typically support field studies, botanical gardens focus on controlled experiments, while secondary research and design projects are well suited to science centers and museums.

New teachers are exposed to rigorous science content while conducting investigations at a professional development workshop.

COMPONENT 1
Professional Development for Teachers and Administrators

For Teachers

Urban Advantage's professional development for teachers emphasizes authentic hands-on experiences in science, the nature of scientific work, specific science topics, and how to support the essential features of inquiry in the form of long-term investigations. To this end, teachers conduct their own "exit projects." Professional development takes place almost exclusively on Saturdays and Sundays, for which teachers receive a stipend. Forty-eight hours of professional development are required for teachers in Year 1. Continuing teachers are offered ten hours of professional development in their second year and beyond.

During professional development workshops, teachers conduct their own investigations.

Year 1: Orientation Session and Inquiry Workshops

Teachers begin with twelve hours of orientation, in which long-term student investigations and the strengths of the eight UA science-rich cultural institutions are introduced. This orientation session recommends ways to pace investigations across the school year, plan field trips, embed resources in instruction, use UA-provided equipment and resources, use vouchers, and learn how to teach students the process of experimental design. During the remaining 36 hours of professional development, teachers attend sessions at two institutions of their choice and complete two different kinds of exit projects. This reinforces teachers' mastery of exit-project learning outcomes and increases their repertoire of field trip destinations.

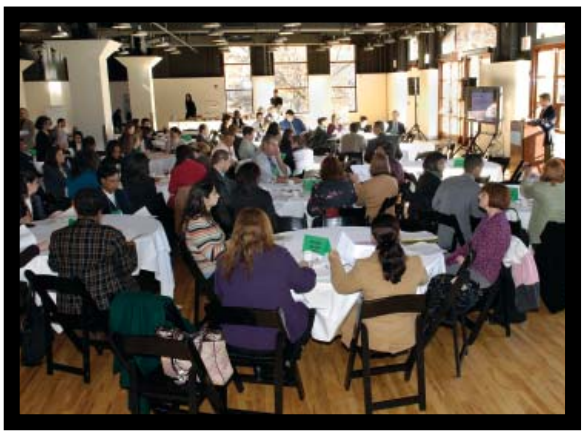
Year 2 and After: Continuing Professional Development

Professional development during the second year (and for as many years as a teacher wishes to continue) is for a total of ten hours and also includes a stipend. Offered after school and on weekends, professional development focuses on topics such as:

- expanding teachers' repertoires to include working with all eight cultural institutions in UA,
- addressing difficult inquiry areas such as engaging in scientifically oriented questions, and formulating explanations from evidence;
- refining classroom practices that relate to pacing investigations; and
- looking at student work and conferencing with students.

"At first the teachers went at my request … but they came back so happy and enthused by the professional development that it kind of set fire to others to also get involved."

–UA Principal



For Administrators

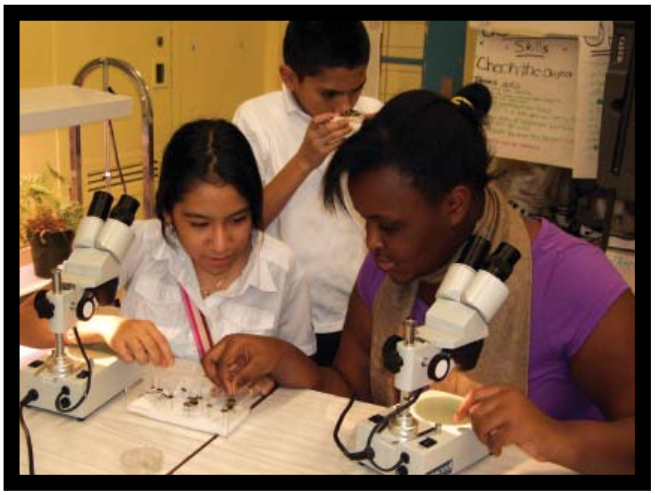
Involving school administrators in a reform effort is critical to creating sustainability. Each year, UA principals attend a series of Science Leadership Days that support inquiry-driven science education. Facilitating conversations through the lens of Urban Advantage, on topics such as current research findings about how students learn science, helps instructional leaders implement UA in their schools.

School administrators attending a UA workshop at a partner institution.

COMPONENT 2
Classroom Materials and Equipment

UA provides participating schools and teachers with science materials and equipment that promote scientific inquiry and authentic investigations.

All UA schools, in their first and second years of participation, receive equipment to support inquiry that is selected by UA cultural institutions in partnership with the local school system. First-year schools receive items that include a lighted plant growing environment with a self-watering seedling system and plant curriculum, digital cameras, a dissecting microscope, stopwatches, magnifying glasses, rock collections, field guides, and kits for studying DNA and designing rockets.



Students investigating their science topic in a UA-equipped classroom.

Second-year schools receive field-test kits for water and soils, thermometers, psychrometers, an aquarium kit, digital cameras, and field guides for plants, animals, and rocks and minerals.

"After seeing how my students enjoyed the process, I created a small zoo in my classroom and used that as a basis for inquiry and made a microcosm of the UA program in my classroom.... We bred crickets and studied plant growth. We had a touch-and-learn center ... microscopes and scales and lab equipment were set up. UA materials allow us to do this stuff."

–UA Teacher

COMPONENT 3
Access to UA Partner Institutions

Many students and families have never visited their local museums or science-rich cultural institutions—even those who live nearby. One goal of UA is to make it easy for families, students, and teachers to visit and return to these institutions, and to instill a sense that these institutions belong to them. To this end, the program provides vouchers to teachers for free field trips, and vouchers to students and parents for free family visits. The field trips generate ideas for science projects, and the voucher program enables students to return multiple times to collect data for their investigations and become familiar with the institution.

"... adding middle school students is something that we hadn't had before.... Now we have a lot of new middle school faces at the zoo."

–UA Partner

UA students visiting a partner institution.

COMPONENT 4
Outreach to Families

Urban Advantage encourages parental involvement in a number of ways:

"I need the reinforcement.... We also need the resources.... It's nice to have the institutions directly involved—it's empowering ..."

–UA Parent Coordinator

Parent Coordinator Workshops

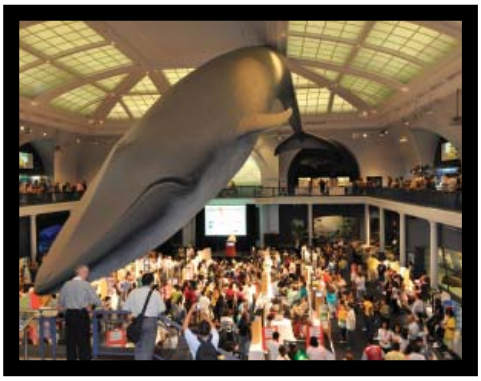
Parent coordinators (full-time staff positions in NYC schools) support families' involvement in their children's education. UA Partner institutions provide workshops for parent coordinators about the eighth grade exit project and their role in helping teachers use cultural institutions to support science investigations. Parent coordinators help teachers plan and carry out activities such as weekend family field trips to UA Partner institutions, class trips, family science nights and science fairs, and exit project workshops.

Family Science Sunday

UA institutions invite students and families to explore a UA Partner institution of their choice on designated Sundays in October. Often it's the family's first visit to the institution. A variety of hands-on science activities are offered throughout the day.

Family Field Trips and Family Science Nights

Parent coordinators, teachers, principals, and parents work together to plan a Family Field Trip to a UA institution on a weekend or school holiday. UA supports this by providing bus allocations for schools. Each parent coordinator receives vouchers that each admit up to 40 people. Additionally, UA Partner institutions work with schools to deliver inquiry-based science events for parents in the evening—typically one Family Science Night per year.



Science EXPO

Hosted at the American Museum of Natural History, the Eighth Grade Science EXPO is the culminating event of the Urban Advantage year and showcases students' work and experiences. Urban Advantage teachers choose two student projects to display from their classes. Participating schools from all districts across NYC, their families, teachers, administrators, and members of the NY City Council gather, along with the general public, to see and interact with over 500 students presenting more than 200 science exit projects. The projects reflect a wide range of life, Earth, and physical science topics that students investigated during their visits to the UA Partner institutions.

COMPONENT 5
Capacity-Building and Sustainability

UA promotes high-quality inquiry-based middle school science education through its emphasis on students' long-term science investigations. To the extent that UA can build support for this goal from within the system—the NYC Department of Education in particular, along with UA schools and UA partner institutions—it builds capacity. To this end, UA:

- develops Lead Teachers who co-facilitate professional development sessions and support other science teachers;
- uses professional development to help administrators build school-wide science-supportive environments; and
- encourages schools to visit and learn from demonstration schools.

These structures establish a common language and culture among teachers and school leadership, and encourage ongoing networking and professional learning relationships. Our goal is that the collaboration between the NYC Department of Education and UA Partner institutions continues to provide high-quality, inquiry-based science education in public schools well into the future.

"UA contributes to teacher satisfaction and lessens the propensity to leave [the system]. There is a lot of ground lost when teachers leave—student performance is affected and learning communities are disrupted."
–UA Principal

Lead Science Teachers

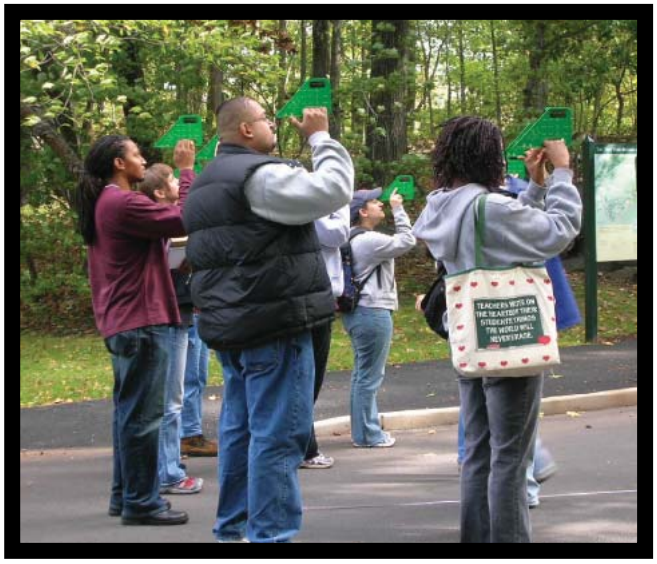
Lead science teachers work with UA Partners to design and facilitate elements of the UA professional development, and receive a stipend for their contributions to the program. Lead teachers are selected on the basis of their teaching practice and science content knowledge, and their demonstrated ability to model and implement UA in classrooms.

Lead science teachers offer continuous follow-up with their colleagues during the year, especially during the lead-up to the year-end Science EXPO. They offer one-on-one help in planning class trips, coaching students, and creating lessons on key topics such as "How to do background research," or "What makes a hypothesis testable?" The annual UA Leadership Institute helps lead science teachers develop the capacity to facilitate adult learning, which ultimately supports student outcomes.

Demonstration Schools

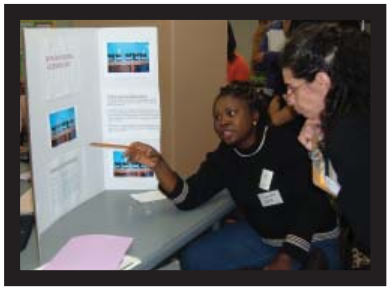
Schools that are prepared to share some of their practices can apply to the Demonstration School initiative. Schools are selected on the basis of strong implementation of UA program components, location, student body diversity, and must have a UA lead science teacher on staff. There are usually between five and ten demonstration schools in an academic year. Demonstration schools benefit from additional support, leadership development opportunities, as well as inform continued program improvement.

"We set up a study group in our school. We talk about the different project ideas that the kids come up with and how to support them so that they can ask their own questions."
–UA Science Teacher



Teachers measuring tree height during an Inquiry Workshop.

COMPONENT 6
Program Assessment and Student Learning



UA Partner giving feedback on an investigation.

UA program goals are assessed by both internal and external evaluators. Each of the six components is evaluated for its impact and adherence to learning goals and outcomes. For example, evaluation measures focus on delivery systems such as voucher usage, classroom application of UA-provided teaching resources and equipment, and the impact of professional development on classroom instruction through site-based classroom observations. Each year, all participating teachers, principals, and parent coordinators receive a survey to share their UA experiences. UA's impact on student learning is also measured through analysis of student achievement data provided by the NYC Department of Education, as well as student work, local assessments, and exit projects.

"I now get to see what teachers do through student projects. The impact of professional development on teachers is transferred to student work."
–UA Partner

Program Impact

Urban Advantage serves over 30 percent of New York City schools with eighth grade students.

Program-wide assessments show that UA has had a tangible impact on the New York City Department of Education's middle school science education program as measured by:

- Learning experiences in UA classrooms have become more inquiry-based.
- Exit projects are now designed around opportunities to conduct hands-on investigations.
- UA teachers report more mastery of science content and an increased capacity to support students' investigations.
- Students have more confidence in their grasp of science content.
- An unprecedented number of school groups and families have visited the eight cultural institutions.

"I'm delighted to celebrate the accomplishments of our middle school students who participated in this year's Urban Advantage program. The Department of Education's valuable partnership with some of New York's most important science-rich cultural and educational institutions enhances our science curriculum and helps us to prepare our middle school students…"

–Joel I. Klein, Chancellor, New York City Public Schools

Citywide year-end Science EXPO at the American Museum of Natural History.

Working together, the UA Partners — public schools, science-rich cultural institutions, and the NYC Department of Education — have succeeded in improving the implementation of middle school student investigations. These partners remain committed to this goal, and excited about its potential to increase science literacy for all eighth grade students in urban areas.

"UA kids do science … think like scientists … behave like scientists."

–UA Teacher

A partnership program in science education

American Museum of Natural History · Wildlife Conservation Society Bronx Zoo · Brooklyn Botanic Garden · Wildlife Conservation Society New York Aquarium · NYBG · NYC Department of Education · NY Hall of Science · Queens Botanical Garden (Where people, plants, and cultures meet) · Zoo Staten Island Zoo

CREDITS

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