



Formal-Informal STEM Partnership Program in Science Education

Multiple reports document the vast gap between the level and quality of science education offered in America's schools and that are required to prepare students for work and participation as fully engaged citizens in today's world, as well to educate the next generation of scientists (Carnegie Corporation of New York-IAS Commission, 2009; National Academy of Sciences, 2007; National Governors Association, 2007; National Science Board, 2006). Informal science education institutions can play a significant role in helping develop students' science literacies in schools serving high-poverty communities, and may have a particular role in engaging children from high poverty and cultural and linguistic minority communities, who find science to be "alienating, boring, and difficult" (Center for the Advancement of Informal Science Education, 2010). Collaborations between schools and informal science education institutions build on the partners' particular resources and strengths to meet shared goals of making science learning more accessible and compelling to students. Drawing on the educational resources found in New York City's (NYC) informal science community and their long-term commitment to science education, the **Urban Advantage NYC (UA)** program was launched as a museum-led middle school science initiative to provide professional development for teachers and hands-on experiences for students to learn how to conduct scientific investigations. The goal of UA is to improve students' understanding of scientific knowledge and inquiry through collaborations between public school systems and informal science education institutions such as museum, gardens, zoos, and science centers. UA designs and shapes learning experiences to align with the science standards and assessments in school systems. In addition, both students and teachers are provided opportunities to engage in authentic science – conducting investigations in which they pose scientifically oriented questions, prioritize evidence, and develop logical explanations – a prerequisite to understanding science (NRC, 2005; 2007).

The UA NYC program was initiated in 2004 by the **American Museum of Natural History** working in collaboration with several informal science education institutions in NYC that include the Brooklyn Botanic Garden, New York Botanical Garden, New York Hall of Science, Queens Botanical Garden, Staten Island Zoological Society, the Wildlife Conservation Society's Bronx Zoo and New York Aquarium, and the New York City Department of Education. Support for the program is provided by the New York City Council and the New York Department of Education. The UA program combines the expertise and resources of these eight partnering informal science education institutions to enhance teachers' skills and students' performance on long-term science investigations which are part of the New York City K-8 science curriculum scope and sequence.

The **UA framework** has six key components that are designed to provide comprehensive support for schools, principals, teachers, and students to facilitate the completion of high quality science investigations. The UA framework consists of the following components: (1) high-quality professional development for teachers and school administrators, (2) classroom materials and equipment for schools, teachers, and students 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, and (6) assessment of program goals, student learning, systems of delivery, and outcomes.





The name “Urban Advantage” reflects the UA partners’ belief that it is an advantage to live in an urban setting with so many science-rich cultural institutions and nature facilities, and that it is also an “urban advantage” to infuse programs with the cultural and linguistic richness of urban areas required for the global interdependence of the 21st Century, and to develop out-of-school experiences for students and families. The UA Program in NYC serves all five boroughs and includes participation from over 20% of the New York City schools with 8th grade students. Since its beginning in 2004, the UA Program has grown from 31 to 123 active schools and from 62 to 364 science teachers who are participating in the program. Currently there are 33,295 students the program is serving through their teacher’s and school’s participation.

In 2010, the **Denver Museum of Nature & Science** received a five-year grant from the National Science Foundation (DRK-12 Award # 1020386) to implement and study an Urban Advantage program in Metro Denver. UA Metro Denver is a partnership between three public school districts and three informal science education institutions in Denver designed to improve science literacy among middle-school students in urban environments. The partners in UA Metro Denver are the Denver Museum of Nature & Science, the Denver Zoo, the Denver Botanic Gardens, Denver Public Schools, Aurora Public Schools, and Adams County School District 14. Currently in its third year of implementation, UA Metro Denver is working with 16 schools and 28 science teachers, reaching almost 2,600 students and their families.

UA Metro Denver is modeled on the UA framework and program in NYC. The six UA Metro Denver partners began working together in 2007 through a planning grant provided by the AMNH to explore how to adapt the UA framework to meet the unique needs of the Denver metro area. The current DRK-12 research and development project involves an efficacy study to determine if partnerships among formal and informal organizations demonstrate an appropriate infrastructure for improving science literacy among urban middle school science students. The study aims to answer the following questions: How does participation in the program affect students' science knowledge, skills, and attitudes toward science; teachers' science knowledge, skills, and abilities; and families’ engagement in and support for their children's science learning and aspirations?

Educational researchers and policy analysts at **New York University** have examined the impact of the UA-NYC program on student achievement. Researchers at NYU’s **Institute for Education and Social Policy** have found that beginning in the third year of the program, differences in student performance between students in UA schools versus students in non-UA schools began to emerge. In 2005-2006, the third year of the program, 44.2% of eighth-grade students in UA schools passed the state science exam, versus 40.5% in non-UA schools. This difference has continued to widen in subsequent years of implementing the program. In 2008-2009, 55.9% of students in UA schools were proficient, compared to 46.2% of students at non-UA schools. No significant differences were found for either ELA or math, suggesting that these findings are not due to coincident overall improvement at UA schools. Participating in UA also contributes to post-8th grade outcomes, including an increased probability of UA students attending STEM high schools. Students at UA schools were found to be 25.5% more likely to take the Living Environment Regents exam in 8th or 9th grade and showed significantly higher levels of proficiency than students in non-UA schools. This could have implications in STEM for a students’ high school career since research has shown that students who take the state science exams early are more likely to take additional science courses and exams in chemistry or physics compared to those who wait to take the required state exam in science to graduate.

