Urban Advantage: Formal-Informal Collaborations to Improve Science Learning and Teaching

Background

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 its long-term commitment to science education, the Urban Advantage (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 museums, 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 (National Research Council [NRC], 2005; 2007).

The UA program was initiated in 2004 by the American Museum of Natural History (AMNH) 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 that are part of the NYC 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: (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.

In 2010, the Denver Museum of Nature & Science received a five-year grant from the National Science Foundation (DRL #1020386) to implement and study a UA 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.

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?

Documented Results

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. Specifically, in 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. No significant differences were found for either ELA or math, suggesting that these findings are not due to coincident overall improvement at UA schools. In addition, their analysis showed that participating in UA also contributed to post-eighth-grade outcomes, including the probability of attending a STEM high school and taking and passing high school state science exams. Specifically, attending a UA school had the greatest impact on whether a student took the Living Environment Regents (state biology exam) in eighth or ninth grade. Students at UA schools are 25.5% more likely to take the high school state biology exam than those at 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 with those who wait to take the required state exam in science to graduate.

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