

NSF Highlights

Engaging Future Scientists through Urban Laboratories

Highlight ID: 21210, Version: AC/GPA



Students collecting and analyzing data using tablet computers.

Credit: Mike Barnett, Boston College

Image Provided by barnetge@bc.edu

[NSF Form 1515](#)

The Lynch School of Education and the Environmental Science Program at Boston College in collaboration with the Urban Ecology Institute have been using geospatial and visualization technologies to improve high school student and teacher knowledge of the impact they have on the urban environment. The program consists of three major components. Each of these three components provides an explicit infusion of career development education. The career development focus is directed toward developing, assessing, and disseminating a set of tools that can be used to promote the exploration and consideration of science, technology, engineering, and mathematics (STEM) majors and careers.

1. An intensive summer program in which students learn urban ecology science and how to use technology to conduct scientific investigations. This summer program also focuses students in reflecting on their own backgrounds and how to leverage their cultural heritages, knowledge, and skills they are learning into the consideration of science and technological careers.

2. In-school components in which teachers implement curriculum materials that engage students in using the same innovative projects as a part of their regular school curriculum.

3. Intensive teacher training program (both in-service and pre-service) where teachers learn both the science and how to use technology to support their students in exploring urban ecological problems.

Research suggests that urban students are motivated to learn science and achieve at high levels when they are engaged in projects that are centered on their interests and involve them actively in "doing" science within their own community. The program consists of two interdisciplinary projects that are implemented during the summer and school year that focus on understanding the services provided by urban ecosystems to a city.

The project is funded by National Science Foundation's Innovative Technology Experiences for Students and Teachers program. During the four years of the grant, the program has conducted a summer institute that has allowed over 200 inner city students, 80 teachers, and 15 school counselors to attend an intensive summer program. Of the 75 students who have graduated and participated in more than two years of our program 50 of them are majoring in Science, Technology, Engineering, or Mathematics field in college.

The teaching training program has expanded beyond Boston Public Schools to encompass teachers throughout Massachusetts, and to include teachers in Maryland, North Carolina, and the District of Columbia. These teachers have implemented our corresponding curriculum materials during the academic year with their students, impacting another estimated 8000 students. In addition to this focus on student learning, participating school counselors have learned how to better guide students to explore and consider science-related careers with all eight of our graduating seniors entering college in a science-related area as evidenced by our success rate with students during the summer program.

The PIs have found that the students who participated in the summer program, and participated in one of the projects in their classroom during the academic year had higher scores than their peers on science interest and career scales (such as self-efficacy and career planning measures). In fact, project research suggests that the greater level of involvement that students had in the program, the higher their scores were when compared to their peers who did not participate in our program. Though it is still preliminary, the PIs predict that the depth of participation in the program can serve as a potential predictor on whether they will choose to major in a STEM related field upon high school graduation.

Primary Strategic Outcome Goal: Learning

- K-12 Education
- Teacher Education and In-service Professional Development
- Professional and Career Development

Secondary Strategic Outcome Goal: Discovery

- Biology

Does this highlight represent potentially transformative research? If so, please explain why. For more information, see [Report to Congress: Transformative Research at the National Science Foundation, April 16, 2011](#) and [Important Notice 130: Transformative Research](#)

Yes

One of the most compelling challenges in managing the labor market crisis is the difficulty in promoting interest in quality Science, Technology, and Engineering, and Mathematics (STEM) courses and STEM-related career exploration opportunities. While considerable effort has been devoted to enhancing the quality of STEM educational offerings, little attention has been paid to understanding how to reduce the barriers that exist in generating a range of STEM interests among all of our nation's students. Despite the plethora of research and program development efforts of the past few decades, we are still left with the perplexing challenge of enhancing the range and number of students who will explore, consider, and persist in STEM courses in high school and subsequent careers in the STEM fields. Our contention is that the vast majority of approaches used to date to examine this phenomenon have not been able to explicate the full depth and nuances of the complex ways that gender, race, culture, and motivational processes intersect to circumvent STEM career exploration, persistence, and performance for women and students of color. We are in the early stages of examining how students make meaning about learning and exploring (STEM) fields. The goal of this research is to better understand how students internalize salient aspects of their context and how these internalizations affect STEM exploration, performance, and persistence.

What is the intellectual merit of this activity?

The project is funded by National Science Foundation's Innovative Technology Experiences for Students and Teachers program. During the four years

the grant, the program has conducted a summer institute that has allowed over 200 inner city students, 80 teachers, and 15 school counselors to attend intensive summer program. Of the 75 students who have graduated and participated in more than two years of our program 50 of them are majoring in Science, Technology, Engineering, or Mathematics field in college.

Our teaching training program has expanded beyond Boston Public Schools to encompass teachers throughout Massachusetts, and to include teachers in Maryland, North Carolina, and the District of Columbia. These teachers have implemented our corresponding curriculum materials during the academic year with their students, impacting another estimated 8000 students. In addition to this focus on student learning, our participating school counselors have learned how to better guide students to explore and consider science-related careers with all eight of our graduating seniors entering college in a science-related area as evidenced by our success rate with students during the summer program.

We have found that the students who participated in our summer program, and participated in one of the projects in their classroom during the academic year had higher scores than their peers on science interest and career scales (such as self-efficacy and career planning measures). In fact, our research suggests that the greater level of involvement that students had in our program, the higher their scores were when compared to their peers who did not participate in our program. Though we are early in our program we believe that the depth of participation in our program can serve as a potential predictor on whether they will choose to major in a STEM related field upon high school graduation.

What are the broader impacts of this activity?

[Merit Review Broader Impacts Criterion: Representative Activities, July 2007](#)

- How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc)?
- Will the results be disseminated broadly to enhance scientific and technological understanding?

Our program has focused on working with students from underrepresented groups. Of the 75 students who have entered college with a focus on a STEM field, 73 have been a member of an underrepresented group. In our partnerships with Boston Public Schools, and other school partners, our program has been used with approximately 6000 students from underrepresented populations. The goal for our program is to provide avenues for inner city students to grow and develop in a safe and supportive environment where science learning and career discernment are integrated together. We have found this to be conducive to encouraging students from underrepresented backgrounds to become more confident to pursue additional science study which is not only a central tenet of the NSF's mission but also critically important to the nation's future economic well being. Moreover, we have developed STEM curriculum that is integrally related to the students' urban environments, thereby enhancing the relevance of the course material for the students.

EHR/DRL 2010

Program Officer: David Hanych

NSF Award Numbers:

[0525040](#)

Award Title: Urban Ecology, Information Technology, and Inquiry Science for Students and Teachers

Start Date: 10/01/2005

Expires: 09/30/2010

Awarded Amount to Date \$1,428,584

PI: George Barnett barnetge@bc.edu

Institution Name: Boston College

State Code: MA

PE Codes: 7645, 7259, 7227

NSF Contract Numbers:

Submitted on 02/27/2010 by David Hanych

DRL: Approved 04/20/2010 by David A. Ucko

EHR: Approved 05/06/2010 by Tyrone A. Jordan