

## Project TRUE (Teens Researching Urban Ecology), Knowledge Building Report

Project TRUE was a summer research experience for New York City youth that focused on strengthening STEM interest, skills, and ultimately, increasing diversity in STEM fields. Jointly run by The Wildlife Conservation Society and Fordham University and funded by the National Science Foundation AISL program, high school students designed and carried out urban ecology research under the guidance of STEM mentors. We studied the impacts of two key parts of the program – conducting authentic science research and mentorship – on the STEM trajectories of almost 200 high school students who participated in the program from 2015 to 2018.

During the 7-week summer program, teams of three to four high school students and one undergraduate mentor developed ecology research projects and conducted fieldwork in New York City parks and green spaces. Graduate students, science educators, and professional scientists provided mentorship to undergraduates throughout the projects. This tiered near-peer mentoring model deliberately paired mentors and mentees who were close in age and academic level, increasing their ability to identify with each other and form stronger mentoring relationships.

Science research projects focused on urban ecology topics, with high school students identifying their own research questions that were nested within the undergraduate mentor's larger research question, thereby establishing a sense of ownership. Research activities involved trapping eels, recording bat vocalizations, catching and sorting insects, and identifying invasive plant species, among others. The research experience culminated in the creation of research posters and teams presenting their posters to the public at a student science symposium.

Over four summers, Project TRUE served 189 high school students, most of whom were from backgrounds traditionally underrepresented in the sciences. Specifically, 71% of high school students identified as female, 43% as Hispanic or Latinx, and 33% as Black or African American. Of the 60 undergraduate mentors, 88% were from backgrounds underrepresented in the sciences.

The research explored short-term outcomes immediately after the program and followed up with students multiple years after participation to understand the medium-term impacts during and after the transition from high school to college. We found that the hands-on research experiences were effective at supporting youths' science interest, intentions to pursue STEM majors in college, and perceptions that STEM would be part of their future careers. These positive effects on science engagement continued at least two years after participation in the program and were similar for youth who entered the program very interested in science, as well as those with relatively lower pre-program science interest. This study's focus on the transition from high school to college is a novel contribution to our understanding of STEM trajectories, indicating that authentic research experiences at the end of high school may increase retention of STEM scholars during a critical transitional period. Previous research has recognized that high school STEM achievement is related to STEM success in college, however, there has been relatively little work to track predictors of STEM outcomes during the college transition. Longitudinal data like this is critical to understanding long-term impacts and the variety of pathways within the STEM pipeline.

In contrast to research experiences, mentoring did not have strong impacts on youths' science interest or intentions to pursue STEM. It did, however, have strong positive relationships with their sense of social connection, suggesting an indirect influence on STEM identities and trajectories. This indirect influence may occur because mentoring helped youth establish a sense of belonging in STEM by establishing social connections with their undergraduate mentors and like-minded peers. Feelings of integration or belongingness to the community appear closely associated with the perceived benefits of programs aimed at increased retention of underrepresented youth in college and are tied to academic outcomes.

