

# Extension Programming to Enhance Urban Well-Being

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## Case Study Series

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### **Rutgers 4-H STEM Ambassador Program New Jersey – Collaboration of Seven Urban Counties**

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This case study series is a supplement to program snapshots featured in the Extension Programming to Enhance Urban Well-Being chapter of ***Extension Education and the Social Sciences***

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# **Program Overview – Rutgers 4-H STEM Ambassador Program**

## **Location**

The Rutgers 4-H STEM Ambassador Program began in 2009. The program is in the central cities of seven of the most urban counties of New Jersey, including six northern and central New Jersey counties that are in the New York metro area, between Philadelphia and New York City. Those counties are Essex, Hudson, Mercer, Middlesex, Passaic, and Union as well as Atlantic County in South Jersey, home of Atlantic City.

## **Issue/s Addressed**

The Rutgers 4-H STEM Ambassador Program began in 2009 with the objective of encouraging urban youth from groups underrepresented in STEM to participate in science and research in a series of interactive activities, and gain a better understanding of opportunities available in science, engineering, and technology. Part of the growing 4-H youth development mandate is to prepare and empower our youth to get involved in a career in STEM. Several years ago, a series of national reports sounded alarm bells among youth development specialists about the need to engage our youth in science and technology, across all backgrounds, but especially in our urban communities.

The 2006 National Academies report, *Rising Above the Gathering Storm*, highlighted the shortage of highly qualified educators and mentors who can translate and teach science, engineering, technology, and math content and skills. A 2007 report from the National Association of State Universities and Land-Grant Colleges identified science, engineering, technology, and math for youth as a growth area. National 4-H later unveiled SET (Science, Engineering, and Technology), now 4-H Science, as a critical part of its mandate, and Rutgers Cooperative Extension has since been playing an ever-increasing and vital role in creating interest and competency in these areas, especially among those traditionally underrepresented in STEM, including women and racial and ethnic minorities.

## **Audience/s**

The primary audience includes high school youth who are from groups underrepresented in STEM majors and careers – including young women, African Americans, and Latinos. The program targets youth from urban communities between Philadelphia and New York City, where 4-H has fewer youth engaged in traditional project areas but more programming through collaborating afterschool and summer program providers. Each year, a new cohort of 45-65 8th-9th graders are selected to receive full scholarships to participate in the multi-year pre-college program (over 500 teenagers have become 4-H STEM Ambassadors since 2009). The recruitment process includes applications, transcripts, essays, and interviews. Many are the first generation in their family to pursue a college education. A secondary audience is the younger youth reached by the trained 4-H STEM Ambassadors, as they facilitate science and engineering projects through afterschool, weekend, and summer programs in their home communities.

Another important audience is a large group of Rutgers scientists and engineers (about 35-50 per year) who contribute their time and expertise to the program. These STEM professionals include Rutgers professors, post docs, graduate students, and undergraduates. They lead full-day research projects, invite STEM Ambassadors into their labs and classrooms, and participate in roundtable discussions about their journey in STEM.

## **Reach**

Currently, seven of New Jersey's 21 counties are engaged in the Rutgers 4-H STEM Ambassador Program by recruiting and supporting a new cohort of 45-65 teenagers as ambassadors each year. This is a total of more than 200 teens involved in any given year (over four years of high school). The STEM Ambassadors primarily serve youth audiences in their home communities in the seven participating counties. They have also expanded their STEM teaching and promotion to other counties with the use of virtual technologies, especially since the start of the COVID-19 pandemic.

## **Urban Context**

The Rutgers 4-H STEM Ambassador Program serves youth from several targeted cities within the New York metropolitan area – including Newark (281,054), New Brunswick (55,960), Passaic (70,019), Paterson (145,710), and Trenton (83,412). These communities stretch from Philadelphia to New York City and represent some of the most densely populated urban communities of New Jersey, which is the most densely populated state in the country. These cities are racially and ethnically diverse with concentrations of poverty, drug abuse, violence, and low performing schools.

## **Strategic Approach to Urban Engagement**

### **Programming**

The Rutgers 4-H STEM Ambassador program currently has three primary clusters of objectives – (a) STEM exposure, skill development, and identity, (b) college readiness and access, and (c) leadership and contribution. The comprehensive, multi-year pre-college program engages traditionally underserved urban youth in a variety of experiences that support their development in each of these three areas. Since its beginning in 2009, the program has primarily accomplished its objectives through an intensive weeklong STEM immersion experience at Rutgers-New Brunswick and through the teens' subsequent ongoing service and development as STEM Ambassadors in their home communities in partnership with their local 4-H staff throughout their remaining years of high school.

### ***Program Kickoff at Rutgers-New Brunswick – Sparking STEM Interest and Engagement***

After 8th and 9th graders from targeted urban communities are selected by their local 4-H staff to join the program, they begin their involvement with a week on campus in July. During their weeklong residential experience, they explore STEM through hands-on activities in animal science, biomedical science, biotechnology, computer science, engineering, exercise science, food science, geospatial technology, landscape architecture, marine science, microbiology, nutritional science, and other disciplines. Youth participate in discussions, workshops, research projects, and engineering challenges alongside faculty, staff, and graduate students.

The roundtable discussions with scientists and engineers is a component that was added in 2013 to allow youth to get to know the scientists, their educational backgrounds, interests, and goals, before jumping into the labs. After quick introductions from 10-12 STEM professionals, the youth select four to get to know better through discussions and Q&A in smaller groups. Since many of the youth welcomed into the program have relatively few STEM mentors and role models, these types of interactions can promote the development of STEM identity in teens initially reluctant to see themselves as scientists and engineers.

After a morning of meeting with STEM professionals, the youth participate in two 90-minute undergraduate lab sessions to experience hands-on, inquiry-based STEM activities in a format similar to what is included in the coursework of an undergraduate student. Since 2014, the participants have also attended an educational and entertaining series of physics demonstrations by the outreach staff of the Rutgers Physics Department.

On Wednesday of their program kickoff week, youth work in small groups with a scientist or team of scientists (often a professor with grad students) on a full-day research project or engineering challenge. These groups and projects are distributed all across campus in a variety of lab and field settings, working on authentic problems with modern technologies. During these sessions the STEM Ambassadors have mapped the effects of Hurricane Sandy using geospatial technologies in the Rutgers Nature Preserve, studied microplastic pollution by sampling local rivers and returning to the lab for sample analysis, and formulated personal fitness plans after taking several measurements before and after exercise in the exercise physiology lab, just to mention a few projects. They have also studied fish migration patterns, computer programming, ocean currents with the aid of drones, genetics, app development, microbiology, robotics, and musculoskeletal tissue regeneration. Youth collect data regarding their research question, interpret their data, and determine the best way to communicate their findings. After Wednesday's dinner, each team prepares a scientific poster to be shared during a STEM poster session on Friday prior to the closing luncheon.

### ***Supporting College Readiness and Access***

While STEM exposure, skill development, and identity are central to the program, we also include several components that address our college readiness and college access objectives. Just the experience of living on campus for the week and attending classes is valuable, as the teenagers anticipate what it will be like to go to college, especially since several of the 4-H STEM Ambassadors will be the first in their family to do so. They also learn about campus life and the opportunities available at Rutgers from an admissions officer's presentation and Q&A on Monday afternoon of the program's kickoff week, a Tuesday afternoon campus bus tour with a student ambassador, and an undergraduate student panel with a representative from the Dean's office during a cookout on Tuesday evening. All of these interactions are designed to help the 4-H STEM Ambassadors develop a better understanding of Rutgers, various schools and majors, the admissions process, scholarships and other forms of financial aid, campus housing, student organizations, and other programs of interest, such as the Equal Opportunity Fund (EOF) program.

After their initial week on campus in July, the 4-H STEM Ambassadors continue to receive pre-college support and guidance during their four years of high school. 4-H faculty and staff provide numerous opportunities for the teenagers to develop leadership skills and participate in meaningful service to their community (see next section). Program staff also provide additional opportunities for career and college exploration, including guest speakers and campus visits. They also assist the 4-H STEM Ambassadors with the college application process and, in many cases, provide letters of recommendation.

### ***Leadership and Contribution as 4-H STEM Ambassadors***

Their initial week on campus also helps prepare them to become 4-H STEM Ambassadors, the aspect of the program focused on leadership and contribution. On Thursday of that week, the teens begin their day with a panel presentation from current 4-H STEM Ambassadors who

showcase all of their community activities and impacts as ambassadors. Then the new recruits learn STEM curricula that they can use to facilitate STEM projects for younger youth. They have time to discuss best practices for out-of-school science programming prior to practicing and teaching a mini-lesson from the morning's workshops. During these "teachbacks" the youth and adult facilitators provide constructive feedback. Then on Friday, they present their science posters of their full-day research projects to administrators, parents, and other guests prior to the closing recognition luncheon, providing another chance for them to practice communicating science.

As 4-H STEM Ambassadors, they return home and work with their local 4-H program to promote 4-H, science, and engineering to other youth. While everyone accepted into the program pledges to contribute a minimum of 50 hours of service to STEM programs in their home county's 4-H program, many provide far more hours. While the portfolio of out-of-school STEM programs varies from county to county, the teen ambassadors work with local 4-H faculty and staff to plan, co-facilitate, teach, and/or support afterschool, Saturday, and summer programs. These programs occur at Extension offices, schools, libraries, collaborating youth organizations, fairs, and on university campuses. Since the start of the COVID-19 pandemic, they have also taught several online programs.

Through the years, the 4-H faculty and staff have engaged the 4-H STEM Ambassadors in a variety of ongoing initiatives, such as the National 4-H STEM Challenge (formerly known as National Youth Science Day). This year, they have facilitated the Mars Base Camp challenge for their peers and younger youth throughout the state, using virtual technologies. In the past, they have also led activities for groups of youth at Rutgers Day, the Rutgers Geology Museum, and at the USA Science and Engineering Festival in Washington, D.C. For a five-year period, the 4-H STEM Ambassadors from Passaic and Mercer counties were also involved in the CYFAR-funded Science Pathways program which provided weekly ongoing training in a variety of maker projects. The ambassadors participated in the projects in the makerspace and then led the projects for other youth.

Each year, several teenagers are rewarded for their level of engagement as 4-H STEM Ambassadors and asked to join the group on campus again in July to serve in a leadership role, helping to plan and implement the program for the newest recruits. When the summer of 2020 kickoff week changed to a virtual experience, the ambassadors worked alongside the staff to plan and implement the week and the resulting online teaching opportunities.

Outside of their involvement as 4-H STEM Ambassadors, once accepted into the program, the teenagers become involved in other aspects of their local 4-H program. Over the years, 4-H STEM Ambassadors have expanded their 4-H involvement by participating in county fair, teen leadership conferences, national 4-H summits, and other events. The 4-H STEM Ambassador Program has served as the entry point into 4-H for several youth from these targeted cities, and it has also helped diversify the overall 4-H program in the seven participating counties.

## **Positioning**

The Rutgers 4-H STEM Ambassador Program is functioning out of a traditional county-based Extension model in partnership with the state 4-H science agent and her staff, located at Rutgers-New Brunswick. For the most part, the seven counties involved in the 4-H STEM Ambassador program do not have large traditional, community club-based 4-H programs focused on animal projects and agricultural traditions. Therefore, 4-H faculty and staff in these

very densely populated counties have been collaborating for several years to redefine how 4-H can serve expanded and diverse audiences through a variety of STEM initiatives, while still providing the essential elements of the 4-H experience.

A lot of the Extension work of these seven urban counties is accomplished through partnerships with other youth-serving organizations located in the targeted central cities of each. These organizations have been key to building awareness of Extension programs such as 4-H STEM Ambassadors. Partnerships with urban schools and organizations with a similar mission have been very helpful to recruitment efforts and to increasing access to the programs by those underrepresented in STEM.

More recently, Rutgers established the [Office of Urban Extension and Engagement](#), and the team is collaborating with them to enhance the awareness and accessibility of programs, including 4-H STEM Ambassadors.

## **Personnel**

The Rutgers 4-H STEM Ambassador Program is led by a team of 4-H faculty and staff with the support of several others throughout Rutgers University.

### ***4-H Faculty and Staff***

4-H faculty and staff from the seven participating counties, along with those from the state 4-H science agent's office on campus, work together to design and implement the 4-H STEM Ambassador program, using the strengths and resources of each. Chad Ripberger is responsible for the overall coordination of the group, program logistics, and fundraising. Janice McDonnell recruits, trains, and coordinates the more than 35 Rutgers scientists and engineers that participate in the program each year. Marycarmen Kunicki and Marissa Staffen lead the training and support of the teens in their work as ambassadors, coordinate the involvement of the returning teen leaders, and work with Janice on evaluation. Jim Nichnadowicz and Kendrin Dyitt, as well as the other aforementioned members of the team, recruit and mentor participants. Christine Bean and Alesha Vega support the on-campus coordination of the scientists' engagement with the youth. Alesha is currently leading the development of online training modules. Kenny Faillace provides technology support. All are involved in the management of the ongoing outreach that the teens lead while serving as 4-H STEM Ambassadors in their home communities.

### ***Internal University Partners***

#### ***Rutgers Scientists and Engineers***

Scientists and engineers, including Rutgers faculty, staff, post-docs, graduate students, and undergraduates, have served as mentors, invited ambassadors into their labs, facilitated research projects and field experiences for the teens, and participated in roundtable discussions, sharing their STEM journey and providing guidance and support. These professionals and students have been recruited from several schools within the university (Arts and Sciences, Engineering, Medical, Nursing, Pharmacy) and all departments within the School of Environmental and Biological Sciences (SEBS).

#### ***Rutgers Center for Mathematics, Science, and Computer Education***

Faculty and staff from the Rutgers Center for Mathematics, Science, and Computer Education have supported the program in many ways over the past several years. As experts in K-12 STEM pedagogy, they have provided training and curricula for the ambassadors in engineering

design, computer science, robotics, and a variety of maker projects. They also conducted an evaluation of the program by shadowing it and conducting focus groups with staff and youth participants in 2018.

#### ***Rutgers Math and Science Learning Center***

Patricia Irizarry coordinates lab-based classes for the ambassadors at the Rutgers Math and Science Learning Center. She has also been instrumental in involving the 4-H STEM Ambassadors in outreach at the Rutgers Geology Museum.

#### ***Rutgers SEBS Office of Academic Programs***

Assistant Deans from the Office of Academic Programs, originally Sharice Richardson and now Serafina Smith, recruit Rutgers students to serve with them on a panel to discuss admissions, financial aid, academics, and student life.

#### ***Rutgers Office of Communications and Marketing***

Staff from the Rutgers Office of Communications and Marketing, including Paula Walcott-Quintin, Jennifer Simon, and Bonnie Wasielewski, have been instrumental in creating awareness of the program through Rutgers Cooperative Extension websites and social media channels. They are strong proponents of the program and have engaged local media organizations in the promotion of the program through coverage on cable news and through statewide newspapers, magazines, and websites, including New Jersey 12 News, The Star Ledger, New Jersey Monthly, and New Jersey Tech Weekly.

#### ***Partnerships (external)***

While the funding for the start of the program in 2009 was from an internal Rutgers Cooperative Extension Community Enhancement grant, the program has received financial support from a variety of corporate partners since, including Tyco International, Samsung, and Bristol Myers Squibb, our current sponsor. In addition to their financial support, volunteers from Bristol Myers Squibb have worked alongside 4-H STEM Ambassadors since 2013 to provide the Tomorrow's Innovators Science Saturday program for 4th-7th graders from Trenton. In addition, STEM professionals from Bristol Myers Squibb have participated in roundtable discussions with our 4-H STEM Ambassadors during their initial training week at Rutgers-New Brunswick.

## **Impact**

### **Program Impacts**

The team has documented their impact through a variety of pre/post surveys, focus groups, and a longitudinal study of the 243 youth who participated in the program's first six years (2009-2014).

Based on the 105 past participants who completed the 2015 survey (43% response rate):

- 82% believe interactions with scientists motivated and supported learning
- 70% feel participation better prepared them for college
- 55% can see themselves as STEM professionals
- 50% reported a positive change in motivation to learn about science



Of those attending college:

- 59% enrolled in a STEM major or are interested in a STEM career
- 31% attended Rutgers

A majority of ambassadors (80%) responded that their experience with the program was positive and helped shape their goals, widening their perspective in terms of possible STEM careers and areas of scientific study and research. Most importantly, most ambassadors said that their interaction with scientists, interaction with fellow participants, and opportunities to share their projects resulted in increased confidence in themselves, improved interpersonal skills, and strengthened interest in science and engineering. A complete description of impact is available in an article published in the National Science Teaching Association's (NSTA) *Connected Science Learning [journal](#)*. The team is currently conducting another study of all participants through 2019 and anticipates sharing those results in late 2021.

## **Recognition**

In addition to the NSTA journal article, the Rutgers 4-H STEM Ambassador Program is featured in the *4-H Science in Urban Communities Promising Practices Guide*, a national 4-H [resource](#). It is also one of eight programs included in *Priming the Pipeline: Lessons from Promising 4-H Science Programs*, a [publication](#) by Policy Studies Associates for National 4-H Council. The team has also presented the program at the National 4-H Leaders Meeting and the National Urban Extension Conference. In 2015, it received the National Excellence in Urban Programming Award from the National Association of Extension 4-H Agents. In 2020, the program team was awarded the Rutgers School of Environmental and Biological Sciences/New Jersey Agricultural Experiment Station Team Excellence Award.

## **Closing Comments and Looking to the Future**

### **New Online Learning Modules Incorporated into Initial Training of New Cohorts**

The Rutgers 4-H STEM Ambassador staff and teens are currently collaborating with Rutgers iTV Studio to finalize a series of [online learning modules](#) that new participants will complete prior to their initial week on campus in July. The goal of these self-directed asynchronous modules is to provide the newly recruited teenagers a foundational understanding of the program, 4-H Youth Development, STEM opportunities and skills, and Rutgers University prior to their time with us on campus. Because of that change, in-person time can be maximized while at Rutgers-New Brunswick to focus on objectives that can't as easily be met online.

### **Cross-County Collaboration for Ongoing STEM Ambassador Outreach**

The goal has always been to increase the number of times the ambassadors from the seven counties can be together to collaborate on projects and continue their own development, as a statewide group. Since the start of the COVID-19 pandemic, significant progress has been made toward accomplishing that goal. Historically, scheduling and transportation have been major challenges. With the use of Zoom and other virtual and remote technologies, the 4-H STEM Ambassadors have been meeting as a statewide club, across county lines, to plan and deliver their outreach. During the in-person programming suspension, the ambassadors have been able to lead training for new recruits, meet with a group of Rutgers scientists and engineers for discussions, travel to a marine lab in Florida, host and emcee an exciting new



series called Ask a Scientist, facilitate numerous sessions of the National 4-H STEM Challenge (Mars Base Camp), film several segments for the above online modules, and provide feedback on a set of activities currently under development for a new curriculum – all remotely.

Institutional support will help further strengthen and grow the program and ensure it is sustained. The strong program model has gradually been built over the past 13 years and is one that is consistent with the goals and aspirations of Rutgers University, at all levels.

## **Recommendations**

Based on experience developing the Rutgers 4-H STEM Ambassador Program – building effective partnerships and capitalizing on their many benefits is important. The extensive partnerships cultivated over the years are critical in providing such a rich youth development opportunity. At the onset of planning in 2008, tapping into the wealth of resources available within the other schools, departments, and centers of Rutgers University was vital. The goal was to connect youth from targeted central cities within the region to the wonderful people, places, technologies, and opportunities available at their state university. If there is an interest in this type of programming, all Extension personnel have similar resources available within their land-grant university.

In similar fashion, partnerships have been formed in the areas of program funding, recruitment, and outreach. Just like universities, urban communities have a tremendous amount of potential for fruitful collaborations and partnerships – it takes time and patience to determine how to best align Extension resources with those of other organizations. If there is interest in this type of programming, it is helpful to determine which community organizations share the passion for promoting the development of STEM identity within youth underrepresented in science and engineering.

Others are encouraged to get started and gradually build and improve over time. With each year of the program, the design has been tweaked and incremental improvements made. This diverse team of 4-H professionals with a variety of skills and abilities has learned each other's strengths and distributed the workload accordingly. As needed, reach out to others throughout the university and cities to capture additional expertise and skills that further enhance the program and the experience for the teenagers serving as ambassadors.

## **Multimedia Documentation/References**

Each of the following resources provide additional information and a better sense of the program:

Impact Report (2018) <http://nj4h.rutgers.edu/pdfs/STEM-Ambassador-Impact-Report.pdf>

New Jersey Teens Delve into STEM Learning, video by Samsung, former sponsor (2014)  
<https://www.youtube.com/watch?v=GDmCczBNuf4>

One of four 4-H Science Programs featured in Partnering with Colleges and Universities and Campus-Based Scientists, in *4-H Science in Urban Communities Promising Practices Guide* (2013) <http://urban4hscience.rutgers.edu/practices/partnerships/college.html>

One of eight 4-H Science Programs featured in *Priming the Pipeline: Lessons from Promising 4-H Science Programs* (2012)

[https://www.canr.msu.edu/4\\_h\\_great\\_lakes\\_natural\\_resources\\_camp/uploads/files/Lessons%20from%20Promising%204-H%20Science%20Programs.pdf](https://www.canr.msu.edu/4_h_great_lakes_natural_resources_camp/uploads/files/Lessons%20from%20Promising%204-H%20Science%20Programs.pdf)

Online Learning Modules <https://4hset.rutgers.edu/training/courses/2021-stem-ambassadors-online-training/>

Program Website <https://nj4h.rutgers.edu/join-stem-ambassadors/>

Promoting STEM Identity and Interest Through the 4-H STEM Ambassadors Program, in *Connected Science Learning*, a journal of the National Science Teaching Association (January-March 2019) <https://www.nsta.org/connected-science-learning/connected-science-learning-january-march-2019/promoting-stem-interest>

Press Release (2019) <https://sebsnjaesnews.rutgers.edu/2019/08/rutgers-stem-ambassadors-program-inspires-new-cohort-of-new-jersey-high-schoolers/>



*STEM Ambassadors conduct research in labs at Rutgers University during the summer, working alongside faculty and graduate students.*



*Teens participate in STEM classes on campus during the program's summer kickoff for the new recruits, to help meet the program's college readiness objectives.*



*Since 2013, the program has informally connected the STEM Ambassadors with Rutgers scientists and engineers through a series of roundtable discussions to help foster mentors and promote STEM identity.*





State 4-H science agent works with Rutgers research groups to engage the STEM Ambassadors in a variety of field experiences that contribute to data collection for ongoing research.

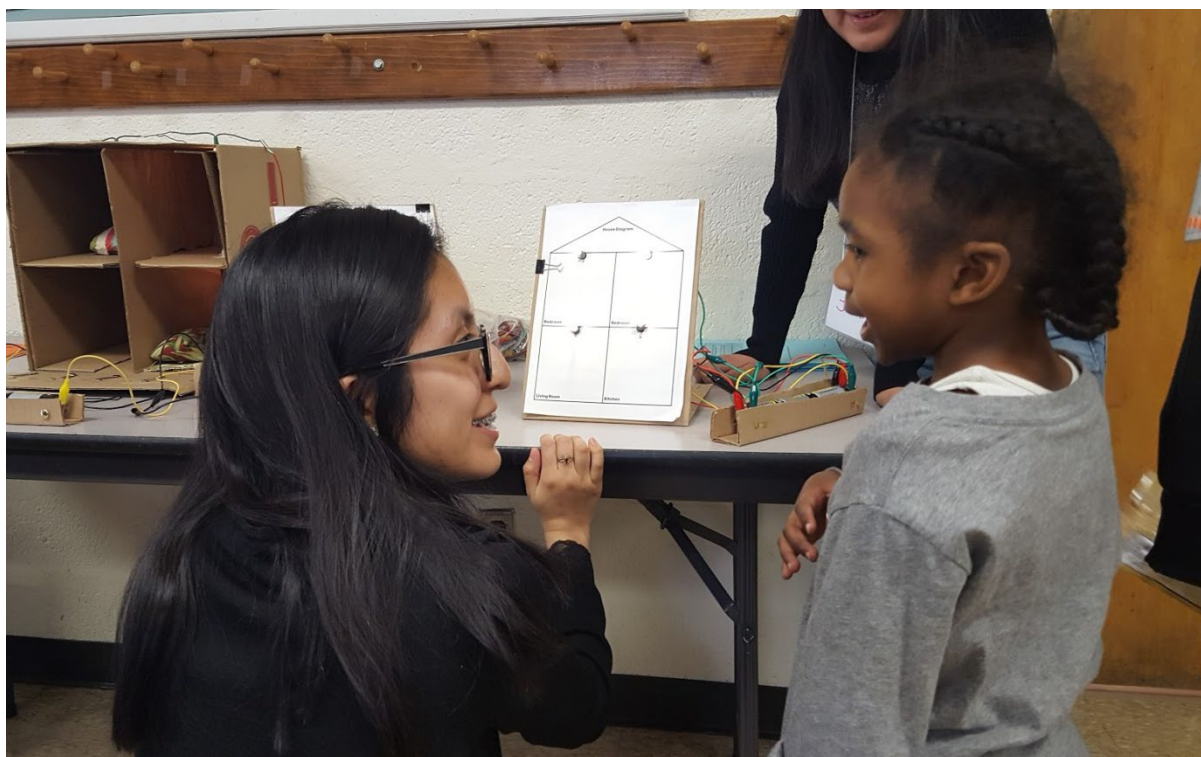


At the conclusion of their initial week on campus during the summer, the STEM Ambassadors present their science and engineering projects through a poster session leading up to the closing luncheon.





*STEM Ambassadors mentor younger students as part of a 4-H Science Saturday program.*



*A STEM Ambassador teaches a child about electricity at a 4-H science outreach event.*



*Each year, a group of veteran STEM Ambassadors are selected to serve in a leadership role for the newly recruited teens just joining the program.*

## Contributor

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Ripberger has focused most of his efforts on increasing youth development opportunities for urban youth through collaboration with afterschool and summer program providers throughout Trenton, New Jersey and the surrounding area. These collaborators have included the Boys and Girls Club, Children's Home Society, City of Trenton, CYO, Education Works, New Jersey Youth Corps, Urban Promise, YMCA, and others. In addition to co-leading the 4-H STEM Ambassadors, he currently leads a large collaboration with 30 volunteers from Bristol Myers Squibb, the Tomorrow's Innovators Science Saturday Program for upper-elementary- and middle school-aged youth from the Trenton area. Since 2009, he has also led New Jersey's involvement in the National Partnerships for After School Science (NPASS) project, providing training for out-of-school educators throughout the state.

Ripberger has led several national and regional 4-H Science initiatives including the National 4-H Science in Urban Communities project (2009-2013), resulting in the comprehensive [4-H Science in Urban Communities Promising Practices Guide](#) and associated professional development efforts for urban 4-H educators throughout the United States. He has shared his urban programming models through the *Journal of Extension*, *Journal of Youth Development*, and at numerous national meetings, including several urban Extension conferences.

Ripberger is just one of a dedicated team who co-lead the Rutgers 4-H STEM Ambassador Program. He acknowledges Janice McDonnell (co-founder), Marycarmen Kunicki, Marissa Staffen, Jim Nichnadowicz, Christine Bean, Alesha Vega, and Kendrin Dyitt, all of Rutgers Cooperative Extension, for their contributions to this case study.