

CURIE 2018 PROGRAM REPORT



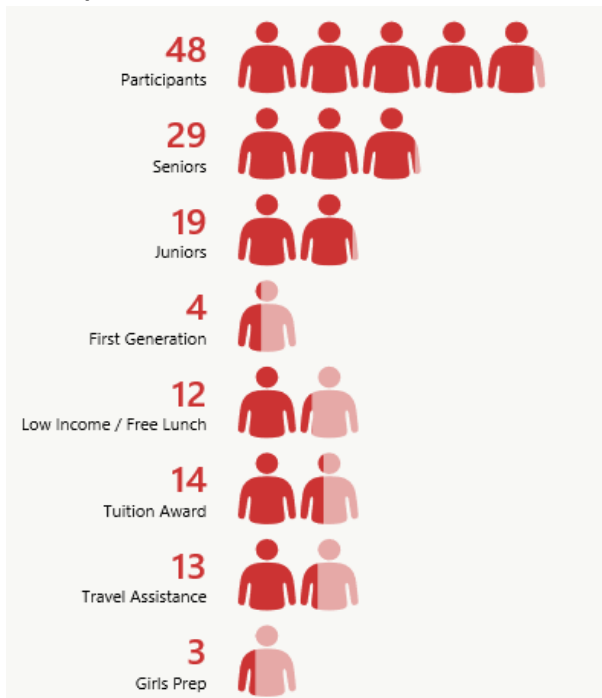
ABOUT CURIE ACADEMY

CURIE Academy is a one-week program hosted by Cornell University’s Diversity Programs in Engineering. The Academy aims to broaden participation and exposure to engineering for 48 high school girls who excel at science and math. The Academy’s target population is juniors and seniors who may not have had prior opportunities to explore engineering, but desire to learn more about it in an interactive atmosphere. Participants enjoy a busy week of field sessions, research sessions and evening social. The academy was held July 15-21, 2018.

CURIE PROFILE & DEMOGRAPHICS

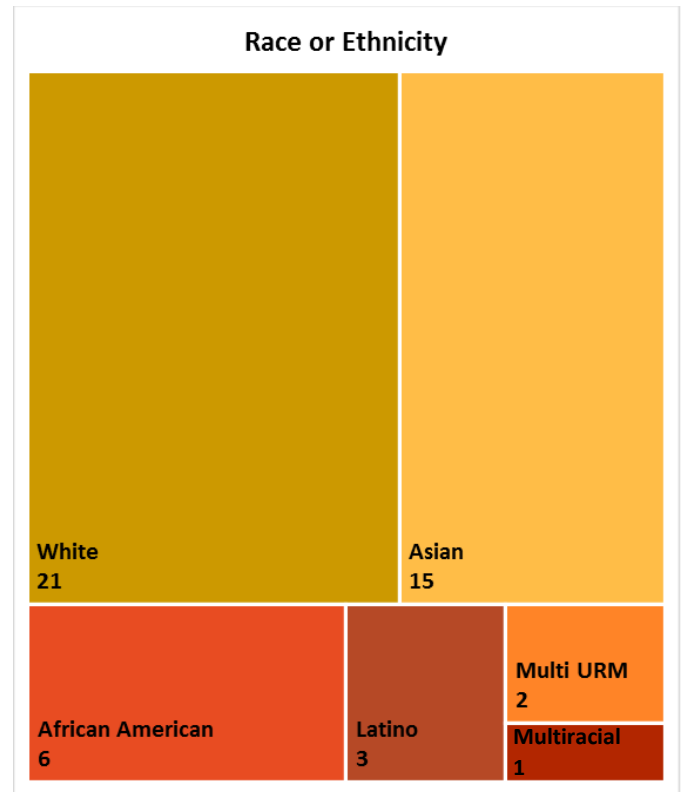
Scholars were chosen based on grades in math and science courses, essay, letters of recommendation, and opportunities to explore engineering. Although all 48 participants excelled in math and science, they differed in many other ways and came from around the country.

Participant Profile



- **48:** CURIE Scholars from **17** states
- **23%:** Underrepresented minorities
- **8%:** Identify as Hispanic (any race)
- **60%:** Seniors, class of 2019
- **8%:** First generation college students
- **25%:** Low income (<\$60,000 family income) or free lunch
- **29%:** Received need- or merit-based tuition aid
- **227:** Applicants

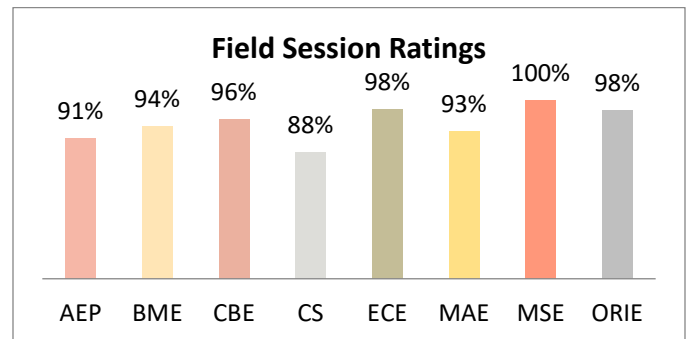
Race or Ethnicity



FIELD SESSION OVERVIEW

CURIE Academy seeks to define engineering and broaden interest through field sessions on eight different majors offered at Cornell. Engineering faculty combine an informative presentation which includes an overview of the field and their research along with hands-on and interactive activities. Some presenters add a personal touch and seek to inspire the students by sharing their educational trajectory.

Overall, the sessions were favorably received as evidenced by the percent of students who agreed or strongly agreed that the session was valuable overall. Students also greatly enjoyed the session by Engineering Admissions.



"This lecture [ECE] is my favorite so far! I really liked how the professor tied the memory game into teaching binary. I felt like this was the perfect level of difficulty for my understanding."

- Senior

"I loved learning about materials science and Professor Singer was so dynamic and interesting! I think it could definitely be something I want to pursue further."

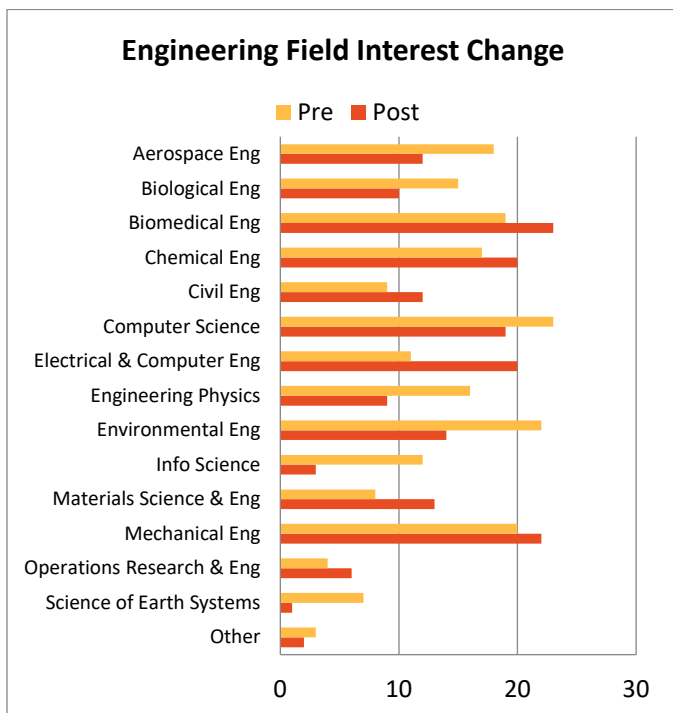
- Senior

"I am considering consulting as a future occupation, so this [ORIE] was an interesting and engaging session."

- Junior

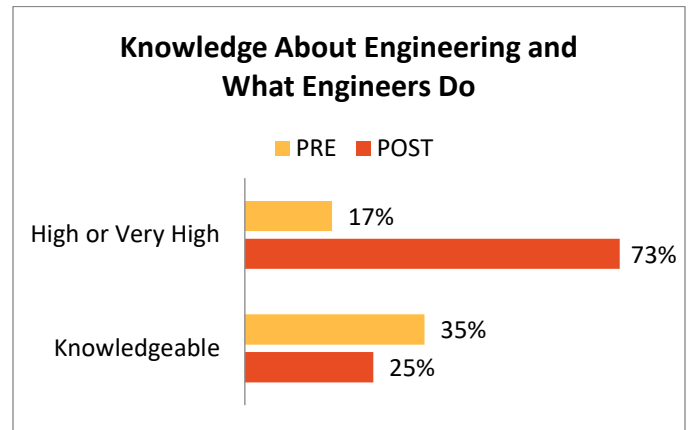
The field sessions, research project sessions and interaction with student staff helped broaden interest in engineering majors.

Following CURIE, interest grew in a number of fields. The fields that saw that largest increase were Electrical and Computer engineering (82%), Materials Science and Engineering (63%), Operations Research and Information Engineering (50%), and Civil Engineering (33%), and Chemical Engineering (24%). The students who selected other in the pre-program survey were interested in nuclear engineering and entrepreneurship.



ENGINEERING EXPLORATION & CAREER PATHWAYS

Awareness of engineering career pathways is critical to maintaining persistence and sustaining a fluid pipeline to successful engineering careers. CURIE participants interact with engineers at various stages of the pipeline from faculty to undergraduates. These activities serve to help students' self-rated level of confidence and knowledge increase.

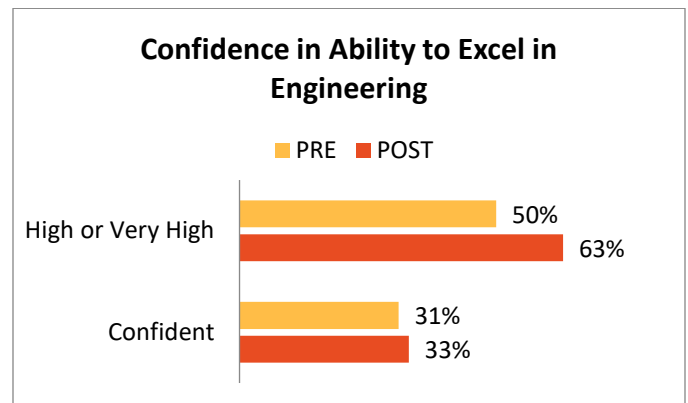


Following CURIE the percentage of students who rated their knowledge about engineering or what engineers do as high or very high increased dramatically from 17% to 73%. One student explained this below:

Through the various lectures we had in the CURIE academy, I feel that my knowledge about engineering and what engineers do has expanded. I learned a more detailed account of what they do.

- Senior

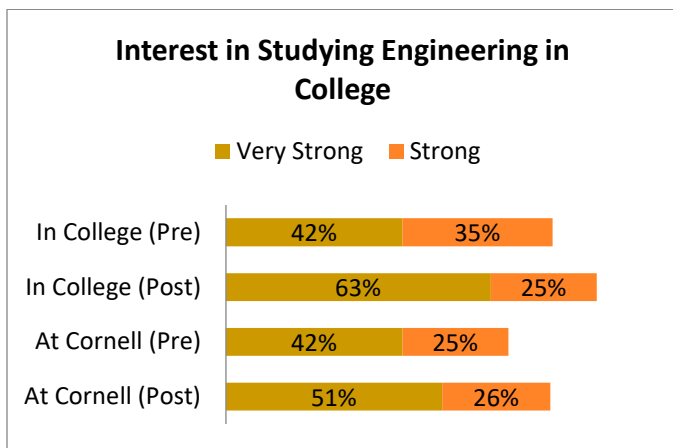
The percentage of students who rated their confidence in their ability of excel in engineering as high or very high increased by 13%.



Likewise, the number of students who rated their confidence as very high increased by 300% following the program. Students felt confident as they were able to use their strengths in math and science to comprehend the presentations and successfully complete the hands-on activities as a group. Further, one student explained the change below:

The academy has boosted my confidence in engineering by educating me more in specific fields and empowering me by presenting female role models.
- Junior

Similarly, the number of students who rated their interest in studying engineering in college as strong and very strong after the program increased by 19%. This interest carried over to Cornell Engineering as well.



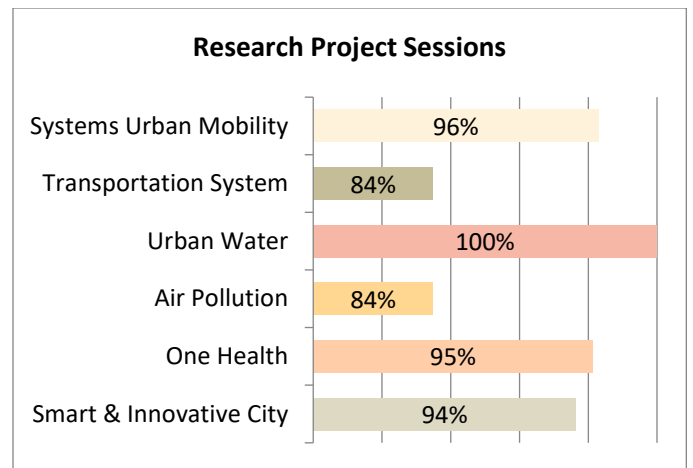
I would be highly interested in attending Cornell because I felt the professors were very receptive of our ideas, the atmosphere encouraged learning, I didn't feel afraid of failing
- Senior

Participants were impressed Cornell's campus, faculty, resources, sense of community, and support for women in engineering. Students noted that they were eager to apply and would be honor to be a part of the Cornell Engineering community.

RESEARCH PROJECT: SMART AND HEALTHY CITIES

In 2017, CATALYST Academy piloted a new research project model led by a Prof. H. Oliver Gao and a team of faculty and researchers connected with the Center for Transportation, Environment and Community Health (CTECH) in the School of Civil and Environmental Engineering. This summer, CURIE implemented a modified model with new modules and included partners in planning. (See appendix for a detailed lesson plan.)

Students reviewed each project session. Below are the percentages of students who agreed or strongly agreed that the session was valuable overall.



The sessions that students cited as the most impactful combined interesting topics and information with hands-on group work that allowed the students to explore their impact on environmental factors. Students also valued the opportunity to explore the campus.

I loved going through the botanical gardens and being about to test air quality in a variety of areas. The coupling of hands-on and information based research helped me stay engaged.
- Junior

I loved [the urban water] session! ... I liked how interactive it was and how it related to our everyday lives, but made us carefully consider the implications of our actions. I am very passionate about the environment and I think I discovered something that would be a good fit for me.
- Senior



Students also gained a better understanding of how individual choices and decisions can impact environmental factors through the research sessions.

The information they presented was very informative. They found a way to relate it to my own life which encouraged me to better my environment by using less water.

- Senior

Following Prof. David R. Schneider's urban mobility challenge, students noted that they enjoyed the opportunity to apply a systems design approach to environmental problems.

I enjoyed actively getting research about bus stops through interviews. It was a very creative and realistic approach to how engineers solve problems in the world.

- Senior

In their feedback, students recommended some changes for the presenters.

I really liked the discussion of LEED buildings and parking spaces, but the presentation that the undergrad researchers gave (about the transportation options from A to C with Lyft and TCAT) was really confusing. I think they were used to talking about it to people who understood the processes behind it, but I didn't understand the majority of what they were talking about because they didn't explain background or what things meant...

- Senior

They also recommended providing the participants with information about their research project early on in the program and allowing for a short break in the four-hour session. Overall, students came away from the Academy

with a greater interest and enthusiasm for Civil Engineering which increase by 33%. They were inspired by the speakers they heard, such as Veronica O. Davis. By the end of the program, they were excited about the prospect of helping to solve societal issues.



CONCLUSION

The CURIE Academy achieved its goals of increasing interest and understanding for a diverse group young women interest in Engineering. In 2018, CURIE Academy began a formal partnership with Public Prep Network to engage alumnae from their Girls Prep elementary school in the program. Due to this partnership, the CURIE Academy was significantly more diverse than in previous summers.

Students were nearly unanimous in their agreement that the Academy increased and gave them a better understanding of the many career possibilities for people with engineering degrees. Further, they agreed that CURIE increased and provided a broader understanding of the variety of engineering fields and how they can work together.

Overall Gains in Understanding about Engineering

47 ★★★★★

Career Possibilities

47 ★★★★★

Engineering Fields

Overall satisfaction in the program was also high and most students reported that they would recommend the program to peers. They enjoyed the various aspects of the program and benefited from a dedicated staff, dynamic field session presenters and a research project that challenged them to think like engineers. Students, they enjoyed connecting with likeminded peers and Cornell students to form lasting friendships.

RECOMMENDATIONS

Key recommendations from student staff and participants pertained to the research project.

- Introduce research project earlier in the week and provide more guidance on the deliverables the students will present on final day of the program.
- Include a short break during research session block.
- Incorporate more small-group activities within the lectures.
- Encourage participation in a method that emphasizes collaboration over competition.
- Ensure all presenters are aware of the background and education level to make presentations appropriately challenging.
- Invite CTECH non-faculty staff to staff training to increase communication between student staff and CTECH support staff.
- Improve communication with students before arrival about what to expect in the research project sessions.

Other CURIE Program Aspects:

- Ensure student staff is aware of flexibility in evening program schedule.
- Clarify purpose of pre-program survey and that research project will not change.
- While we value the interdisciplinary research at Cornell, students reported that they would hope the mechanical engineering and biomedical engineering field session presentations overlapped less. This also applies to electrical engineering and computer science.
- Reconsider session on entrepreneurship during engineering field sessions.

CURIE Academy, Summer 2018
Center for Transportation, Environment, and Community Health
Smart and Healthy Cities



Lesson Plan
Professor H. Oliver Gao

Sunday, July 15, Bethe House Dining Room

6:30 – 7:00 p.m.

Overview of Research Project

Professor H. Oliver Gao, Civil and Environmental Engineering

Monday, July 16, 142 Upson

1:00 – 5:00 p.m.

Systems engineering and systems design thinking for urban mobility challenge

Professor David R. Schneider, Systems Engineering & Siritetta Simoncini, M. Arch., Systems Engineering

Albert Einstein once said, “If I had an hour to solve a problem I'd spend 55 minutes thinking about the problem and five minutes thinking about solutions”. The challenge of creating Smart and Healthy Cities is a complex one, filled with numerous stakeholders and interactions between stakeholders, that must be well understood if one is to develop a truly high performing sustainable solution. In this lab, students will explore an urban mobility challenge, which at first glance may appear to have some clear solutions, but through an application of systems engineering and systems design thinking approaches in a real world setting (across campus, interviewing clients, etc.), students will uncover a broader understanding of the complex needs within. In doing so, students will also gain valuable experience in problem definition skills that can be applied towards any future career they may pursue.

Tuesday, July 17, 366 Hollister and Carpenter Red, Orange and Green Accel Labs 1:00 – 5:00 p.m.

Ride sharing, transit systems, and performance measure of sustainable transportation system

**Professor Samitha Samaranayake, School of Civil and Environmental Engineering &
Bridgette Brady, CAPP, Senior Director of Cornell Transportation and Mail Services
Division of Infrastructure, Properties and Planning**

In this lab session, students will get introduced to the diverse and interdisciplinary elements that are considered in the design of ride-sharing and transit systems, with a focus on the new technological advancements surrounding on-demand services. We will discuss the problem through both high level concepts and an interactive design game in which students will compete to build the best subway system improvements for New York City. We will also discuss how new ride-hailing services can help and/or hurt transit services.

Universities function as cities, this is particularly noticeable when you realize the demands placed on the transportation systems. University transportation professionals recognize their roles in supporting Smart and Healthy Cities. However, currently there isn't a tool with which to measure the efficacy of the use of transportation resources. Students will have the opportunity to participate in an interactive polling session to further assist CTECH and the U.S. Green Building Council in the development of methods for measuring the performance of sustainable transportation systems.

Students may have the opportunity to visit the Peterson “Green” Parking Lot Demonstration Site (currently under construction).

Wednesday, July 18, 366 Hollister and 150 Hollister

1:00 – 5:00 p.m.

Urban water challenge and green infrastructure solutions

Marika Nell, Ph.D. Candidate Environmental Processes; Casey Ching, Ph.D. Candidate Environmental Processes, Helbling Research Group, CEE & and Lena Abu-Ali, Ph.D. Candidate Environmental Processes, Reid Research Group, CEE

Water is the most essential resource on earth, but rapid population growth and aging water infrastructure systems pose significant challenges for cities to provide water sustainably in the future. In the first part of this session, students will learn about urban water systems and explore water footprints from individual homes to whole cities using interactive software. We will discuss water consumption and identify the most important ways in which cities can adapt to improve water conservation. In the second part of this session, students will investigate water quality throughout the urban water cycle and learn how the use of sensor networks with green infrastructure systems can improve the sustainability of urban water management. We will combine field sampling with interactive laboratory modules to evaluate basic water quality parameters and discuss relationships between water quality, water uses, and public health.

**Thursday, July 19, Wiswall Lab (Dry A & B) Vet School
Transportation and One Health**

1:00 – 5:00 p.m.

Professor H. Oliver Gao, School of Civil and Environment Engineering &
Professor Alexander Travis, Baker Institute for Animal Health, Department of Biomedical Sciences

While providing critical services for mobility needs, transportation-related air pollution constitutes an important risk factor for cardiopulmonary disease, increases children's asthma rates and premature mortality, lung cancer fatalities, and substantial loss of average life expectancy. In the first part of this lab session, students will first learn systems thinking about the complexity of transportation, emissions, air pollution, and public health problems. After this, we'll conduct real-time measurements of respiratory exposures at different places/facilities (e.g., walking, behind a bus, near a stop sign, in a parking lot, etc.) on Cornell's Ithaca, New York campus. With the collected exposure data, the students will then come back to the lab to analyze the data and discuss the results.

In the second part of this lab session, Professor Travis and his group will expose students to the broader One Health concept in a lecture and discussion session. He will then lead an interactive computer laboratory session in which students will have the opportunity to visualize and explore differences in the global burden of disease, comparing countries of the students' choosing, and emphasizing differences between high and low income countries, urban vs rural populations, etc.

Friday, July 20, 253 Rhodes

1:00 – 5:00 p.m.

Transportation in Practice *and* What makes a city smart and innovative?

Adria Finch, Director of Innovation, City of Syracuse; Veronica O. Davis, PE, Nspiregreen, LLC & Sayeeda Aishee – CATALYST and REU Experience

Across the United States, governments are working to improve infrastructure. Some cities are using technology to leverage the internet of things and become "smart cities". Projects, like Chicago's Array of Things utilize sensors to collect real time, location based data that can be used to evaluate the condition of infrastructure as well as the effect that it has on people's lives. Other cities still struggle to use data to make informed decisions about infrastructure investments. In this session, participants will learn about different ways to collect, analyze, and utilize data to improve infrastructure systems.

Today, urban areas are plagued with congestion. Widening streets and making cars move faster does not work. Cities are grappling with how to move people today and how to move people in the future when new technologies become available. In this lesson, you will learn about technologies available today that are being tested for future use. You will have the opportunity to work in teams to design a transportation system of the future.

**Saturday, July 21, Bethe House Dining Room
Research Presentations**

10:15 a.m. – 12:30 p.m.