

PROGRAM REPORT

CATALYST ACADEMY 2017



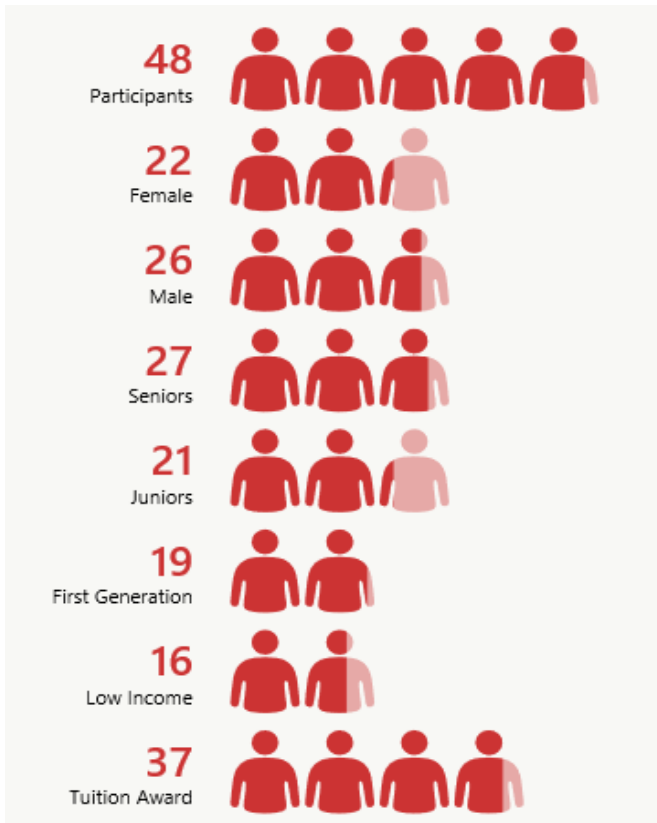
ABOUT CATALYST ACADEMY

CATALYST Academy is a one-week program hosted by Cornell University’s Diversity Programs in Engineering. The Academy goals is to increase participation and exposure to engineering for underrepresented minority high school students 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 social activities. The academy was held July 16-22, 2017.

CATALYST PROFILE & DEMOGRAPHICS

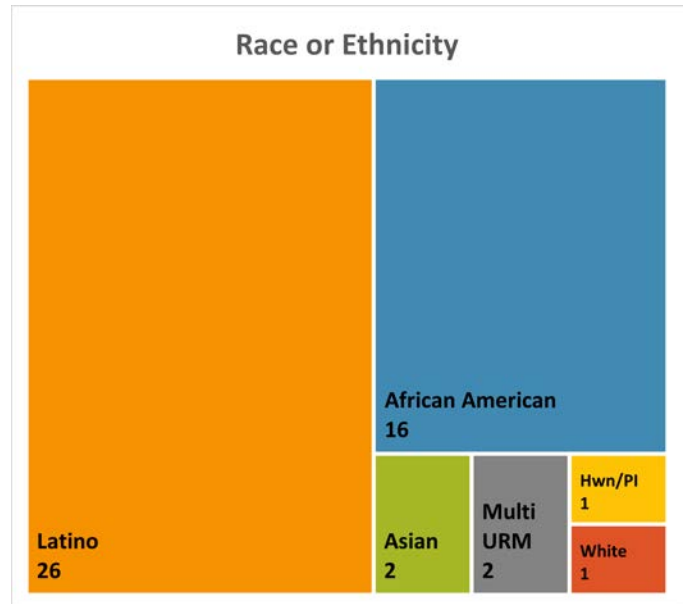
In 2017, DPE continued CATALYST Plus and prioritized selection of high achieving rising seniors from backgrounds underrepresented in STEM. Scholars were chosen based on grades in math and science courses, essay, letters of recommendation, and opportunities to explore engineering.

Participant Profile



- **48:** CATALYST Scholars from **12** states
- **94%:** Underrepresented minorities
- **56%:** Identify as Hispanic (any race)
- **56%:** Seniors, class of 2018

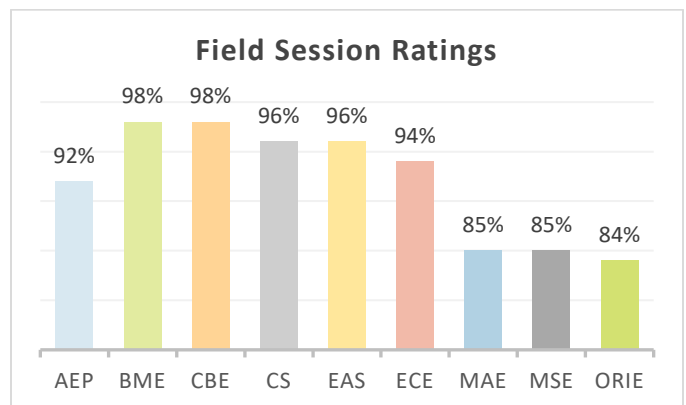
- **40%:** First generation college students
- **33%:** Low income (<\$60,000 family income)
- **77%:** Received need- or merit-based tuition aid
- **258:** Applicants; 8% increase from 2016



FIELD SESSION OVERVIEW

CATALYST Academy seeks to define engineering and broaden interest through field sessions on nine 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 presentation was very helpful since I would like to study Biomedical Engineering as an undergraduate student, and his presentation plenty of information both on the field and the professor himself.

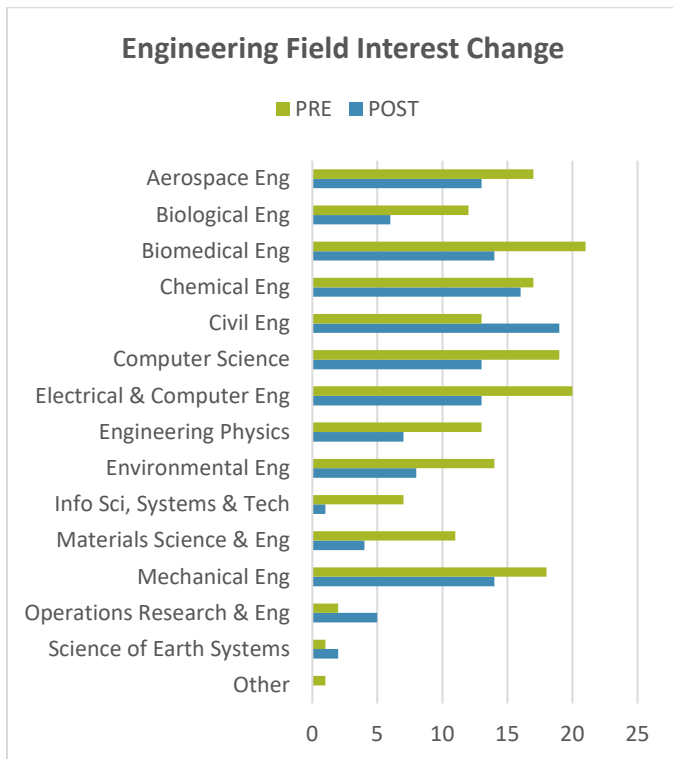
- Male, Junior

I really liked the way he organized his presentation. I especially liked the way he connected things and his level of interaction with the audience.

- Female, Junior

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

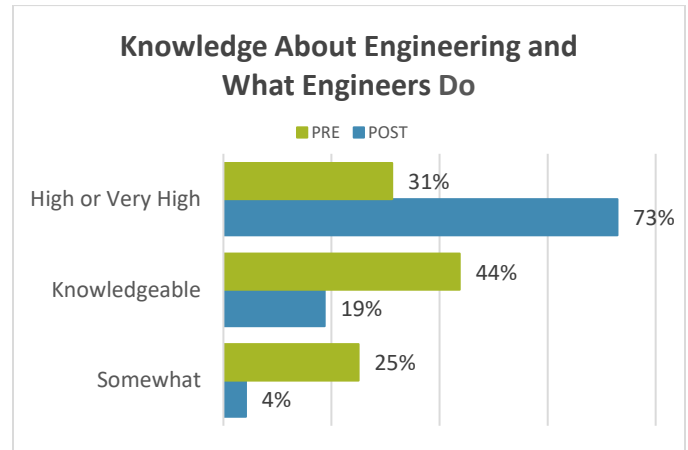
Following CATALYST, interest in Operations Research and Information Engineering and Civil Engineering increased by 150% and 38%, respectively as noted below. The student who selected other was interested in nanotechnology and genetics.



ENGINEERING EXPLORATION & CAREER PATHWAYS

Awareness of engineering career pathways is critical to maintaining persistence and sustaining a fluid pipeline to successful engineering careers. CATALYST 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.

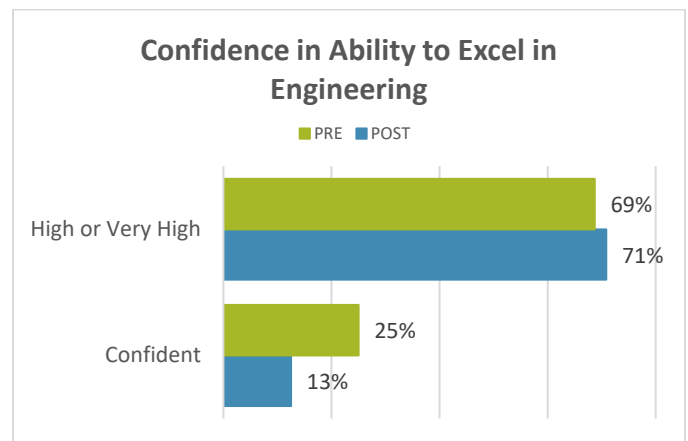


Following CATALYST the percentage of students who rated their knowledge about engineering or what engineers do as high or very high increase more than twofold from 31% to 73%. One student explained this below:

I have researched the area of engineering I am interested in and with CATALYST I was able to talk with professionals and get a much better understanding.

- Senior, Female

The percentage of students who rated their confidence in their ability of excel in engineering as high or very high did not change very much overall.



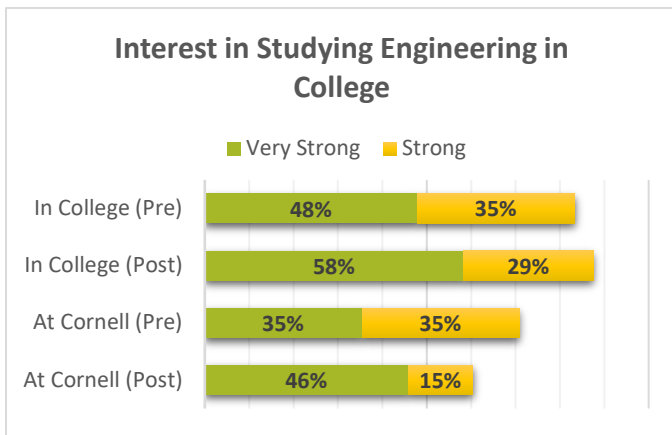
However, the number of students who rated their confidence as very high increased greatly from 2 before the program to 18 following the program. Students felt confident as they were able to use their strengths in math and science to comprehend the presentations and

successfully complete the hands-on activities. Further, one student explained the change below:

Attending CATALYST has allowed me to see engineering as a possible career. I've become aware of how my skills in STEM can help me reach goals in engineering. In addition, because of the information I've learned about what certain engineers do, I can form a clearer picture of myself as an engineer.
 - Senior, Female

Similarly, more students rated their interest in studying engineering in college as strong and very strong after the program. The largest change came from those in the very strong group whose interest was cemented following CATALYST.

Strong or very strong interest in attending Cornell Engineering dipped slightly as students cited interest in medicine or other fields outside engineering as well as hesitancy with the large campus and somewhat rural environment.



Despite this change, 11% more students were very strongly interested in attending Cornell following the Academy.

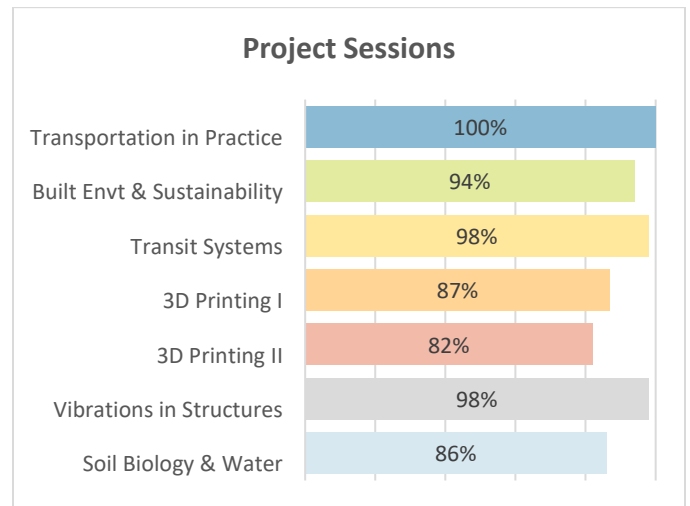
I loved a lot of the facilities and all the professors seem genuinely devoted to their careers as teachers and researchers.
 - Senior, Female

Participants were impressed with everything they experienced and some noted that Cornell was a top choice for college and could not wait to apply.

RESEARCH PROJECT: SUSTAINABILITY AND THE BUILT ENVIRONMENT

This year the Academy tried a new model in which students did several projects in Civil and Environmental Engineering several faculty and researchers connected with the Center for Transportation, Environment and Community Health in the School of Civil and Environmental Engineering. Professor H. Oliver Gao led this team of nine and coordinated the individual modules along with administrative and academic staff. (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.



Note: Soil biology and environmental water sampling sessions were separate but evaluated together.

Students also had suggestions for ways to improve sessions. For instance, some felt that they needed more time to tackle the hands-on activity, especially when introduced to new software and working within groups.

The presentation involving additive manufacturing was very clear, but during the portion that the presenter went over the Repetier program I felt very confused and many of my peers did not know how to use the program. This was not a fault of the presenter but rather an effect of time constraints.
 - Junior, Male

While learning a new skill may have been challenging, the students also were happy to gain new knowledge they could take home. Further, students also valued

being able to connect the activities to relevant issues in their daily lives. For instance, Prof. Samitha Samaranayake's presentation and exercise on designing a transit system resonated with students from large cities with subways or other light rail systems.

Other CATALYST Scholars valued the way faculty connected data and sustainability issues.

I really enjoyed the exposure to how statistics was used to calculate impact of pollutants that can have a global impact.

Looking at air quality throughout the campus and understanding how that affect our health, helped me understand how little extra pollution everyday can add up to have a big effect.
- Senior, Female

Finally, students valued the sessions with CTECH faculty because the hands-on activities allowed them to both see themselves as engineers and further understand how engineers solve real world problems.

This activity helped allowed us to be placed in the shoes of an engineer and come up with solutions to help actual people. Which was very interesting and helped me learn a great deal.
- Senior, Male



Students came away from the Academy with a greater interest and enthusiasm for Civil and Environmental Engineering. They were excited about the prospect of helping to solve societal issues. Interest in Civil Engineering increased 38%.

I cannot wait to study civil engineering. I enjoyed the civil and structural engineering lab so much I hope to be able to study in a lab like that one day.

- Senior, Female

I would be interested in environmental engineering and civil engineering because I really want to help people, specifically. I want to solve our pollution problem so humans and nature could co-exist for a better future.

- Junior, Female

CONCLUSION

Students were unanimous in reporting that they were satisfied or very satisfied with CATALYST Academy. Nearly all participants agreed that they would recommend CATALYST Academy to fellow students. They enjoyed the various aspects of the program and benefited from an experienced staff, dynamic field session presenters and research project sessions covering multiple topics in Civil and Environmental Engineering.

Overall Satisfaction

47



Would Recommend to Other Students

48



Very Satisfied or Satisfied

Those who suggested improvements focused on the research project. However, many were happy with the program as is and would not change any aspects.

The CATALYST Academy achieved its goals of increasing understanding of the many career possibilities available for those who study engineering. All participants agreed that CATALYST gave them a better understanding of the many career possibilities for people with engineering degrees. Through the field sessions students' understanding of the breadth of engineering increased. Last, they enjoyed connecting with likeminded peers and Cornell students to form lasting friendships.



Welcome to the 2017 CATALYST Academy Built Environment and Sustainability

The week at the CATALYST Academy at CTECH

Each afternoon you will listen to a short lecture on a different aspect of built environment and then work on a design or discovery-oriented activity. You will work in groups to explore all different aspects of built environment: conducting surveys and experiments on the topic of crowding; co-meeting in planning, design and management of transit systems learning transportation emissions and monitoring real time exposure to air pollution; 3-D printing of a test plate subjected to a ballistic impact; Seismic design and testing; a demonstration on how we can determine the types of microorganisms that are present in different types of soils and water testing.

Program Schedule for the Week

Monday, July 17

Transportation in Practice

1pm-2:30pm, 166 Hollister Hall



Veronica O. Davis, P.E.



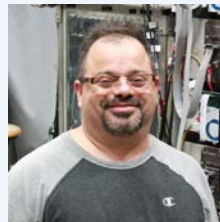
Today urban areas are plagued with congestion. Widening streets and making cars move faster does not work. Cities are grappling with how to move people today and how to move people in the future when new technologies become available. In this lesson you will learn about technologies available today and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

3-D Printing Load Bearing Structures (Part 1)

2:30pm-5pm
366 Hollister Hall



Derek Warner
Associate Professor



Paul Charles
Facilities Coordinator



Additive Manufacturing (AM), popularly known as 3D Printing, has the potential to be a truly disruptive technology. AM technology presents the capability to create customized parts rapidly, economically, and with a geometric complexity beyond what is possible with traditional manufacturing. This ability will significantly impact the biomedical, aerospace, and construction enterprises. In this module, students will be introduced to the concept of AM, with a focus on creating load bearing parts and structures. As a demonstration, students will use AM technology to design, create, and test plate subjected to a ballistic impact.



The week at the CATALYST Academy

Tuesday, July 18, 1pm-5pm
366 Hollister Hall

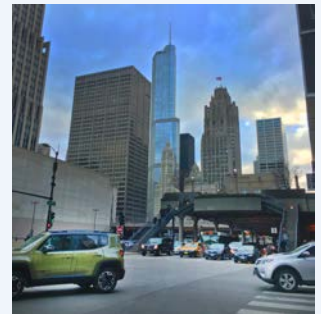
Built Environment and Sustainability: Transportation in Practice, Emissions, and Air Pollution



Oliver Gao
Associate Professor



Edwin (Todd) Cowen
Professor



While providing critical service for the mobility needs, transportation-related air pollution constitutes important risk factor for cardiopulmonary disease, increases children's asthma rates and premature death, lung cancer death, and substantial loss of average life expectancy. In 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 measurement of respiratory exposures at different places/facilities (e.g., walking, on a bus, near a stop sign, on a parking lot, etc.) on Cornell campus in Ithaca, NY. With the collected exposure data, the students will then come back to the lab to analyze the data and discuss the results. More specifically, this lab session consists of the following sections:

1:00-2:00pm (366 Hollister Hall) Presentation and discussion led by Associate Professor Gao on transportation, emissions, and air quality.

2:00-3:30pm (start in 366 Hollister Hall, then to the demonstration site) Discussion and demonstration of pollutant dispersion led by Professor Todd Cowen.

3:30-4:30pm (Cornell campus, students will be divided into 4 groups) Measurements of exposure to PM_{2.5} on campus.

4:30-5:00pm Back in computer room to download and view the data.



The week at the CATALYST Academy

Wednesday, July 19

Transit Systems Design

1pm-3:30pm
366 Hollister Hall



Samitha Samaranayake
Assistant Professor



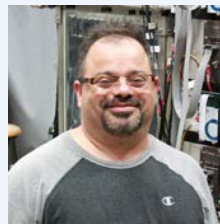
In this lab session, students will get introduced to some engineering problems that arise in the context of urban mobility. We will discuss the different modes of transportation available to commuters and explore the benefits and challenges of each of these modes, paying special attention to the rapidly growing segment of on-demand transportation services (such as Uber, Lyft and bike sharing). Students will take part in thought experiment on how to redesign the NYC transit system given the existence of these new services.

3-D Printing Load Bearing Structures (Part 2)

3:30pm-5pm
366 Hollister Hall



Derek Warner
Associate Professor



Paul Charles
Facilities Coordinator



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The week at the CATALYST Academy

Thursday, July 20

Vibrations in Structures

GROUP 1

1pm-5pm

366 Hollister Hall



Greg McLaskey
Assistant Professor



In this lab session, students will be introduced to vibrations in structures ranging from the Earth to buildings and bridges to electric guitars. Students will learn about resonant frequencies of vibration, modal shapes, and how to measure those vibrations with sensors, and visualize the vibration measurements with computer software. Students will then participate in a field test involving the vibrations of the Duffield Hall stairs on the engineering quadrangle.

Soil Biology, Water Quality, and Climate Change

GROUP 2

1pm-2:30pm

166 Hollister Hall



Matt Reid
Assistant Professor



Professor Reid will discuss how the “unseen majority” of microorganisms in soils have an outsized influence on chemical pollutants that make their way into waterways, and on the emission of gases that contribute to climate change. There will be a discussion on how humans can change the makeup of these microbial communities, with either positive or negative results. The session will include a demonstration on how we can determine the types of microorganisms that are present in different types of soils.

Environmental Water Sampling

GROUP 2

2:30pm-5pm

166 Hollister Hall



Yolanda Brooks
Postdoctoral Associate



In this lab session Dr. Yolanda Brooks will give a demonstration of water testing and discuss her current research.



The week at the CATALYST Academy

Friday, July 21

Soil Biology, Water Quality, and Climate Change

GROUP 1

1pm-2:30pm

166 Hollister Hall

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Greg McLaskey
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