I-STEM EDUCATION INITIATIVE

Science, Technology, Engineering, and Mathematics Education | University of Illinois at Urbana-Champaign

2017 I-STEM Summer Camp: A Multidisciplinary Program

ILLINOIS

Front Cover: Lonna Edwards, an ECE grad student, helps I-STEM camper Trey Walker build a circuit.
Front Inside Cover: I-STEM Summer Camp participants, mentors, and leaders.
Back Cover: During Aerospace Day, UHS student Bryson Tatum waits to test his rocket on Bardeen Quad.

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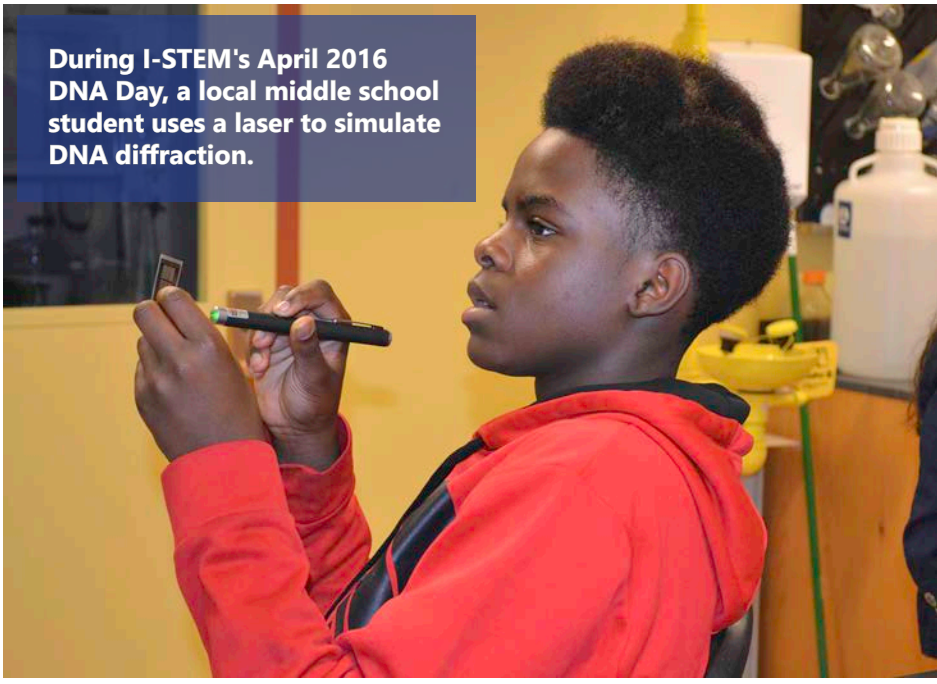
I-STEM SUMMER CAMP: A MULTI-DISCIPLINARY PROGRAM ...

On April 29, 2016, under the NIH National DNA Day umbrella, I-STEM launched a one-day partnership event where about 32 students from underrepresented groups from both Champaign and Urbana school districts participated in DNA-focused multidisciplinary activities led by different research groups on our campus. The Center for the Physics of Living Cells (CPLC) in the Physics Department, the McBees graduate student organization in the School of Molecular and Cellular Biology, a molecular group in the Anthropology Department, together with the Institute for Genomic Biology (IGB) organized and led the hands-on activities. The overall objective was to offer high school students multidisciplinary perspectives for various STEM careers by the use of results in the existent DNA research. A year later, in February 2017, the event was replicated as a Health DNA Day with 64 student-athlete participants from Urbana High School. This second event, shaped by a collaboration among the Chemistry Department, the McBees group, and IGB, produced an exceptional educational experience highlighted on Zeiss site, the international leader in optics and optoelectronics.

Luisa Rosu, Interim Director of I-STEM

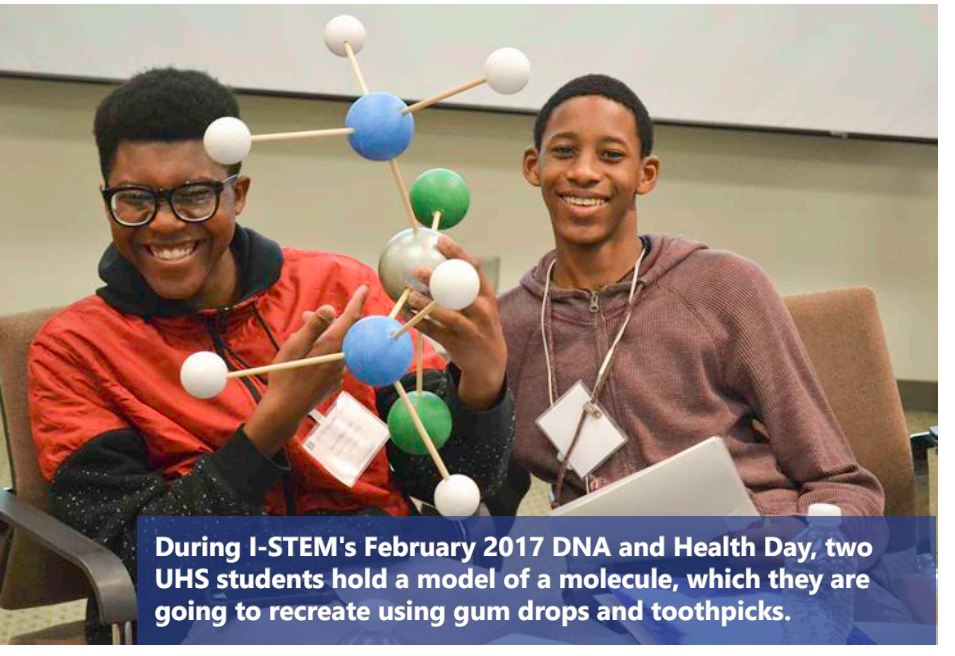
The realization of these two events culminated in August 2017 with the organization of a pilot multidisciplinary STEM summer program, the subject of this magazine, with 10 different departments and units at the University of Illinois at Urbana-Champaign (*Illinois*) participating. The I-STEM Multidisciplinary Summer Program was not launched with the intention of producing another STEM outreach initiative. Rather, the aim was to encourage and support existent successful STEM outreach efforts on campus to act upon and contribute to the development of a strong partnership among various Champaign-Urbana STEM education stakeholders. This initiative was, in some sense, a program experiment to see how I-STEM, an evaluation center serving various STEM programs on our campus, could respond to local schools' needs and facilitate meaningful and long-lasting STEM alliances with *Illinois*.



During I-STEM's April 2016 DNA Day, a local middle school student uses a laser to simulate DNA diffraction.

From previous evaluation work, we learned that to ensure student retention in STEM disciplines, a common goal for both schools and the university was to have students become more familiar with campus life and college learning experiences: what it means to study independently, do lab work, work in groups, and take responsibility for one's own learning. During August 2017, Stage 1 of the I-STEM Multidisciplinary Summer Program was organized towards these ends, specifically to:

- expose participants to various STEM fields so they know what their options are when choosing their career/college path;
- build teamwork and lab skills in different STEM disciplines;
- allow high school students to experience what STEM research is about.



During I-STEM's February 2017 DNA and Health Day, two UHS students hold a model of a molecule, which they are going to recreate using gum drops and toothpicks.

During Stage 2 of the program, research internships will be offered to students who participated in Stage 1 so they may continue to work with one of the *Illinois* research groups involved in Stage 1. From the 27 participants this summer, we anticipate that five research internships will be awarded in 2018.

The I-STEM interdisciplinary summer program was a test of the degree to which about 100 people—both STEM educators and students and administrative personnel on our campus, as well as educators from a local school, could work collectively to contribute to the learning experiences of students from underrepresented groups and to develop a robust STEM partnership with Illinois schools. The success of this program depended significantly on the dedication of the school leaders, teachers, coaches, and I-STEM staff. Without their direct involvement to recruit students, contact families, and explain the benefits of participating in the program, this partnership would not be possible. This program is a tremendous effort engaging all involved STEM stakeholders.

I am extremely appreciative of the commitment and creativeness of the around 50 *Illinois* faculty, graduate students, and undergraduate students who volunteered their laboratories, developed new and improved past STEM outreach activities, and served as mentors. More than anything, they inspired students! Besides exposing the high school student-athletes to various STEM research experiences and helping them to make informed decisions when choosing their career/college paths, the mentors also offered learning opportunities for developing soft skills, like teamwork, communication, assertiveness, and adaptability. The testimonies in this magazine illustrate how students' attitudes gradually shifted from just being comfortable with campus life to becoming more familiar with lab work, taking ownership of their learning, and having a better sense of their future career path. This kind of change is what is needed to ensure the envisioned STEM partnership will endure.

Luisa-Maria Rosu, Ph.D.

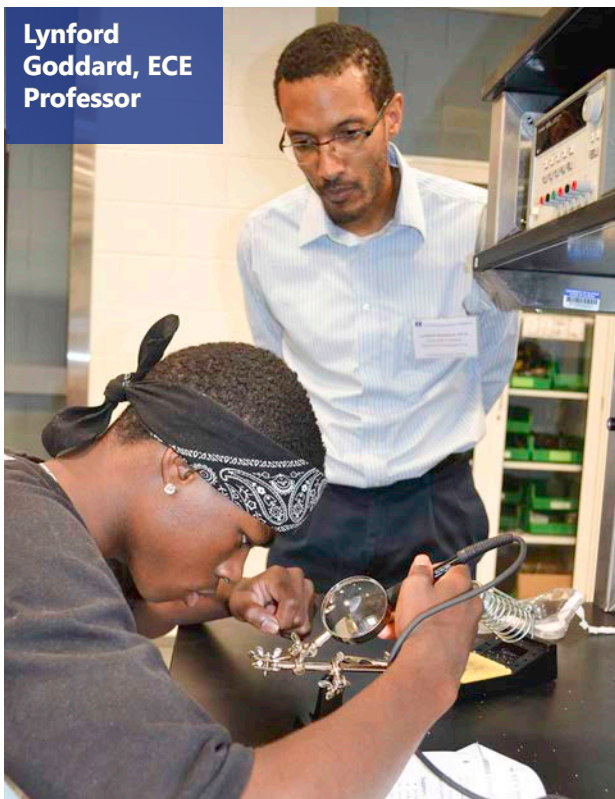
Interim Director, I-STEM Education Initiative

PARTICIPATING DEPARTMENTS, UNITS, AND ORGANIZATIONS

I-STEM would like to express appreciation to the *Illinois* departments, units, and organizations who participated in the camp—the *Illinois* professors, researchers, and other staff; graduate students; and undergraduate students who served as instructors for the camp. Without their help, this camp could not have taken place. Also, thanks to the *Illinois* students who devoted two weeks of their summers to serve as camp mentors.

The following departments, units, and/or organizations were each responsible for an entire day's activities during the camp. Also listed are university administrative personnel who helped with various administrative tasks, as well as the Urbana High School administrators and personnel, without whose help the camp could not have taken place.


Assistant Professor Ange-Therese Akono


Lynford Goddard, ECE Professor

August 7: MCB (School of Molecular and Cellular Biology) Day, MCBees

- Mara Livezey, MCB graduate student and MCBees Outreach Coordinator
- Paola Estrada, MCB graduate student
- Kristen Farley, MCB graduate student
- Katie Frye, MCB graduate student
- Jeremiah Heredia, MCB graduate student
- Pradeep Kumar, MCB graduate student
- Adedolapo Ojoawo, MCB graduate student
- Shawna Smith, Assistant to the Associate Director, MCB
- Madhura Duttagupta, MCB graduate student
- Anshika Gupta, MCB graduate student

August 8, MNTL (Micro and Nanotechnology Laboratory) Day

- Irfan Ahmad, Executive Director, CNST
- Mark McCollum, Principal Research Engineer
- Dorothy Gordon, Academic Hourly Administrator, CNST/MNTL

August 9, CEE (Civil and Environmental Engineering) Day

- Ange-Therese Akono, Assistant Professor
- Anleng Cao, CEE undergraduate student
- Jiaxin Chen, CEE graduate student
- Yue Cui, CEE graduate student
- Pooyan Kabir, CEE graduate student
- Amrita Kataruka, CEE graduate student
- Kavya Mendu, CEE graduate student
- Rachel Rayburn, Office Manager

August 10, ECE (Electrical and Computer Engineering) Day

- Lynford Goddard, Professor
- Lonna Edwards, ECE graduate student
- Arunita Kar, ECE graduate student
- Aditi Udupa, ECE graduate student
- Clint Harper, Research Facility Attendant
- Jeannette Beck, Assistant Head
- Lisa Weidinger, Office Support Specialist

August 11, Mathematics Day

- Matt Ando, Professor and Head
- Jeremy Tyson, Professor
- Philipp Hieronymi, Associate Professor
- Elizabeth Field, Math graduate student
- Vanessa Rivera Quinones, Math graduate student
- Colleen Robichaux, Math graduate student
- Alexi Block Gorman, Math graduate student
- Ann Byers, Accountant I

Matt Ando, Professor and Head (right)
Philipp Hieronymi, Associate Professor

August 14, Aerospace Day, Aerospace Outreach Society

- Dr. Philippe Geubelle, Bliss Professor and Head
- Elle Wroblewski, Aerospace graduate student
- Matt Koll, Aerospace graduate student
- Jose De Lara, Aerospace undergraduate student
- Mingwan Jeon, Aerospace graduate student
- Alex Kiran, Aerospace undergraduate student
- Yanbin Long, Aerospace undergraduate student
- Sijian Tan, Aerospace undergraduate student
- Travis Zook, Aerospace undergraduate student
- Laura Gerhold, Academic Advisor & Coordinator of Undergrad Program

Tina Huang, Lecturer

August 15, Chemistry Day

- Tina Huang, Lecturer
- Stephanie Legare, Physical Science Tech Assistant
- Elijah Chen, Chemistry undergraduate student
- Jenny Cox, Assistant Director of Finance & Administration
- Keena Finney, Office Manager

August 16, Computer Science (CS) Day

- Everett Hildenbrandt, CS graduate student
- Grigore Rosu, Professor

August 17, MechSE (Mechanical Science and Engineering) Day

- Mariana E Kersch, Assistant Professor
- Elif Ertekin, Associate Professor
- Kazem Alidoost, MechSE graduate student
- John Shanley, MechSE graduate student
- Jason (Woojae) Kim, MechSE grad student
- Melissa Biehl, Undergraduate Program Coordinator, MechSE

August 18, NCSA (National Center for Supercomputing Applications) Day

- Barbara Jewett, Managing Editor
- Olena Kindratenko, Education & Outreach Coordinator
- Donna Cox, Professor
- Eliu Huerta, Research Scientist
- Daniel Lapine, Technical Program Manager
- Adam Slagell, Sr. Assistant Director
- Kalina Borkiewicz, AVL research programmer

I-STEM Education Initiative

- Luisa Rosu, Interim Director
- Joseph Cross, I-STEM Camp Coordinator, Academic Hourly
- Elizabeth Innes, Communications Specialist
- Emily Loveland, Research Associate, graduate student
- Debby Reynolds, Office Support Specialist

Undergraduate Student Workers

- Kristina Allen
- Myungjin Kim
- Payal Mallik
- Nicholas O'Connell
- Patrick Pavilonis
- Megan Sullivan

Mentor Kushal Goenka and Lead Mentor Kadeem Fuller

I-STEM Mentors

Graduate Students

- Kadeem Fuller, lead mentor
- Paige Sturley, lead mentor

Undergraduate Students

- Danille Camacho
- Jacqueline Coreno
- Kushal Goenka
- Brittany Rhed
- Amber Shields

Shawn Hampton, UHS Academic Coach (center), watches as Jacob Barker and Jeremie Bakota make a circuit.

Urbana High School

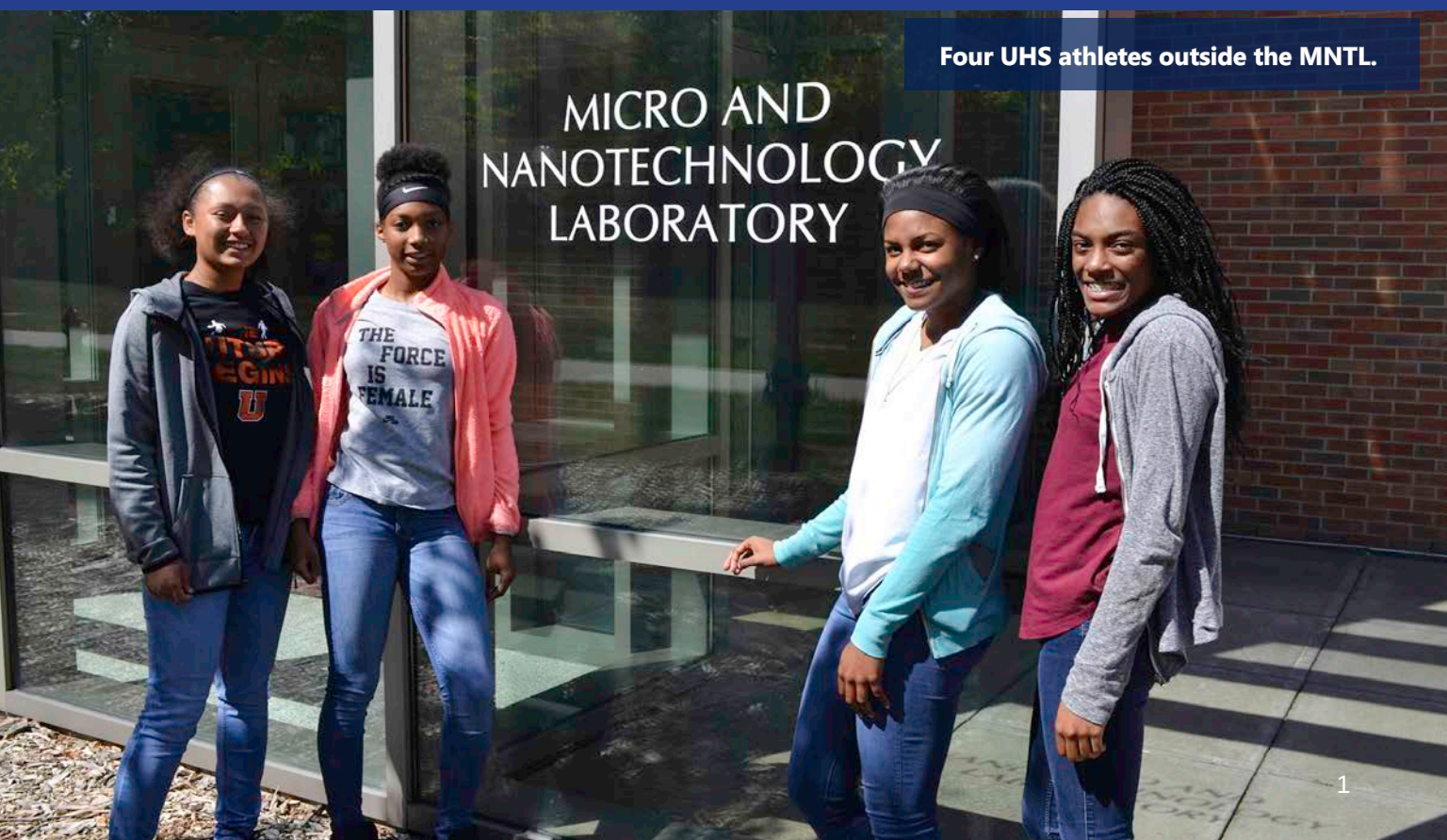
- Shawn Hampton, Academic Coach
- Matthew Stark, Principal
- Carol Baker, Director of Business
- Linda Corbett, Administrative Assistant to CFO

University Administrative Personnel

- Chris Carr, Human Resource Manager, Staff Human Resources
- Nicole Elliott, Assistant Director, Business & Finance, Engineering Shared Administrative Services
- Jenny Gibson, Business Administration Associate, Office of the Provost
- Ryan Hall, Human Resource Officer, Staff Human Resources
- Yulee Kim, Employee Relations Coordinator, Academic Human Resources
- Amie Loyd, Associate Director of Budget Resource Planning, Office of the Provost
- Jennifer Payan, Administrative Clerk Division of Public Safety
- Carmen Vetter, Human Resource Associate, Office of the Chancellor

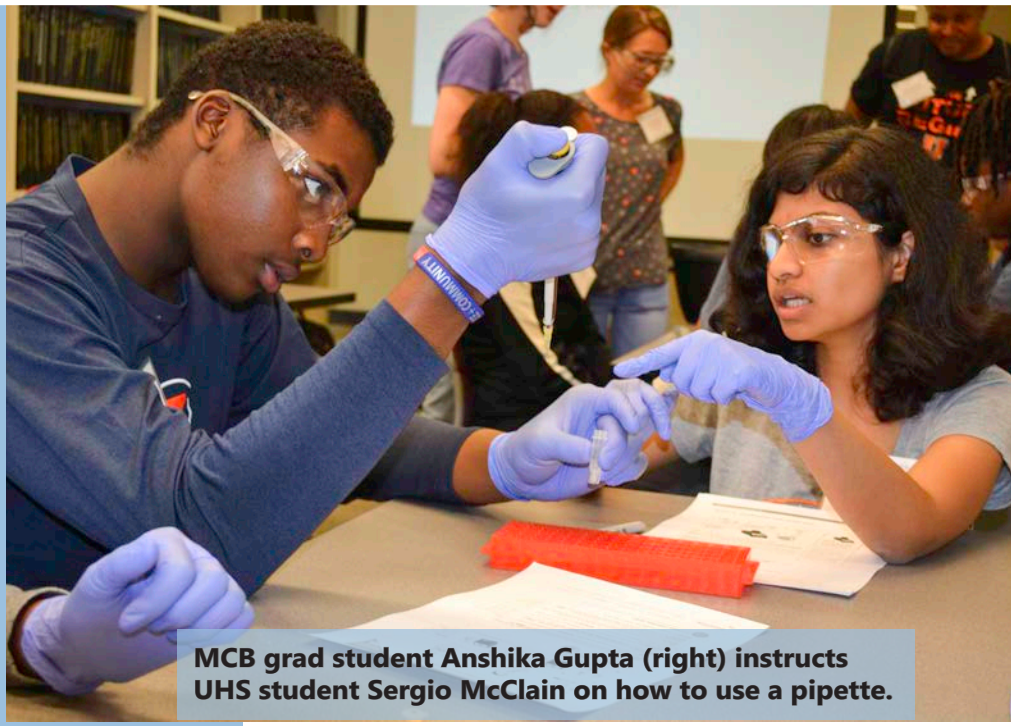
I-STEM campers tour the National Petascale Computing Facility during NCSA Day.

MULTIDISCIPLINARY ACTIVITIES BY UNIT, DEPARTMENT, OR GROUP



Four UHS athletes outside the MNTL.

MCBEES USE "WHODUNIT?" TO PIQUE UHS STUDENTS' INTEREST IN SCIENCE DURING MCB DAY



MCB grad student Anshika Gupta (right) instructs UHS student Sergio McClain on how to use a pipette.

August 7, 2017

A grad student is dead. Who did it? An undergrad who wanted the grad student's spot and/or funding? The professor who was upset with the student because he wasn't working hard enough in the lab?

This "Whodunit?" was the scenario members of the MCBees came up with to get the 27 UHS students excited about STEM, specifically DNA research. The MCBees, the MCB (School of Molecular and Cellular Biology) graduate student organization, provided the hands-on activities for day one of the first-ever, I-STEM Summer Camp, a multidisciplinary summer program from August 7–18, which focused on exposing underrepresented minorities to the many different STEM fields and career opportunities, building teamwork and lab skills in the students, and showing them what STEM research is like.

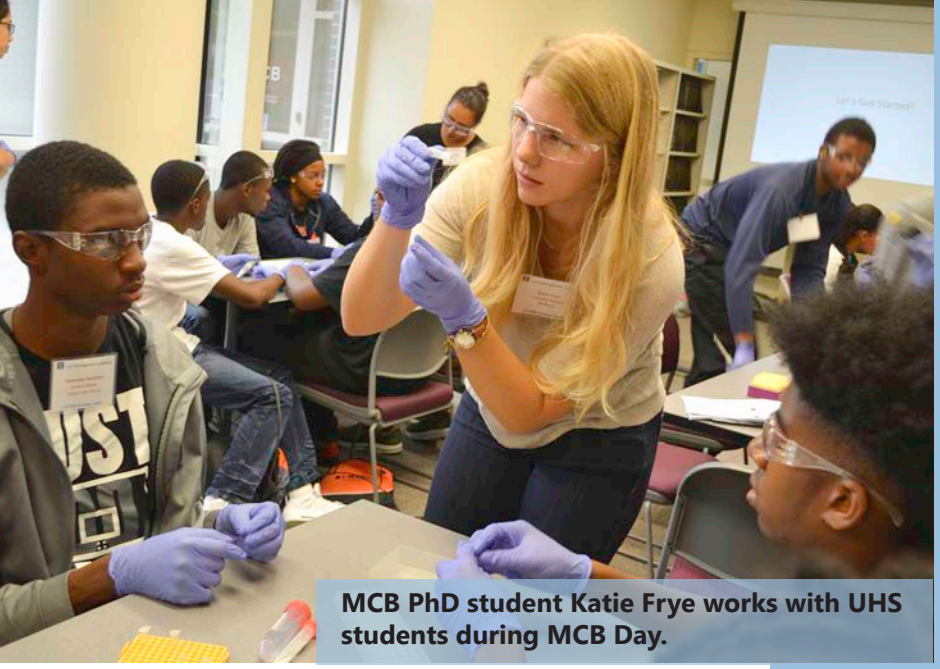
To capture the students' interest, the MCBees used the fun murder mystery scenario to structure their hands-on activities. Students were to use DNA research—similar to what's done in forensic laboratories and to what many of them do day-in, day-out in the lab—to discover which of the two suspects did it.

The high schoolers were to take DNA samples from the crime scene, extract DNA from cells found there, then perform a Polymerase Chain Reaction to amplify the part of the DNA they were interested in, thus producing millions of copies of that DNA. Then they were to take that DNA and separate it on a gel, a thick, jello-like substance that they could run the DNA through. Based on size, a different pattern would appear, that they would then need to match to the pattern found on the murder weapon.

MCB grad student Madhura Duttagupta (center) teaches Trey Walker and Zach Glass how to use pipettes.

The reason the MCBees chose this experiment, says **Outreach Coordinator Mara Livezey**, is because it was a real research experience.

"It's like a real, start-to-finish experiment, and a lot of the techniques we use today are things that I use in lab every day. So this is a real research experience."



MCB PhD student Katie Frye works with UHS students during MCB Day.

She adds that it's not until even further along in a student's career that they're taking something from start to finish and answering a question. "Something like this," Livezey continues, "where they're really following an experiment from start to finish, is something that you don't get in high school. The first time you're really exposed to something like this is in undergrad, in maybe your biochemistry class."

She hopes to expose them to the kinds of things scientists in her field do in hopes of piquing their interest in science.

"I think something like this where we can make a fun scenario for the kids to follow along with is more interesting. It can maybe grab their excitement a little bit more and motivate them to consider science in their future. I want them to have a real experience, like this is really what we do every day in lab. And if they can understand that, then maybe they'll be interested, hopefully."

Another MCBee member, MCB Ph.D. student **Paola Estrada**, who's majoring in biochemistry, participated in the camp because she enjoys working with students. Also, Estrada hopes to get them interested in science.

"I like to volunteer, do something else, get out of the lab," she admits. "It seems like a good thing to get people into science, especially high school students."

Her goal for the day? To expose the high school students to real science:

"To get them interested a little bit, to see what it actually looks like. I feel like in high school, you do a lot of book stuff, and you think that maybe it's all not real. But I guess what we show here is actual, real science. What we're doing today, PCR gel electrophoresis, this is stuff that we do every day. Especially the way we're doing it, showing them a crime or how to solve the crime, it maybe makes it relevant or more interesting."

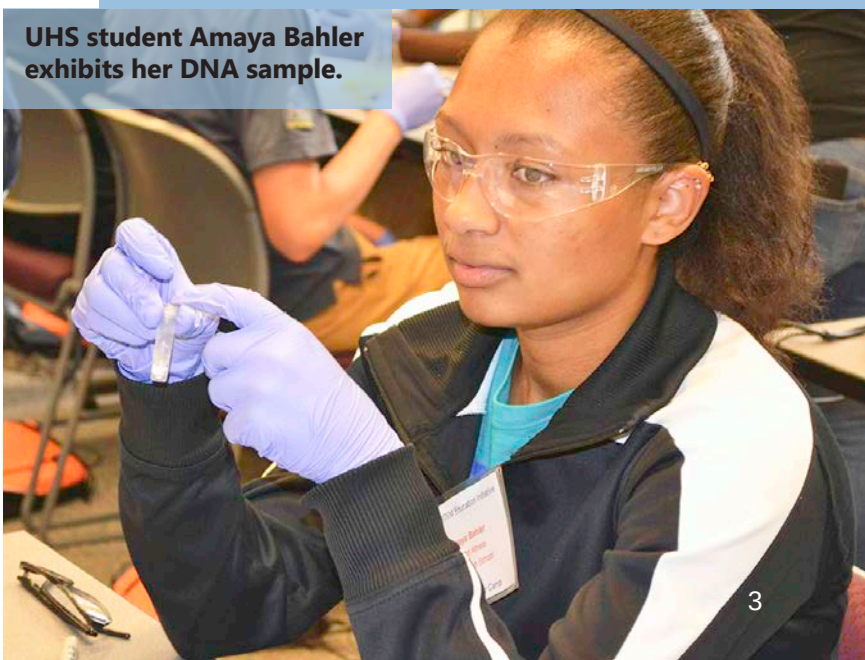
Is this something that a forensic scientist would actually do?

"Yes, definitely," she says. She qualifies that in this activity, students were only looking at one aspect, whereas in the FBI, for instance, they usually look at maybe 13 different factors. Plus they use specialized software to compare the DNA to a whole database of DNA. "But it actually is stuff that forensic scientists use."

For **Anshika Gupta**, currently in the 2nd year of her MCB graduate program, this was her first time ever participating in such an event. She reports:

"I was keen on seeing how enthusiastic high schoolers are about science, and if I can do anything to motivate them more...Also, I was keen on trying to explain science to someone who is not familiar with the kind of science terminology we scientists use. So, trying to explain them in ways which they could understand and correlate from their daily life, was something I was very excited to try my hand at."

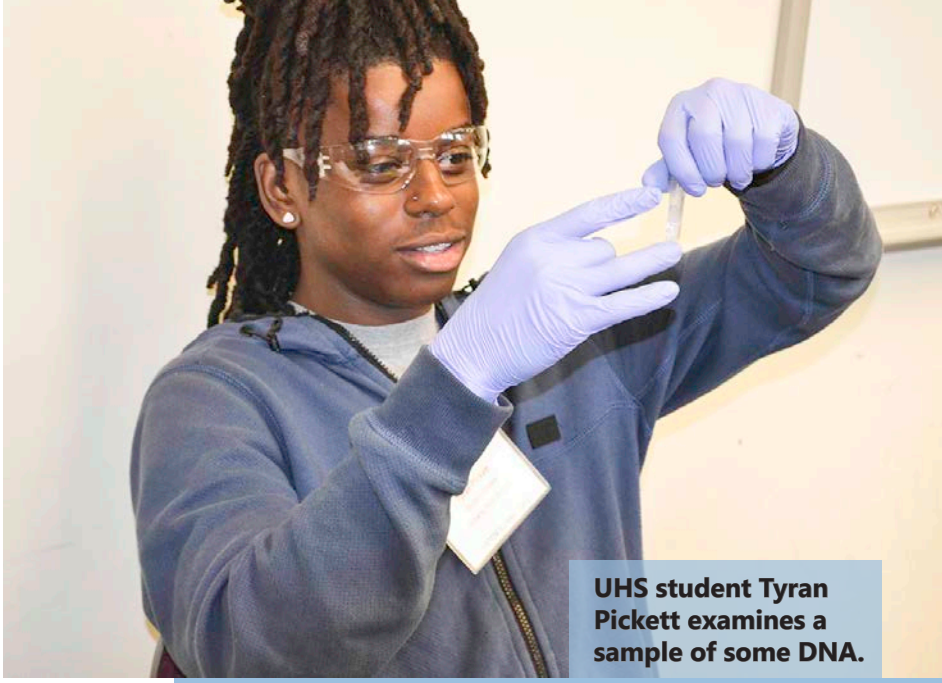
UHS student Amaya Bahler exhibits her DNA sample.



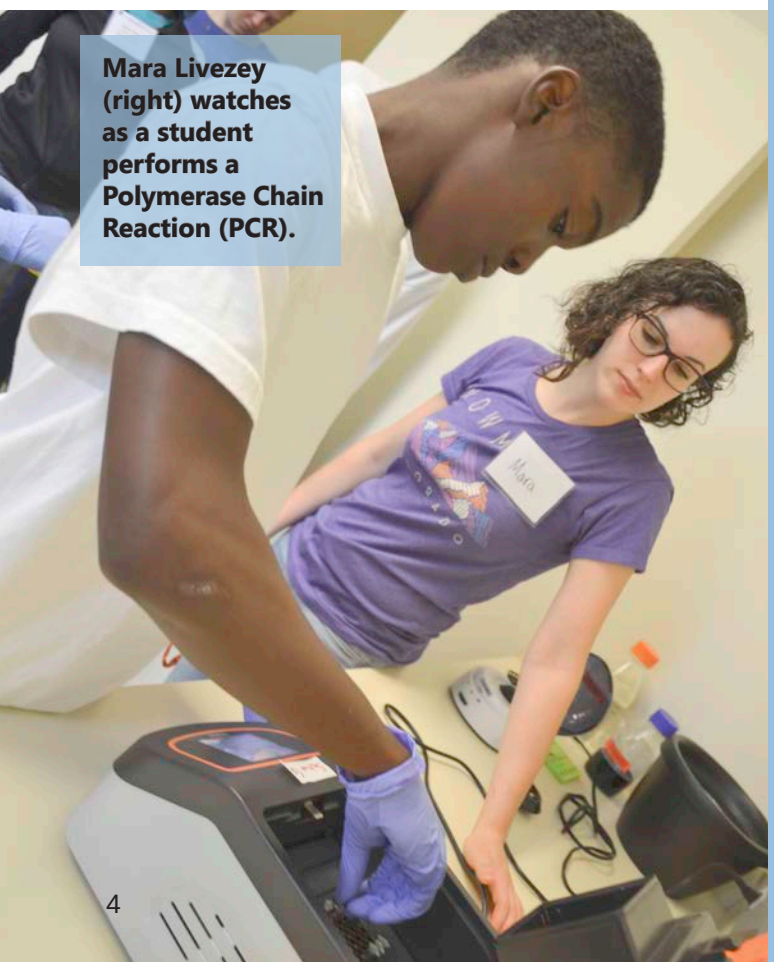
Gupta, who works in Dr. James Imlay's lab, is researching DNA repair enzymes important under oxidative stress, in particular, enzymes which play a major role in E.coli.

Gupta, who never got to see this part of biological sciences as a youngster, says these kinds of events "open up a vast world of opportunities for high schoolers." She claims that in high school, she only saw a few anatomical structures of some animals more related to the field of medicine, which never interested her.

"But there is a huge field of biology at the cellular level which no one taught us, which I find really interesting. Had someone exposed me to this branch of biology in high school, I might not have taken up engineering in college or explored much more about biology than learning its basics. But nevertheless, here I am, doing something which I really like. A practical experience like this makes it so much more interesting to learn something and know what people like the forensics actually do."



UHS student Tyran Pickett examines a sample of some DNA.



Mara Livezey (right) watches as a student performs a Polymerase Chain Reaction (PCR).

Regarding MCB Day's impact on the students, Gupta thinks most really enjoyed it.

"These kinds of activities bring their curiosity out, which I could observe by the kind of questions they asked. I think in this playful game they ended up learning something new and cool which they wouldn't have experienced otherwise."

Jeremiah Heredia, a 4th-year MCB PhD student whose research involves developing an HIV-1 vaccine, participated in the camp to give back to the community. In fact, he is where he is today because of two similar programs, MARC and RISE, which train minority students for entering a PhD program.

"I owe my career to these programs, because before I joined, I did not believe science was for me, because no scientist looked like me," he acknowledges. I had this preconceived notion that research scientists were all just naturally gifted and that they did not like sports or to socialize. I wanted to show these students a different perspective of science than the one I had as a teen. I wanted to show that science is fun and, more importantly, meant for everyone."

As a member of an underrepresented group in STEM, Heredia is cognizant of the importance of programs such as I-STEM's camp, which can help steer minorities into the STEM pipeline.

"There is a lack of women and minorities in the science field," he says. "It isn't because these groups are less capable of doing science; instead, it's simply that they are not

exposed/encouraged to do science. I-STEM's camp is great because it exposes students to science while they are still in high school."

Regarding the camp's impact, Heredia says he tried to connect with the students and believes he might have gotten a few interested in science.

"I wanted to get to know the students. I asked them several questions about their goals, and I laughed with them. When I gave my 10-minute research talk about developing a vaccine against HIV-1, I had several questions from the students. I hope by doing all of this, I sparked an interest in the students, while at the same time making them feel comfortable with science."

Rising UHS sophomore, Alarea Jackson, participated in the camp to learn more about science.

"Because I wanted to get a better knowledge on science and the stuff that we are doing, and hopefully it will help me with my high school studies and probably college."

In light of her possible future career choice (Jackson hopes to become an anesthesiologist and to major in chemistry in college), the MCB's lab activities were very apropos, and she gained some important skills: "I have never used a pipette before, and it was my first time using it."

Who did she think did it? "I think the undergrad did it," she admits.

UHS student, Jaden Johnson does a hands-on activity during MCB Day.

MCB grad student, Jeremiah Heredia, works with UHS student, Akierra Bufford, who is learning how to use a pipette.

Participant Impact

"Probably the first day when we did the DNA experiment." – Jaden Johnson on his favorite day of the camp.

"Biochemistry... Because for some reason I like the human body, I like to study it but I'm not going to study it by the time I get to college." – Jeremiah Hamilton on his favorite day of the camp.

MNTL DAY EXPOSES UHS STUDENTS TO NANO-TECHNOLOGY RESEARCH DURING I-STEM CAMP

August 8, 2017

On Tuesday, August 8, MNTL Day, the 27 UHS student athletes who participated in I-STEM's pilot summer camp visited MNTL (the Micro and Nanotechnology Lab) for "A Primer on Semiconductors." Students had the opportunity to hear from each of the eleven P–20 STEM teachers who had participated in the nano@illinois Research Experience for Teachers (RET), funded by the National Science Foundation, where they did cutting-edge research in nanotechnology under some of *Illinois'* premier researchers in the field. In the afternoon, Dr. Mark McCollum led students on a tour of MNTL's cleanroom laboratory.

In addition to hearing about the research done by the eleven nano@illinois RET teachers, the goal was for them to closely evaluate the poster presentations teachers did about their research this past summer, in preparation for creating their own posters about their I-STEM camp experiences. Students used a rubric to evaluate each teacher's presentation according to the following four criteria: organization, use of graphics, effectiveness, and responsiveness, giving each a grade from 1 to 3.

The high schoolers also learned a bit about nano-technology research. For instance, one Nano@ Illinois RET participant, J. D. Graham, who teaches biological sciences to grades 9–12 at Sullivan High School in Sullivan, Illinois, shared a poster about his research, which involved using a nanoSIMS machine to separate out atoms or ions according to their mass by sputtering (hitting a cell and exploding an area over and over), thus removing layer by layer, nano-meter by nano-meter, to create a 3D model of where all of those atoms were, then label them and associate them with certain organelles, enabling researchers to learn their composition and their position, which has never been done before at this resolution.

Graham shares why the I-STEM camp was a good experience for the UHS students.

"It's just exposure," he acknowledges. "It's like learning another language; it's like going to another country. You can hear that those things exist, but to actually see somebody speak a language, it takes the mystery away that it's not something somebody else does, it's something you can do."

Another teacher who shared his poster with the high-schoolers was Antonio Gamboa, who teaches Chemistry, Biology, and AP classes in Pomona, CA. While he also worked with cells and neurons during his research this summer, one significant accomplishment that relates to his high school students was the creation of a solar panel.

UHS students and I-STEM mentors during a research poster presentation at MNTL.

“So the students will be able to create a solar panel in the classroom,” he says, “and it’s really fast, easy, inexpensive; the lesson is all written and available for teachers; so it's really exciting.”

Regarding why high school students should be exposed to research, Gamboa says:

“It's essential. I mean high school students—anybody—should participate. I think they should be exposed to the fact of being able to try to find out something new. Just to learn something you didn't know and to question, I think is fantastic. That's a great opportunity.”

Regarding the positive impact participating in the I-STEM camp and attending their poster presentation ostensibly had on the local high schoolers, Gamboa shares why it was good for the students to come to something like this:

“It opens up their eyes,” he says. “It's very difficult in high school to be able to see the opportunities. You can tell them, talk to them, show them, but there's nothing like walking on a campus, seeing the buildings, talking to people, seeing the posters, seeing everything. It all becomes real."

And according to Gamboa, after students participate in programs like this, there's a noticeable change.

Dr. Mark McCollum, Principal Research Engineer at MNTL, speaks to the campers.

"You notice it when they come back; they are different. What I notice is that they come back and they're ready to go to college. They're excited, motivated, and now they see that it's real. So many of the communities don't have this exposure. They don't have doctors or lawyers; they don't have anybody. You tell them and it seems to be open in the air, like maybe it's for someone else. But once they come, they realize that, ‘Maybe this is something for me!’ And that is life changing.”

In addition to listening to and evaluating the presentations, the students also spent time with Dr. Mark McCollum a principal research engineer at MNTL, who explained how semiconductors work and why cleanrooms are important to research

UHS students listen to poster presentations and complete rubrics assessing the speakers' effectiveness during MNTL Day.

going on at MNTL. He also discussed a number of instruments that MNTL researchers use. To cap off the day, the students then suited up for a tour of the cleanrooms.

Regarding why it was important to bring high schoolers onto campus for an event the camp, Shawn Hampton, UHS Academic Coach, says it's to inspire them:

“I feel it's important because of inspiration. I feel children need to be inspired, and they also need to be exposed. I feel a lot of the things I do now are the things I did in high school or grade school. And so it's important for them to be exposed at as young an age as possible to possibly find something that they love.”

In his role as Academic Coach, he says one important aspect of the program is exposure, which is why the I-STEM camp was important. In fact, Hampton expects that in the future, they’ll see results. He shares an anecdote:

“So one of the philosophies that we uphold is the principle of the bamboo seed. When you plant a bamboo seed, it takes 5 years before growth. You have to nurture it; you have to feed it; you have to water it. After year one you get nothing. After year two you get nothing. After year three you're still looking at a piece of ground that has no growth. Year four, and in year five, that bamboo seedling actually grows 90 feet.”

He says that in a similar fashion, the impact of events like I-STEM's camp, "May take a while. And the way we look at our children is that they're all bamboo seedlings,” he continues.

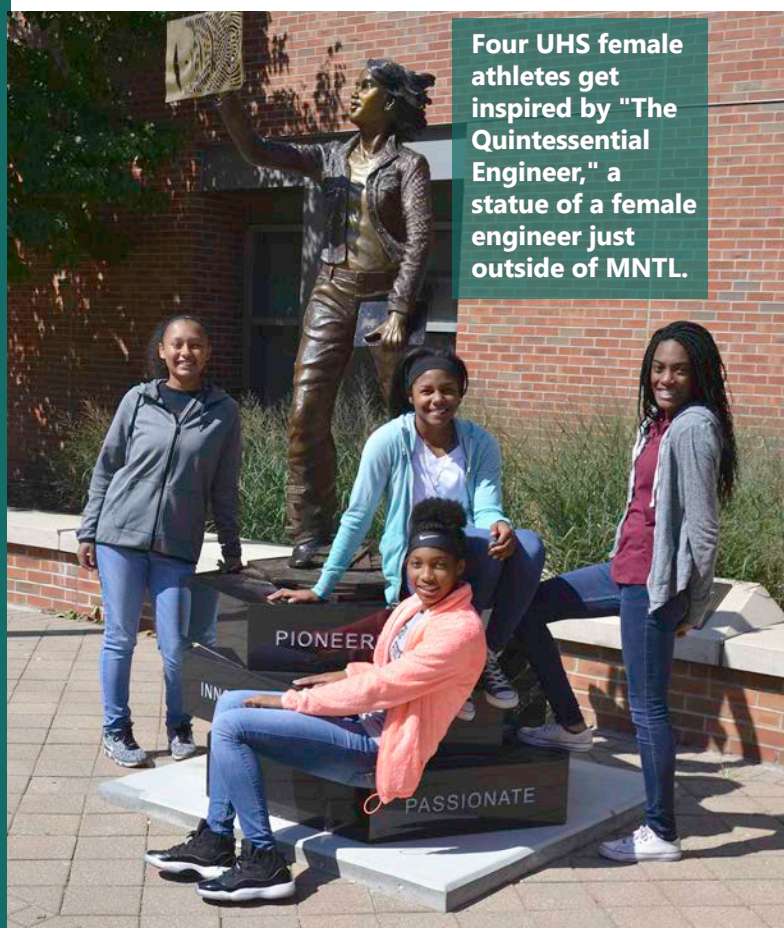
“Even though we’re pouring into them, we're exposing them, we're giving them different opportunities, we're not seeing the result like we expect to see the result. But what I want to let people know is that it's happening. And it's going to come out, and it's going to come out really fast, but it's going to come out much later. And so, I may not see how I've impacted these kids this year, or even next year. But what I know is that in 10 years, there's going to be something that they really grab hold of. And that's really what it's about.”

Does he expect to get a call in, say, 10 years saying “Hey coach, that was so important!”?

Yep, and then he says he expects to hear something like, “'I just built this missile,’ or 'I just made this code!'"

Participant Impact

"I'm loving it; I'm learning a lot more than I should have...Usually I try to limit myself, but today I broke all of that, and I'm not limiting it anymore. I'm learning a lot and loving it — especially science; science is one of my favorite subjects." – Kyartan Earvin on the camp's impact



Four UHS female athletes get inspired by "The Quintessential Engineer," a statue of a female engineer just outside of MNTL.

DURING CEE DAY, AKONO & COMPANY TEACH STUDENTS ABOUT CIVIL ENGINEERING & STRENGTH OF MATERIALS

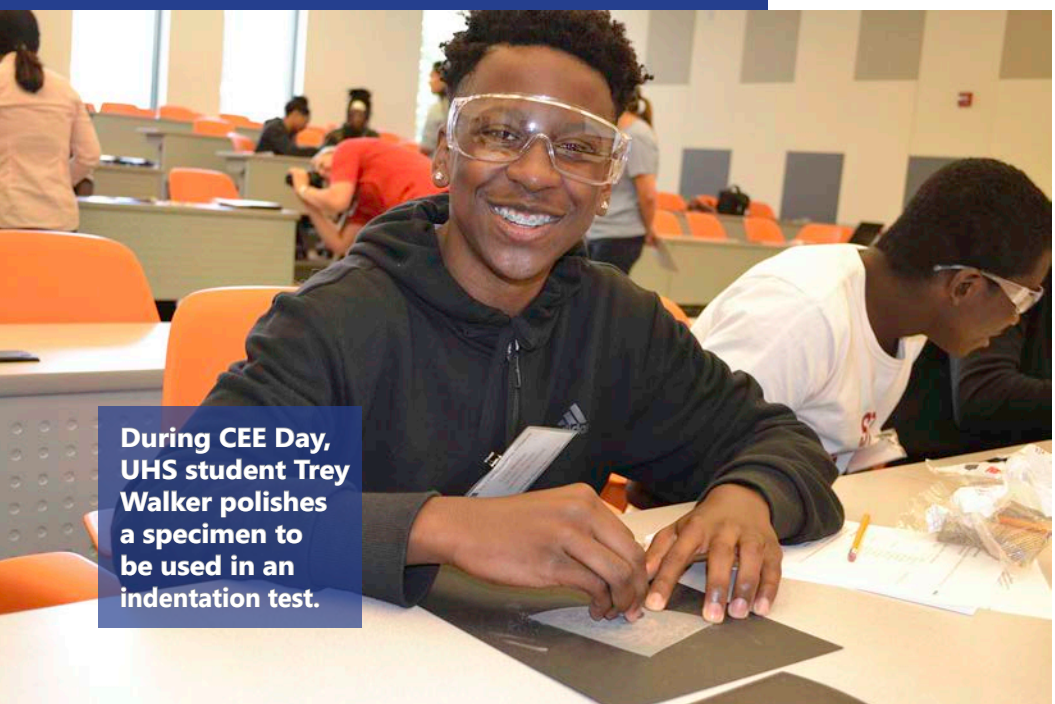
August 9, 2017

Concerned about bridges or other structures cracking? Civil & Environmental Engineering (CEE) Assistant Professor Ange-Therese Akono is. So on Wednesday, August 9, she introduced the 27 UHS students to her niche: determining the strength of various materials in order to build stronger structures. Plus, along with several hands-on activities related to Akono's Design for Toughness research philosophy, the students not only discovered what research is like, but got to interact with college students and to experience being on a college campus.

Akono explains a principle of civil engineering to the UHS students.

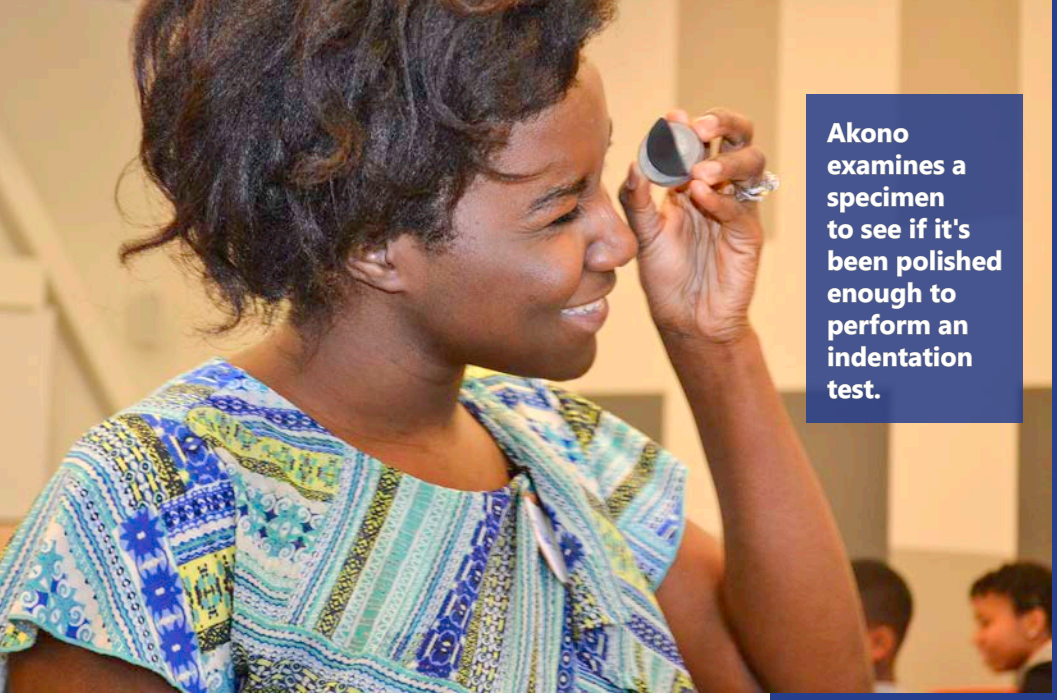
During the CEE Day activities, Akono and her students introduced the high-schoolers to jargon they use every day—concepts like the mechanics and physics of fracture and the connection between a material's microstructure, composition, and fracture resistance. After each brief teaching, students performed a related hands-on activity. For instance, they did an indentation test to measure the strength of various materials, using metal balls to make indentations in a foam block, a limestone slab, and a piece of composite or plastic, then measuring the indentations in each.

To experience how researchers prepare stones for indentation tests, the high schoolers learned how to polish specimens. Using a four-part polishing process, they polished for two minutes using a very rough piece of sandpaper, repeating the step with progressively finer and finer sandpaper, until the stones' surfaces were no longer cloudy and rough but so smooth and polished that an image of the building visible in the windows behind them was reflected on the face stone.



During CEE Day, UHS student Trey Walker polishes a specimen to be used in an indentation test.

This procedure wasn't busy work Akono and company came up with to keep the students occupied; it's what Akono's students do in the lab every day in order to test materials. In fact, undergrad Anleng Cao insists:



Akono examines a specimen to see if it's been polished enough to perform an indentation test.

“I've done all the stuff that they're doing, so it's real lab work that they're doing. They're using real materials that were extracted from New York; they use big machines to get these rocks out. And they're using the real polishing heads that I also use in the labs. So, this is all exactly the same stuff. So that's pretty cool.”

The high schoolers also learned principles about building sturdy structures, then were challenged to see which group could build the sturdiest popsicle-stick bridge, which they tested at the end of the day.

Plus, in the afternoon, students toured a couple of Newmark’s Labs. In the indentation lab, they saw how the stones like the ones they had polished are used in indentation testing. They got to see a small drill in action: first it was pressed into a specimen, then a computer program that determines a specimen’s strength measured the microscopic indentation it had made. They also experienced Newmark Lab’s huge Crane Bay.

According to Akono, events like this help high school students **“get excited about science. They get to discover an aspect of science they wouldn't have thought about. In this case, we're looking at civil engineering. They get to understand what it is to be a civil engineer, what kind of questions we're asking, and how this is both exciting but also applicable in real life.”**

Akono also wants students to understand how her field is related to their everyday lives. She says students experience civil engineering every day, “but maybe they’ve never thought about all the people actually designing it.”

Her long-term goal is that some of the high schoolers might decide to become civil engineers themselves, and hopes **“to inspire them so that later, they would select these careers and be the future engineers that we need for this country.”**

While holding an event for high schoolers is extra work for Akono and her team, she believes they also benefit from students' enthusiasm and different perspectives. “I like the breadth of the questions that they have, the diversity of questions that they have, and a lot of times, actually, I'm taken aback by an aspect that I actually hadn't thought about, so it's actually very exciting.” She admits: “I'm actually looking forward, because later, in the afternoon, they are going to go into the lab, and I want to see what types of questions they will ask.”

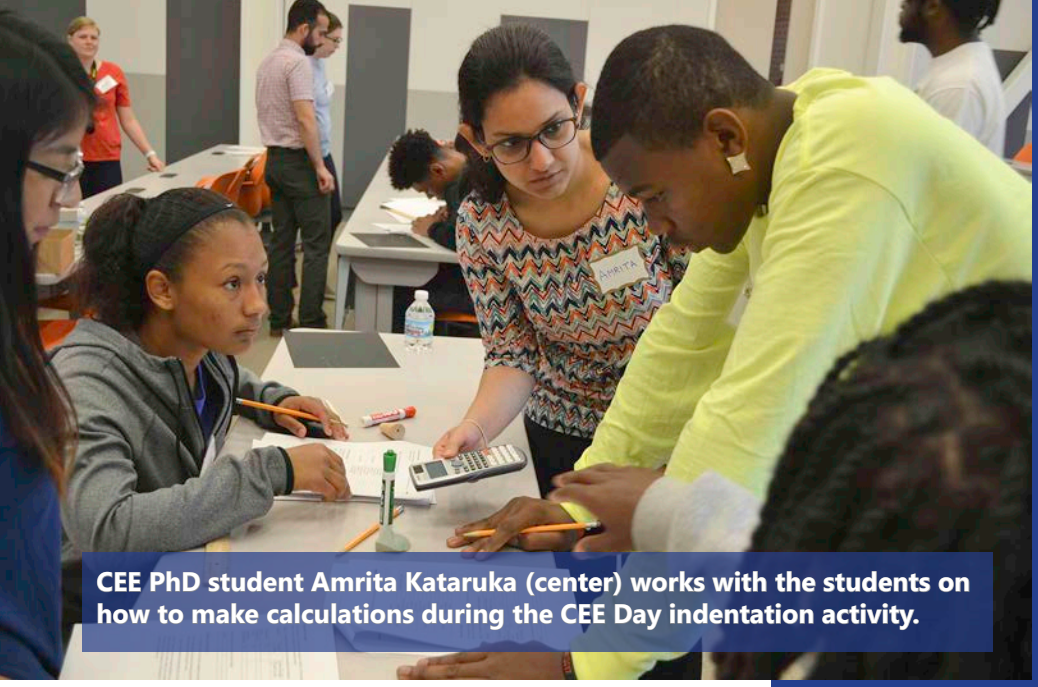
One of the challenges Akono encountered was to communicate her research in a way that high school students could understand. She says it’s very different teaching this age group compared to the college students she’s used to teaching.

“I think, to some extent, it is a little harder,” she admits. “It is easier because I have to be rigorous, but I just need to make the material more accessible. But this becomes more of a challenge because there are a lot of notions for me that are very obvious. I tend to be even oblivious to those terms that have a very obvious definition. For me, it's just common sense, but I need to find a way to explain it.”

Another challenge is not just communicating to a different age level, but taking into consideration the students' interests and passions. “How do I make it relevant to their day-to-day lives?" she asks.

"How do I make civil engineering relevant to a 15-year-old? How do I connect it to an iPhone? There's definitely a lot of overlap, but just having to constantly be thinking about it, that is actually why there is that level of challenge.”

In fact, at one point, to connect with the students, she did pull out a cell phone to use as an illustration when discussing materials.



CEE PhD student Amrita Kataruka (center) works with the students on how to make calculations during the CEE Day indentation activity.

She admits that, for her, a lot of challenge lies in trying to find the correct balance in terms of how challenging to make the material.

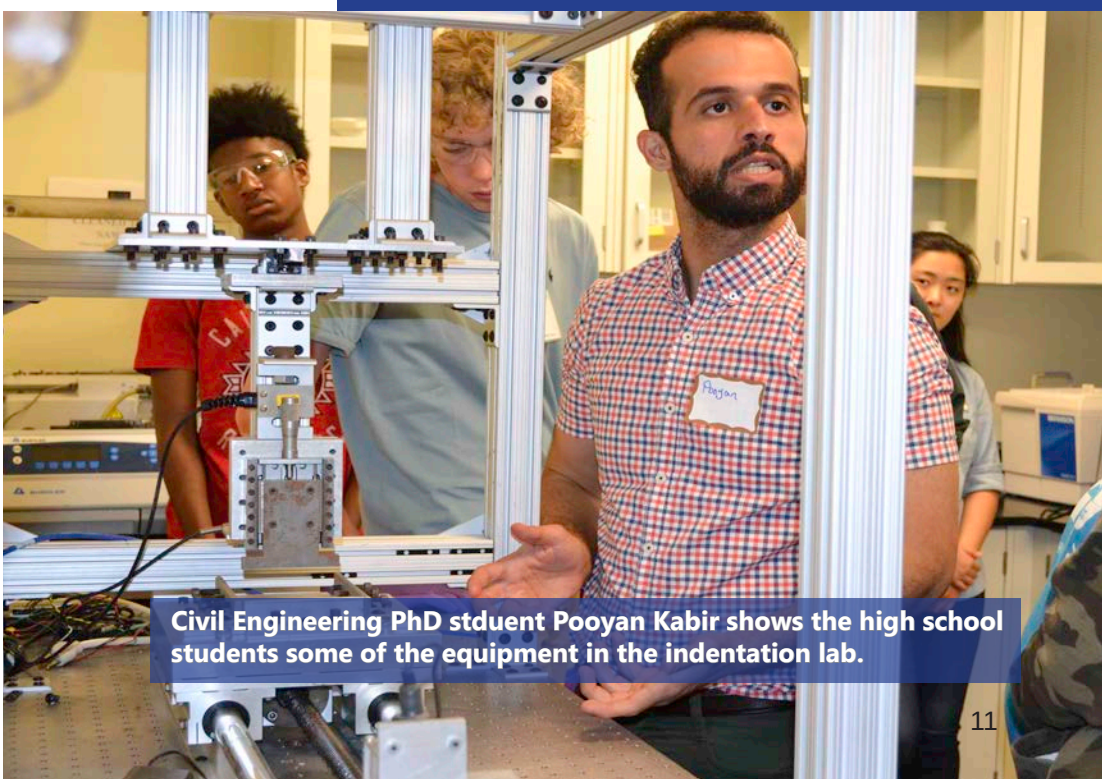
"I want the activity to be interesting for them and challenging, but not too challenging. College students, I'm teaching them every day. But it's been a long time since I graduated from high school, and I didn't actually do my high school here in the US. So I have to kind of ask myself, is this the correct level? Is it not too hard, not too easy? Also because we don't want them to think that we're treating them as if they are kindergartners."

Amrita Kataruka, a PhD student in Akono's lab in her second year, says she participated in the camp "mostly because I kind of like to interact with kids. So when Professor Akono told me there's going to be an outreach, I was actually excited about the idea. So I told her, 'Sure, why not?'"

Regarding the benefit for high school students of an activity like this, Kataruka says that, **"As a high schooler, they have a lot of questions in their minds about what future aspects they have or what should they choose later on. If they start doing such kind of activities, they kind of get a feel of what they're enjoying more or if this is something they want to do or not. So it basically, I think, it helps them decide what they want to do later in their lives."**

Another PhD students in Akono's lab, Pooyan Kabir, agrees with Kataruka regarding the importance of bringing high school kids to events on campus in order to help them in their decision making regarding their career.

"I remember when I was in high school, I didn't know what I wanted to do!" he recalls. So his dad, a mechanical engineer, and his brother, who was studying electrical engineering, took him to the university. "They showed me what each group goes through, and then I saw what they're working on , so I had an idea." And based on that input, "I decided to do civil engineering," he adds. "So it's always good to bring in some new fresh high school people and then they know what they want to do in the future and that way they have an idea of what they're getting into in the future."

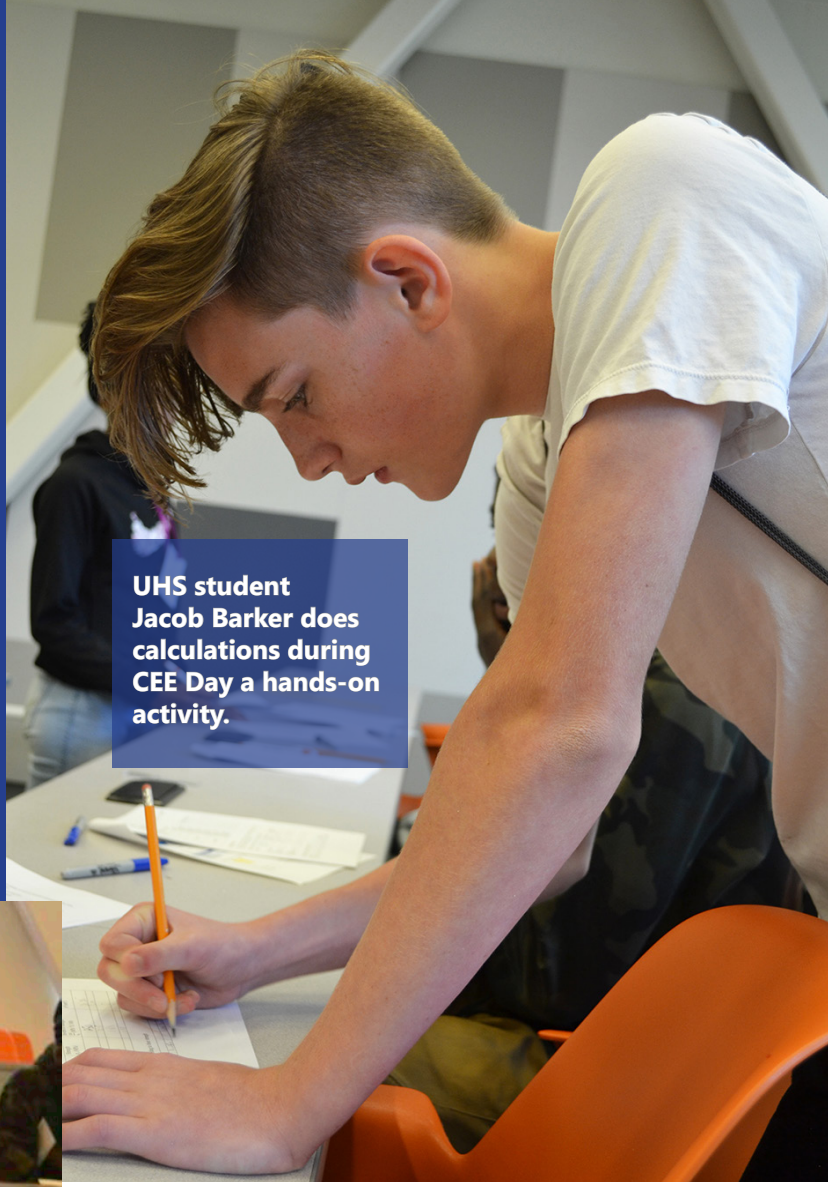


Civil Engineering PhD stduent Pooyan Kabir shows the high school students some of the equipment in the indentation lab.

Kabir, who did his undergrad in Iran, got his Master's at Texas, and is now going for his PhD at the University of Illinois. When he was in high school, did he ever think he would end up in one of the best civil engineering schools in the world? “Probably not,” he says. “My dad wouldn't have thought that either. It's a pleasure to be here. I love doing this, and I'll keep doing this as long as I'm in this environment.”

Kabir says he loves working with high school kids and doing outreach, and that’s why he participated in the outreach:

“I had a company back home when I was young, when I was like 20 years old, and I always worked with younger people and the younger generation. I always like to inspire them and teach them something and also have fun with them. It's important to have fun as well when you're teaching them. That's what inspires me.”



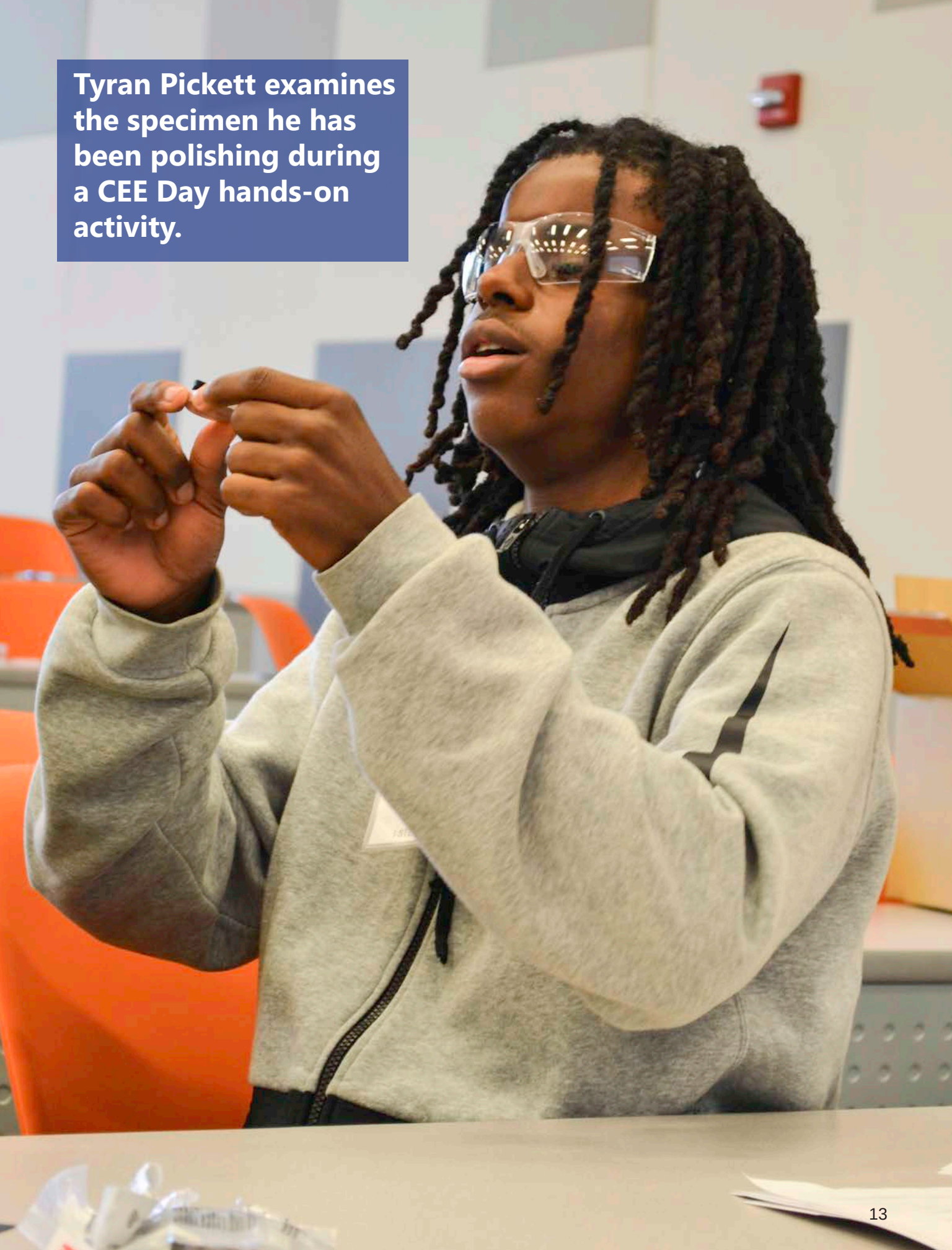
UHS student Jacob Barker does calculations during CEE Day a hands-on activity.

UHS student Miller Calhoun during during a CEE Day hands-on activity.

Participant Impact

"Today's been very interesting, it's been fun so far. I've really enjoyed learning about the architecture part of the program. I'm glad that I'll be able to continue that throughout the day." – Jacob Barker about the Civil Engineering Day of I-STEM's Summer Camp

"Civil Engineering Day, where we got to build the bridges, because that's real-life application." – Miller Calhoun on his favorite day of the I-STEM Summer Camp.



Tyran Pickett examines the specimen he has been polishing during a CEE Day hands-on activity.

ECE DAY AT I-STEM'S MULTIDISCIPLINARY SUMMER CAMP: SOLDERING, CIRCUITS, AND SOFTWARE

August 10, 2017

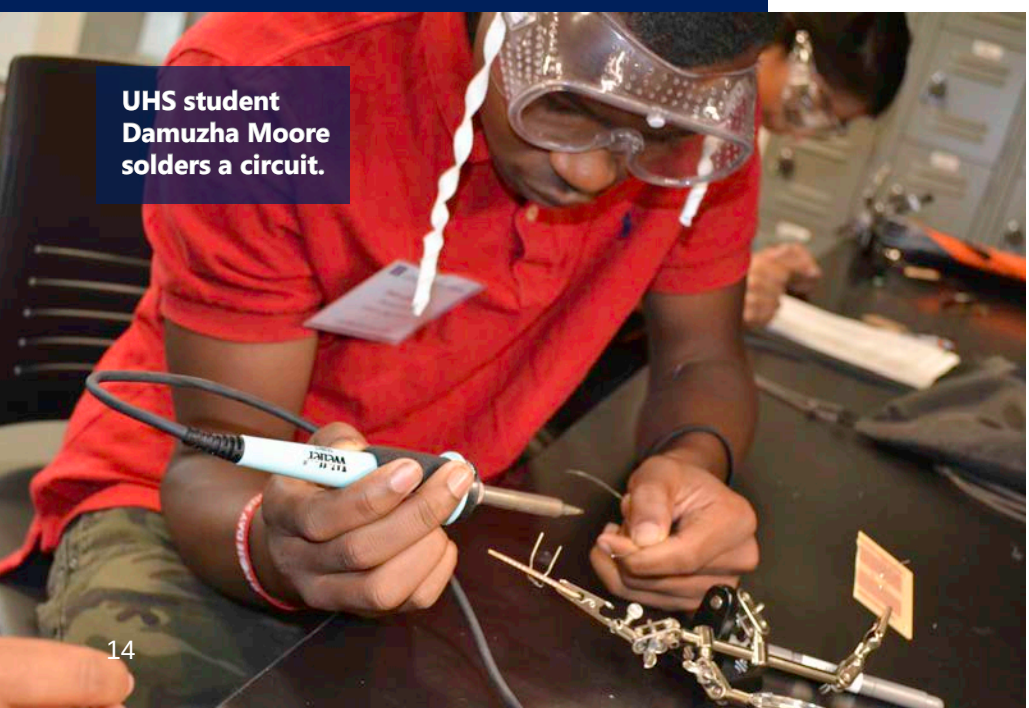
The earlier you get exposed, the better you'll be at it…because it's something you've seen before." — ECE Graduate Student Lonna Edwards

ECE grad student Lonna Edwards shows camper Jaden Johnson how to build a circuit.

What is Electrical and Computer Engineering (ECE) anyway? On Thursday, August 10, the 27 UHS student athletes found out a little about it during ECE Day, when Professor Lynford Goddard and several students from his lab exposed the campers to some activities related to ECE. Students learned about then did hands-on activities about research experiment design, how to solder, and how to build circuits. In addition to learning about the field, students also interacted with several ECE graduate students and discovered a bit about what being an engineering student might be like.

Goddard began the day by teaching the UHS students what makes a good research experiment and how to design one. He even threw them a curve ball: to challenge them to trouble shoot, he led them in an LED light research activity where only half of the LEDs would light up. Then, after learning some things about circuits, such as their role and importance in electronics, how they work, and how to build one, the students then proceeded to build one of their own.

Key to the circuit-making process was soldering; while a few of the high schoolers had had previous experience soldering, for most, this was the first time they had ever tried it. But after a brief lecture about the specifics, they all eagerly began the activity, and through trial and error, they got the hang of it. According to Aditi Udupa, one of the graduate students in Goddard's lab,



UHS student Damuzha Moore solders a circuit.

"Most of them are new, but they picked it up very fast. Initially, they were very confused, but considering they didn't have any experience, they were pretty fast to learn it."

Goddard and his team also exposed the high school students to the other half of ECE: Computer Engineering. So learning to write code to test their circuits was also on the agenda. In order to make

Arunita Kar, an ECE grad student, helps UHS student Kyartan Earvin during a circuit-building hands-on activity.

sure their circuits worked, they were taken up to a computer lab. Goddard led the students step by step to create code that would test whether or not their circuits were connected and soldered correctly. Then he used the program to test a few of the circuits they'd just built. Each student also received a copy of the program to take home and experiment with.

Why do Goddard and his students take time away from their research to work with high school students? Udupa says outreach events like this one might encourage students to consider college…and to show them that they too can do engineering. She claims the activities can "Get them interested and give them motivation to go to college." She also says the camp could

them interested in engineering **"because they may not know what engineering is about, and they may not know that they can do something like this."**

She believes the camp could give them something to get interested in and get started with.

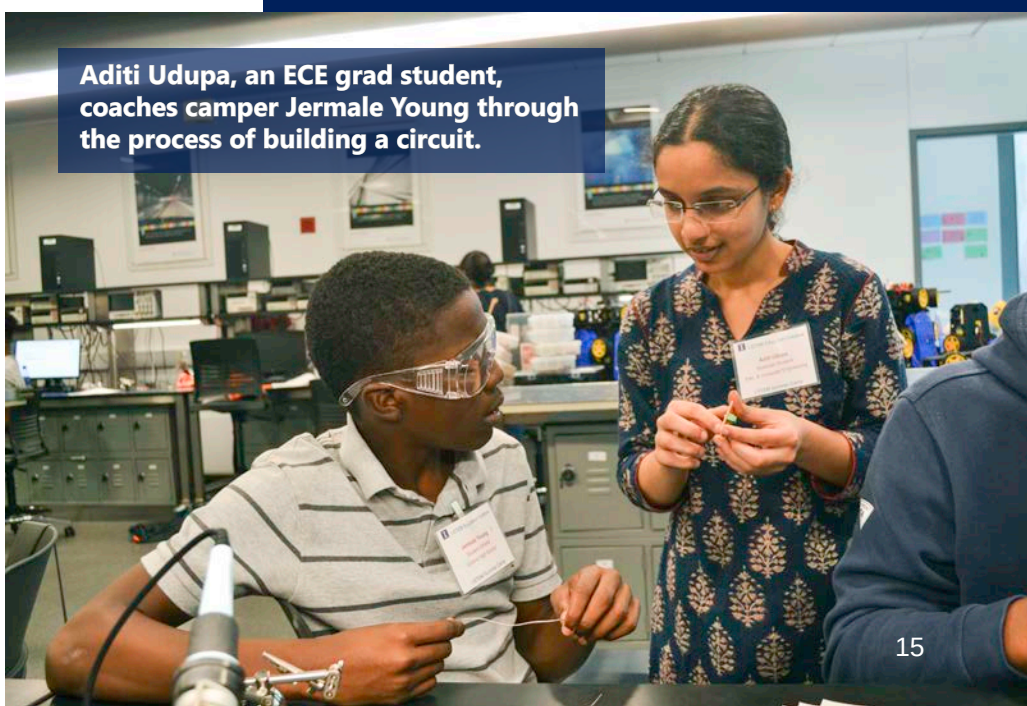
Udupa claims she also got involved because her mentor, Goddard, is really passionate about outreach, "So I think I took some of that, and I like to teach specifically, so this is a good way to get some experience."

Another of Goddard's graduate students, Arunita Kar, who's just finishing up her Masters' and will soon begin her PhD, reports that the benefit of bringing high school kids into a lab like this is "mainly the exposure." She indicates that when she was growing up, anytime someone said electrical engineering, she thought of not just circuits, but trains and things like that.

"But here, she explains, "not only do you get circuits, but you get photonics and optics, and you get to see the whole convergence of all of those many different things that all rely on electricity and electrical engineering and electronics. So it's really nice."

Regarding the day's activities, Kar says,

"Getting an early start on some of the things they're doing in these projects, like soldering and programming, is really useful later on in life, and I wish I had had these opportunities."



Aditi Udupa, an ECE grad student, coaches camper Jermale Young through the process of building a circuit.

Another grad student from Goddard's lab, Lonna Edwards, (who was also involved in four other camps this past summer), indicates that, like Kar, she participates in outreach events like ECE Day because it's something she didn't have access to at that age.

"I love doing outreach. It's something I wish that I'd had when I was younger. I wasn't aware. I didn't know what an engineer was until I was starting college, and I learned about what they do, so I just picked it as a major, not really knowing much about it. It was a struggle in the sense that I had to maintain a certain GPA, so I was stressed out a lot of the time. But I made it, so I made it a goal to expose people earlier."

Edwards says it's a good idea to bring high school kids into a lab early. "The earlier the better," she says. "But kids who get to experience this are at an advantage, because they're learning about things I didn't learn until I got to college. I tell them not to feel bad if they feel like they're not getting something, I tell them that they're still ahead of the game."

"The earlier you get exposed, the better you'll be at it, because it won't be as stressful, and because it's something you've seen before," she adds. "You'll be able to learn it and be confident. So I wanted to reach out to kids who are younger so they get that exposure, especially kids that are underrepresented in the field. That's my main reason for doing it."

In addition to exposing underrepresented students, Edwards likes to participate in events like I-STEM's camp because she just plain likes teaching.

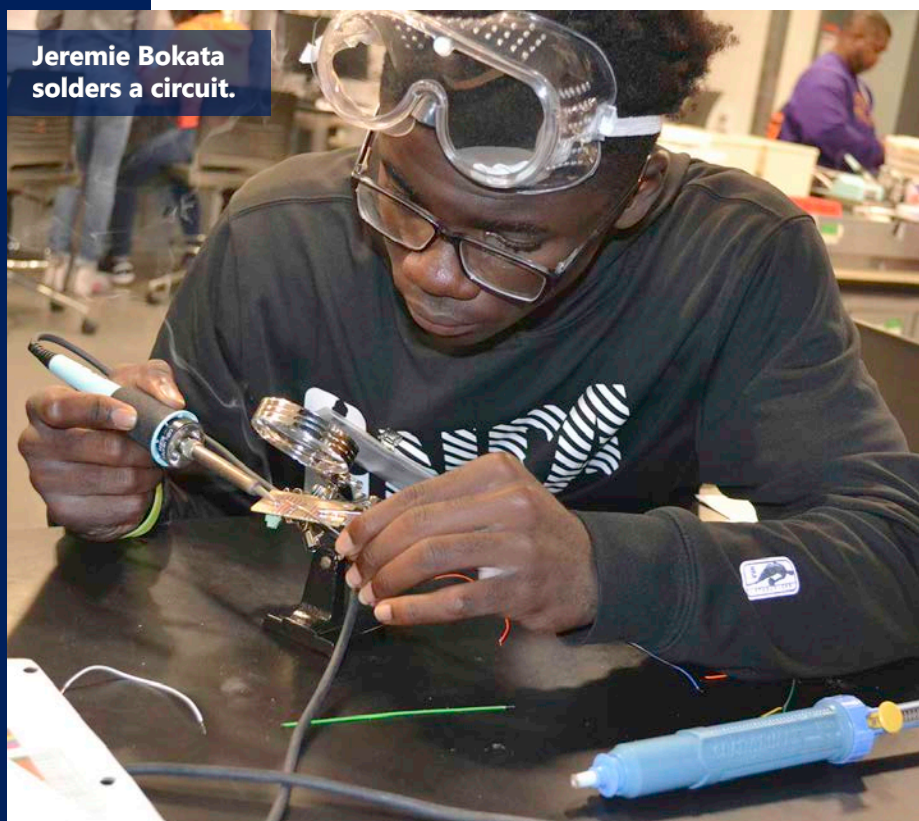
"I feel like a lot of people think that engineering, math, and physics are hard. They're difficult, but I think that it's all in how someone teaches it to you. Somebody can explain it to you in simple terms, because anything can be broken down into simple terms. Then, you see that it's not too hard, and it makes you want to do it. I kind of want to motivate kids and say that "It's not too bad. It's hard to the outside world, but really, I know this trick!'

UHS student Lauryn Cross solders a circuit during ECE Day.

Participant Impact

"Yesterday when we did that soldering, that has been the most interesting so far, because it was a hands-on activity, so I really enjoyed that." – Lauryn Cross

"This camp has influenced some of the fields I'm looking into. Specifically, computer engineering...because it's interesting!" – Jeremie Bokata



Jeremie Bokata solders a circuit.

Jermale Young exhibits a glowing LED as proof that he completed the activity correctly.

MATH DAY AT I-STEM'S MULTIDISCIPLINARY SUMMER CAMP ADDS UP TO FUN

August 11, 2017

"Math should be painted in a fun light!" – Mathematics PhD student Vanessa Rivera-Quinones.

"And that's what the folks from Illinois' math department did when the 27 UHS athletes, mostly underrepresented minorities, participated in Math Day as part of the first-ever I-STEM Summer Camp. This is math?" is a question that cropped up frequently while, grinning from ear to ear, the students raced against time to stop the spread of an epidemic on the VAX website, or wrestled with a challenging combinatorics activity, or struggled to get their mind around mathematical logic as Philip Hieronymi presented some virtually unsolvable brain teasers. So while participating in a variety of challenging, hands-on activities that showed them that math is useful in real-life situations and can be quite different from what they learn in school, they also learned to think outside the box where math is concerned...and discovered that math can be fun.

Math Day on Friday, August 11, introduced the high schoolers to a number of *Illinois'* mathematicians, who made the students feel welcome and introduced them to some of the work that they do. Mathematics Department Head, Professor Matt Ando, welcomed the students and discussed the importance of math. Assistant Professor Phillip Hieronymi introduced students to mathematical logic via a "brain teaser" about Alan Turing. Plus, several math Ph.D. students, Elizabeth Field, Alexi Gorman, Vanessa Rivera-Quinones, and Colleen Robichaux led the high schoolers in hands-on activities related to math research.

For instance, Vanessa Rivera-Quinones, a fifth year math Ph.D. student, uses mathematical models in her research to try to understand how disease spreads.

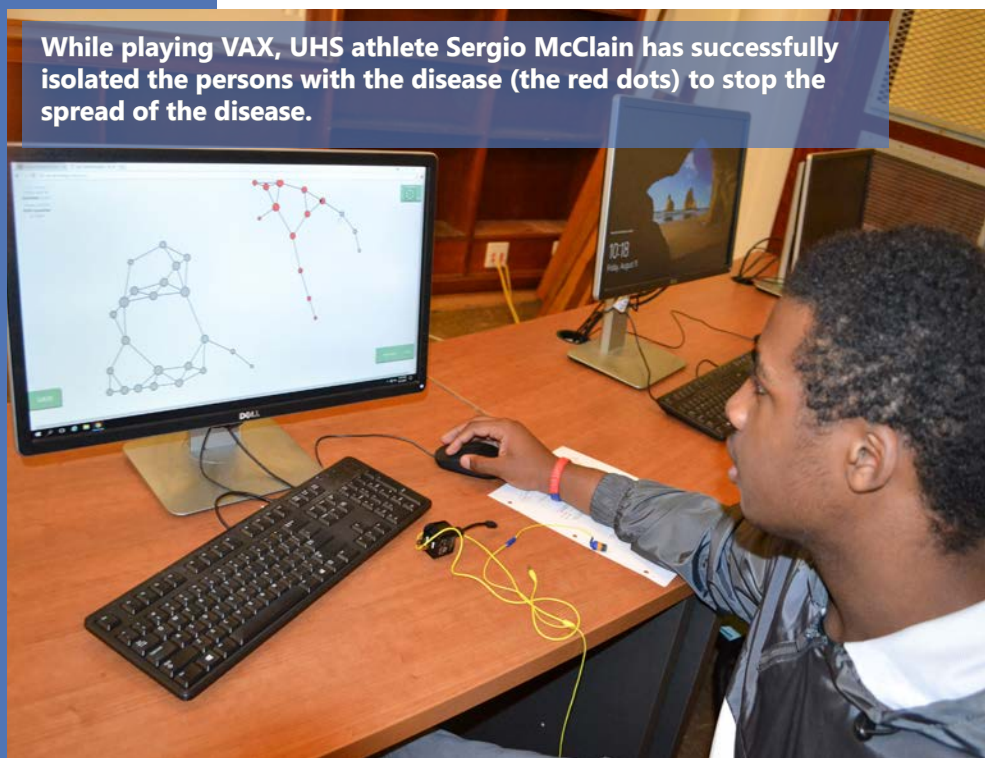
In collaboration with a researcher in bioengineering who studies specific parasites, she makes mathematical models to explain what happens during an epidemic in a lake ecosystem. To give students a glimpse into her work, she did a fun event with the students related to disease modeling, leading the students in an exciting exercise related to real life and to her work in epidemiology (the spread of infectious diseases).

In a website game, called VAX, students were to stop an infectious disease epidemic and were given a limited number of "quarantines" (breaking a link from one person to another) to try to stop the spread of the disease. However, once the disease got started, it spread rapidly from person to person, and the students were quite engaged as they scrambled to try stop it from spreading—with varying degrees of success.

For instance, how'd I-STEM mentor Kushal Goenka, an ECE major, do on the VAX game? He crashed and burned.

"The easy part was pretty simple, but the medium, I did quite bad. Everyone died in the game," he confesses.

But despite the varying degrees of success the students—even the mentors—had, they had a great time. Rivera-Quinones believes "math should



While playing VAX, UHS athlete Sergio McClain has successfully isolated the persons with the disease (the red dots) to stop the spread of the disease.

be painted in a fun light," and that's why she participated in I-STEM's camp. While admitting that math in school is interesting, she claims, "It doesn't tell you the complete picture. I always want try to motivate other students to see how math is used in non-traditional settings or how the math in high school could be pushed to explain some real-life phenomenon."

Regarding the impact I-STEM's camp had on the students, Rivera-Quinones reports, "Since this program is trying to paint the picture of what a researcher looks like, hopefully they can see that it's not just one picture; across different disciplines, we do different types of things, and all of them are research."

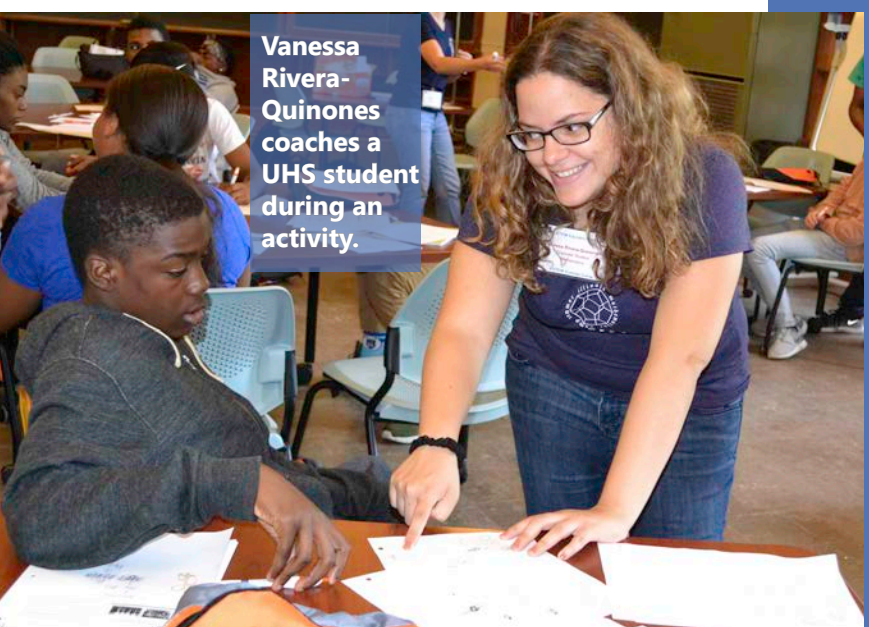
Professor Phillip Hieronymi introduces students to mathematical logic.

According to Rivera-Quinones, her main goal was for the students to gain confidence:

"My hope for them is that they understand that there's not one definition of being a mathematician," she explains. "They can also be mathematicians even though they're not pursuing a PhD in math. As long as they have interest in how things work and how patterns are formed, they can also be mathematicians."

She also hopes that the experience during the camp leads the students down the path of self-discovery and they gain some insight into how they might make their own unique contribution to the world.

"I think it's important that they're doing this program and that they get to see what it's like to be a scientist, or a mathematician, and really think about what that means for themselves…So I'm hoping this allows them to identify things about themselves and what they want to maybe pursue and, hopefully, later on contribute to the world."



Vanessa Rivera-Quinones coaches a UHS student during an activity.

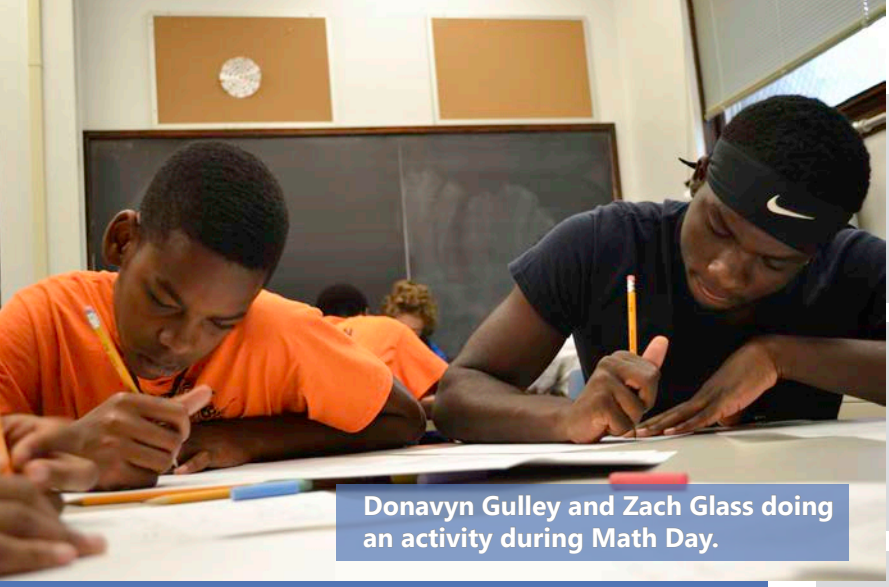
Elizabeth Field, another Math grad student, says she got involved with the camp because in high school, students don't really see how the math they're learning is used. "They don't necessarily see that it's something they can actually study for a job. They see it more as a means to an end," she says. "I think it's great for high schoolers to see that math and science are very different from what they're necessarily learning in high school. It's very cool for them to be able to see that it's something they can actually do or they're interested in."

Regarding the impact Math Day had on the students, Field adds, **"I hope that it's allowed them to see that math can be used in ways that they haven't necessarily thought about. Who would think that you would use math to model how a disease spreads? You don't realize that."**

Working with the combinatorics and number theory activity were Math PhD students Colleen Robichaux and Alexi Gorman. Combinatorics focuses on the patterns between various sets of numbers and evaluates similarities and differences between different sets of numbers. Students were taught about how numbers can be diagrammed to better see patterns between different numbers. Although the theory and way of thinking was new, as the students came to understand it, they found it interesting and enjoyable.

One instructor who worked with the combinatorics activity was second year Math PhD student Alexi Gorman, whose research is finding ways to make mathematical structures understandable in a way a computer might understand it.

Excited to work with high school students and high school athletes, she participated in Math



Donavyn Gulley and Zach Glass doing an activity during Math Day.

"I just wanted to experience what this is like to do this in the next level like in college." – Jaden Johnson on why he came to the I-STEM Summer Camp.

There are a lot of new things about science I never knew about because I'm not really into that type of thing. – Zach Glass on what impact the camp had had on him.

"Today [Mathematics Day], I learned how to do the special counting type of stuff. – Miller Calhoun about things he has learned at the camp.

Day because, "It's another good opportunity to make very sophisticated mathematics understandable to people who would benefit from knowing that this type of math is out there."

Colleen Robichaux, a second-year math PhD student interested in Algebraic Combinatorics says she participated in Math Day because she's passionate about education. She says her undergraduate degree was math with a concentration in secondary education. "So I'm passionate about education and enjoy working with students. I was excited to show them concepts they had never seen before in a digestible way."

Robichaux says it's important to bring high school students onto campus for an event like the I-STEM camp's Math Day so they might see math as a potential career. **"If not for this program, many of these students would never have any idea of what math research is or that there is a place for them in math research. This program is excellent in that it not only humanizes the researchers, but also is designed to appeal to students to show them potential career paths they might never have considered. Further, it is simply a fun way to get students thinking!"**

And Robichaux thinks the students learned that math is fun…and cool…and that they could do it!

"The students seemed very engaged," Robichaux reports, "and surprised that what we were doing is considered math. They seemed intrigued and had fun thinking through the activity and discussing with their peers. In the long term, I think this has shown students a more realistic view of what mathematicians do and how we work, as well as showing them that they are more than capable of doing some cool math."

UHS student Miller Calhoun gets help on an activity from Math grad student Alexi Block Gorman during Math Day.

DURING AERO DAY, STUDENTS' UNDERSTANDING OF AEROSPACE ENGINEERING SOARS

August 14, 2017

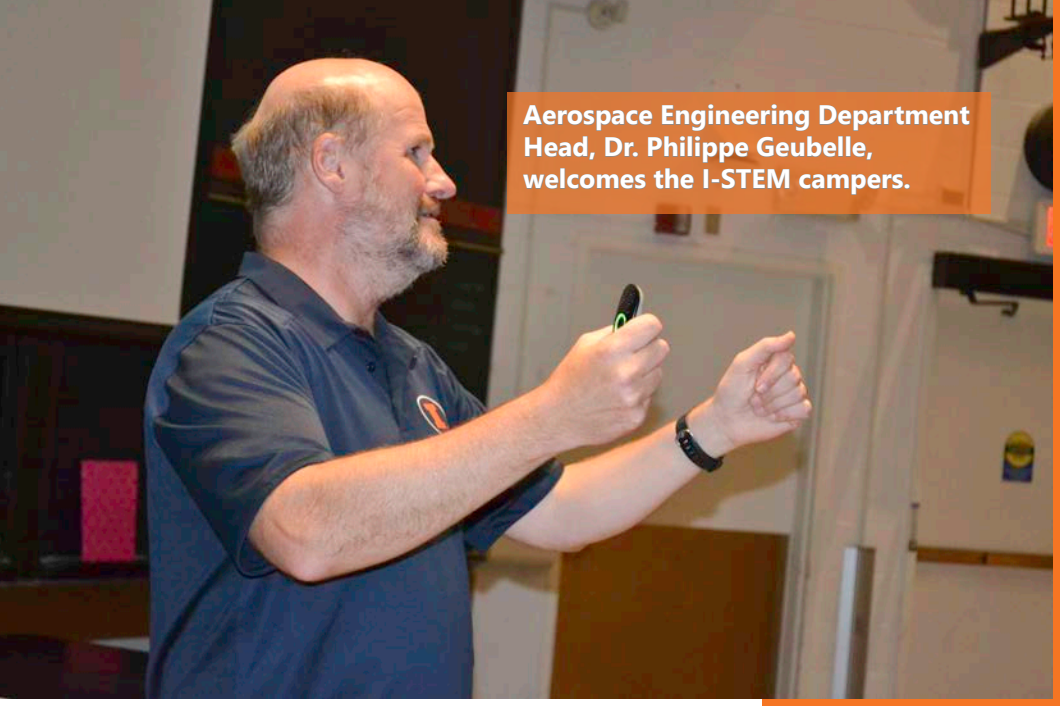
Amidst cheering, laughter, and lots of trash talking, the 27 UHS student athletes at I-STEM's first-ever, multidisciplinary summer camp were attempting to launch (some successfully, some not so successfully) tbalsa wood gliders and model rockets they had built. It was Aerospace Day on Monday, August 14. Students had learned some of the engineering and physics behind how airplanes and rockets fly: via several brief lectures, demonstrations, tours and lots of hands-on activities, they'd learned about flight mechanics and jet engines, the basics of rocketry, and experienced the wind tunnel and how the aerodynamics of various shapes are tested. Then, after designing and building their masterpieces, they came to the high point of the day—a chance to attempt to launch their aircraft.

The day began with a brief introduction about Aerospace Engineering from Bliss Professor and Department Head Dr. Philippe Geubelle, then a couple of Aerospace grad students shared about current research on the shape of airplanes and how to improve rockets.

The UHS students then visited Talbot lab, home of Aerospace Engineering. During a tour, students saw several Rolls-Royce jet engines used for teaching purposes, learning about some of the different designs and how they'd been uses in aircraft in the past. Students also visited the wind tunnel lab for a demonstration of testing the aerodynamics of different shapes, and saw how light and mirrors are employed to show the air movement created by those shapes.

The day wasn't just about instruction and tours. Students actually created their own aircraft. They made Balsa Wood Gliders which they "flew" in one of Talbot's long halls to test how they could change the way their plane flew by using different weights and positioning pieces in different ways.

Campers fly their balsa wood gliders in the hallways of Talbot.



Aerospace Engineering Department Head, Dr. Philippe Geubelle, welcomes the I-STEM campers.

After learning the basics of rocketry, the students then built their own rockets. To make the activity a bit more interesting, the instructors made it a competition: using the principles of aerodynamics and rocket design they'd learned, the students were to create a rocket that would fly the highest. And of course, each aircraft was unique, reflecting each student's personality. Then, toting the aircraft they'd built, they retired to Bardeen Quad to see if their aircraft would fly, and if so, how long and how high.

While some tested their rockets, others explored Alka-Seltzer Rockets. Combining Alka-Seltzer tablets and water in a film canister, the students then closed the lid and tipped them upside down until enough pressure built up to cause the main body of the film canister to shoot up into the air.

Elle Wroblewski, an Aerospace Ph.D. student, shares why events like the camp are important for high school students.

"When I was in high school," she explains, "my impression of engineering was only based off of what older people would tell me; I didn't have any first-hand experiences as to what that meant. An event like this shows students more in depth and gives them a better grasp as to what engineering is and shows them a practical application in math and science, whereas beforehand, I feel like it's a little more theoretical, or it's a bit more science-fiction based."

In fact, Wroblewski says much of what kids believe about space flight is based on what they've seen in movies and on TV and "not so much on the technical details," she admits. "**An event like this makes it more realistic, so that when they're thinking about careers, they have a better grasp as to what it actually is."**

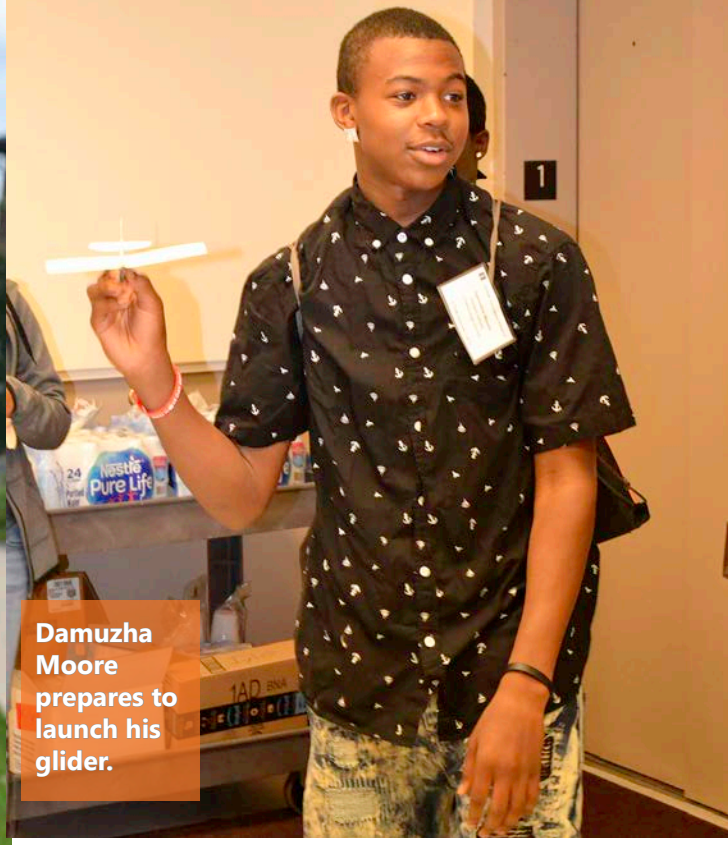
More importantly, Wroblewski says these types of events show them that they have what it takes to be engineers, refuting **"pre-conceived notions like 'I can't do that because I'm not smart enough,' because they've experienced that they are smart enough to do it. It's exciting and fun that they can achieve something as opposed to not knowing whether or not they could."**

Aerospace Day definitely impacted the UHS students in a positive way. For instance, Damuzha Moore indicated that Aerospace Engineering might be one of his choices for college.

Jeremiah Hamilton indicates that his favorite day was "Rocketry: I do this for Boy Scouts and other things like that."

Akierra Buford and Alarea Jackson making balsa wood gliders.

UHS student Bryson Tatum hopes his rocket will fly the highest during the competition on Bardeen Quad.



Damuzha Moore prepares to launch his glider.

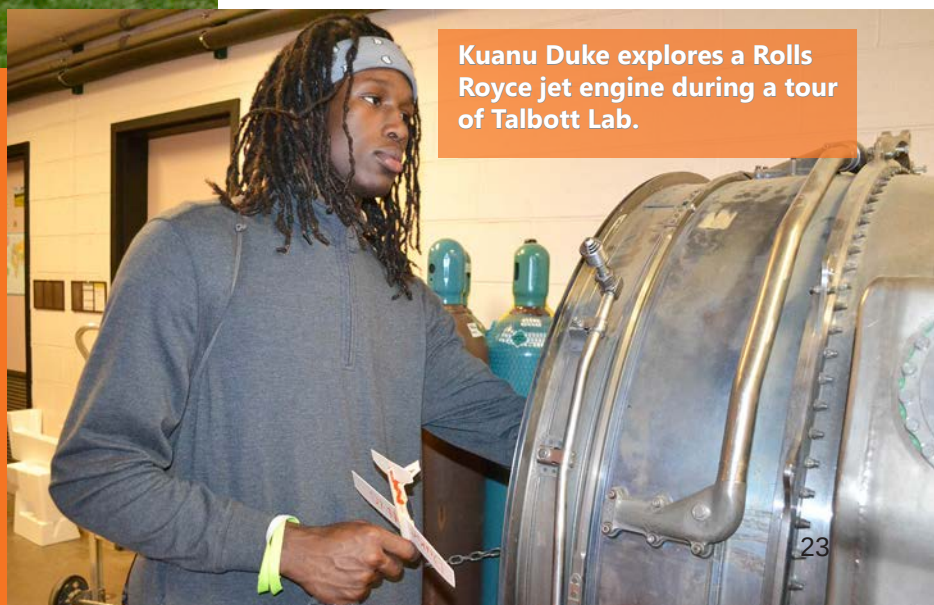
Participant Impact

"This [Aerospace Engineering] is probably my favorite thing right now, because it's focused all on the jet engineering, and the engines and all that." – Damuzha Moore

"[My favorite day was] probably today, [Aerospace Engineering] or the day we built some bridges because we did interactive stuff, like we were touching and building stuff." – Kuanu Duke

One I-STEM mentor, Kushal Geonka, was hopeful that Aerospace Day and I-STEM camp might influence some of the students to consider careers in STEM fields:

"I just hope at the end of these two weeks, some of them will decide on STEM careers, some of them will think of what they want to do in the future and that it may be related to science, technology, engineering, and mathematics."



Kuanu Duke explores a Rolls Royce jet engine during a tour of Talbott Lab.

UHS STUDENTS HAVE FUN ON CHEMISTRY DAY— FROM SOAP MAKING TO GLOW STICKS TO ICE CREAM

August 15, 2017

How cold do you like your ice cream? Just on the cusp of melting? Cold enough to start a major brain freeze? However you like to eat ice cream, using liquid nitrogen to freeze the ingredients will provide an instant, delicious dessert. And this was one thing the 27 UHS students discovered when they got to explore and test a number of chemistry-related topics on Tuesday, August 15, as a part Chemistry Day during the I-STEM Summer Camp from August 7–18. The camp was aimed at exposing under-represented minorities to many STEM fields and job opportunities, as well as building teamwork and lab skills.

UHS students work together to make their own soap.

The day started with a presentation on lab safety from Dr. Tina Huang and her lab assistant Stephanie Legare. Though some might question why this was necessary, Huang explains:

"You can experiment, but you also have certain parameters. That's for safety reasons. You can't just randomly mix stuff that we told you that you can't. Especially with chemistry, explosions can happen, you know, things like that. That's why you have to understand what is a healthy dose of the boundaries in which we have to work in a chemical lab." Although the day was all about encouraging curiosity and creativity, Huang also emphasized the need for proper lab safety for the well-being of everyone present.

So, after donning the tie dye lab coats and neon orange safety goggles, the students began experimenting. Huang had planned out four experiments to engage students.

Students mold their soap after mixing and stirring all the ingredients.

The first was saponification, the process by which soap is made. Students mixed, melted, and stirred the ingredients over a hot plate until they were left with liquid soap. As it cooled, the soap could then be molded into any shape the students desired. Many creative designs emerged, but the question remained: what was the point of the experiment? Huang wanted to show students that soap is actually just made up of fats and oils at its most basic level. With the addition of an alkali metal, the oils in soap are fundamentally changed so that they are able to latch onto and dissolve other oils. This is how soap cleans!

UHS student explores chemiluminescence, using chemicals to produce light.

Ever wondered how glow sticks can produce light without any heat? For the second experiment of the day, students explored the topic of chemiluminescence, which uses chemicals to produce light as opposed to combustion, which burns a fuel to produce both heat and light. The budding chemists' faces glowed just as much as their test tubes when the lights were turned off.

Document forgery is something one would normally hear in the plot of an action movie. For their third experiment, however, students experienced how scientists use chromatography, the process of determining the elements of a substance through a chemical process, to determine if documents have been altered or even if money has been forged. They started with melting the outer shells of M&Ms to figure out what colors are combined to create the rainbow of candies in every pack. For example, when melting brown, students discovered that instead of leaving a streak of the same color on the filler paper, the candy actually left streaks of red and blue. This process was carried over to pen inks, which were heated to a similar temperature to the M&Ms. The different types of ink flowed at different speeds, which is how it is possible to detect a forgery. If the ink from a suspect document flows at a different speed than a proven document, then the suspect document is proven to be a forgery.

To end the day, Huang had a special experiment planned to explore the topic of heat transfer, or how objects with different temperatures interact with one another. Students mixed whole milk, sugar, egg yolks, and a few other ingredients in a bag. Excitement swept around the room like a wave as the students realized that they were mixing the ingredients for ice cream! But how would they chill it? The day was almost over, and there was no freezer in the lab.

At that moment, Huang and Legare dragged in a big insulated tank filled with a mysterious liquid. After telling the students near her to stay well clear, Huang donned a pair of heavy duty protective glasses and goggles and opened the top of the tank, unleashing a blast of frozen air around the entire room. Students then handed their ice cream mixes to Huang and watched as they were dipped into the mysterious cold liquid and flash frozen to the perfect ice cream consistency. Huang explained that the liquid was actually a super-chilled liquid form of the gas nitrogen. Because it has such a low vaporization temperature, liquid nitrogen is cold enough to cause severe frostbite in a fraction of a second.

Handled properly, however, it can be used to create a delicious cooled dessert in no time at all!

According to Huang, activities like I-STEM camp's Chemistry Day are important to help students overcome their fear of certain STEM subjects:

"We hear from the students that in order for them to get interested, they need to start as early as possible," Huang explains. "Many students have a fear of STEM. Even though they want to major in it, they're sometimes afraid when they get to the college level. They view certain topics as really hard and difficult to master. I think if we get the attitude out and give them something fun that they can do, they'll know that it's not impossible and that learning also takes time. So then, we can have that attitude when they get college that it's going to be hard, but it's not impossible."

Regarding why she agreed to participate in the I-STEM Camp, Huang replied:

"I enjoy interacting with students in general. I have kids at the high school age, and I kind of understand how they think. I think I'm much more patient than other people when it comes to dealing with high school students. I kind of know how to push them a little bit, they can't just push me, because I will push back. I have my own rules, especially for their own safety. I see that a lot of the good kids ask really good questions, and some of them say that they enjoy certain parts of the things and this is something that they don't get to do very often."

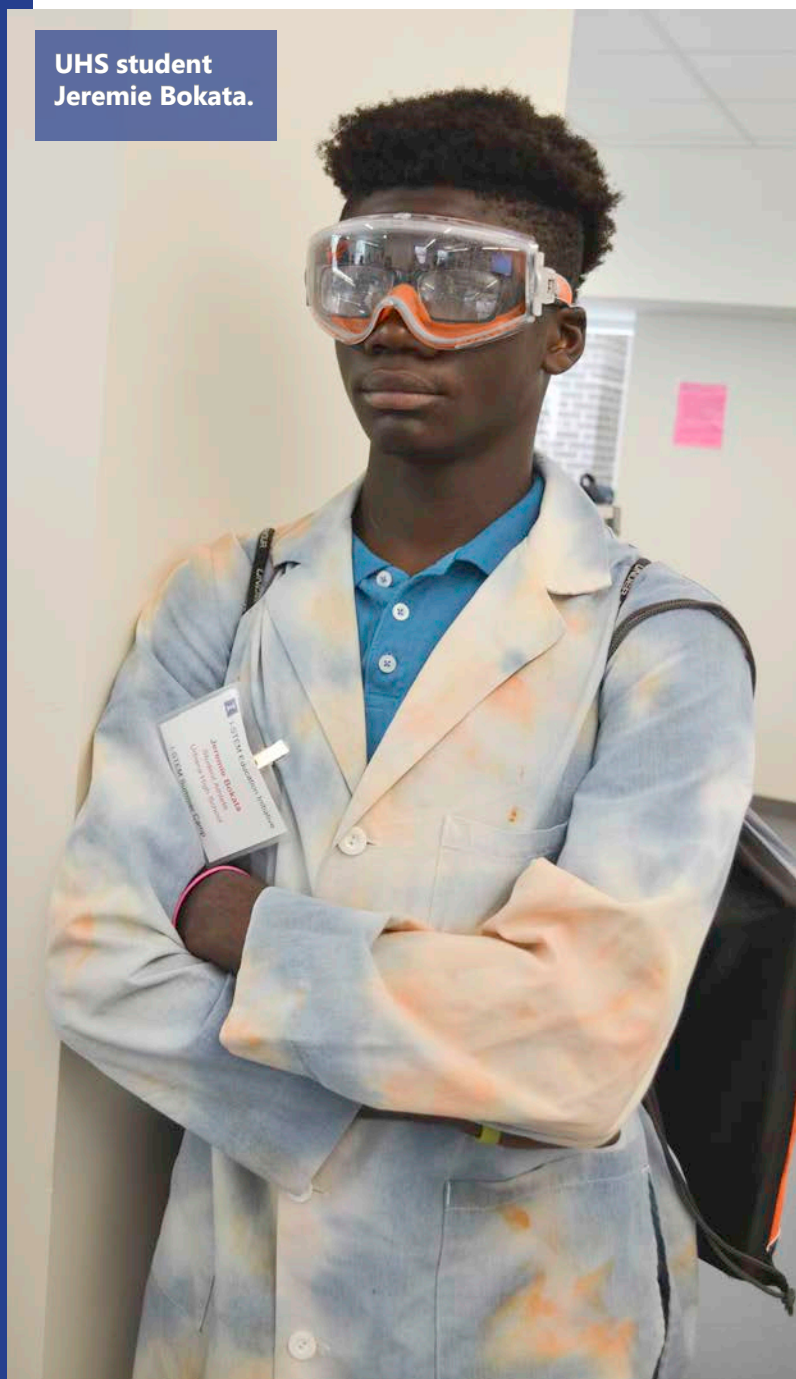
Regarding why she participated in the camp, Legare says she enjoys helping students learn about entirely new topics, "They enjoy it; it's fun to see them excited to learn something." She continues that camps like I-STEM's allow kids to experience what it could be like to work in a STEM field. They also allow students to dip their toes into how education at a higher level looks and gives them a sneak peek into the future if they do end up attending college.

With students munching their frozen desserts as they headed out the door, and conversations flying left and right as they chattered about their experiments with, soap, glow sticks, and M&Ms, the chemistry between the students was palpable. It appears that Chemistry Day was a resounding success.

Participant Impact

"To learn about science and all the fun stuff I can do with my career... I like the ice cream making and... the Chemistry day!"– Chris Cross on why he came to the camp and his favorite day

"Because she went right to the point, and it was just interesting." – Jeremie Bokata on why Chemistry Day was his favorite



UHS student Jeremie Bokata.

A team of UHS students perform a soap-making hands-on activity during Chemistry Day.

UHS STUDENTS EXPLORE COMPUTER SCIENCE, CODING, DURING I-STEM CAMP'S CS DAY

August 16, 2017

For students from a generation that cut their teeth on computer and electronic games, what could be more fun than creating their own? So on Wednesday, August 16, the 27 UHS students learned a bit about Computer Science and coding during CS Day. And to put what they'd learned into practice, they each created their own game or story on Scratch.

UHS student Trey Walker works on his Scratch project.

Computer Science is a field that can seem intimidating to many people, but I-STEM camp's CS Day helped to demystify the discipline. I-STEM camp mentor and ECE major Kushal Goenka played a key role in teaching the students about the many facets of CS, as well as helping them trouble shoot while doing some coding themselves. He began by teaching students how to code and exposing them to a variety of coding languages. Among the programs he introduced was one known as Scratch, a free online community where students can code and create their own games and stories or add on to those that other Scratch members have created.

After Goenka's presentation about what it means to code, students visited a CS computer lab and made SCRATCH projects of their own. Following an introductory session about Scratch, students logged onto computers in a CS computer lab to create their own projects. The students were quite engaged as they created their own programs and then got to present them to the other campers.

Following the Scratch project, students learned about real-world applications from CS PhD student Everett Hildenbrandt, who taught them that computer science is everywhere, explained about CS formal methods, then led them in a Magnet/ Copper hands-on activity.

At the end of the day, students were encouraged to reflect on all that they'd learned so far during the camp and to begin to tie every day of the camp together. Students were asked to think about the camp collectively and choose one word to describe their interaction with the STEM field. This word then became the basis of the group project they began working on in the afternoon. Their assignment was to put together a presentation and poster to be presented at Urbana High School to teach others what they had learned over the two-week camp. As students reflected on their experiences, they could hardly wait to come together to work on their project.

I-STEM campers engaged in coding their own Scratch program.

CS PhD student Everett Hildenbrandt shares a magnet/copper activity with the campers.

ECE sophomore and I-STEM mentor Kushal Geonka, who played a large role in the CS Day activities, shares why an outreach like I-STEM's camp is beneficial for high school students.

"I feel like they don't have opportunities to actually see what college life could be, since they aren't exposed to them," he says. "This gives them a hands-on opportunity to see how classes can be, colleges can be, and speak to professors. Yesterday, we had students interacting and eating lunch with a PhD professor who has been teaching here for 10 years, so he told them how classes are going to be, and how you have lectures and work on your own. It prepares them for what lies in the future and not what they've been doing for 10–12 years in school."

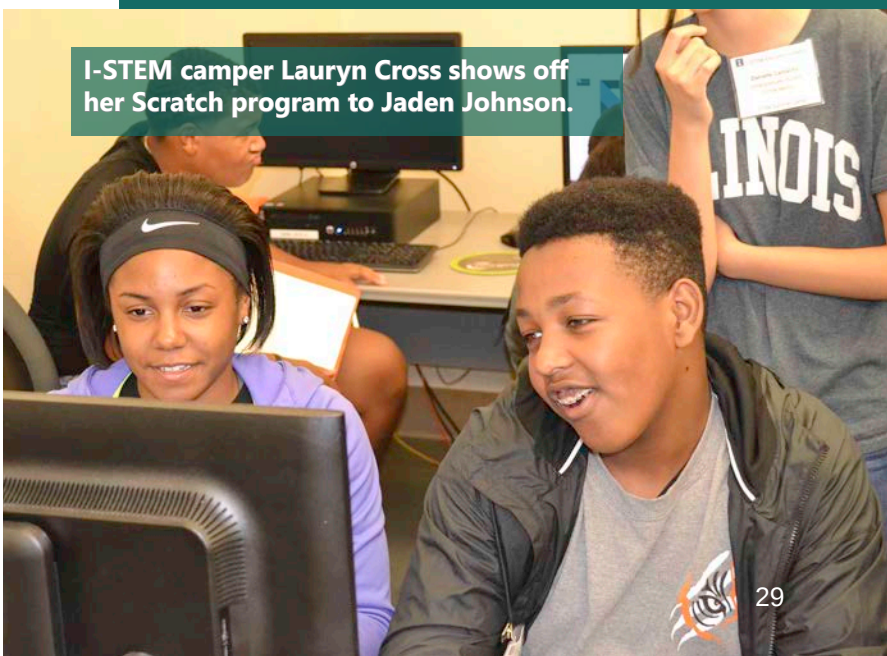
Goenka indicates that he participated in the camp because he was going to be here on campus for the two weeks following the end of his summer courses and was looking for something interesting to do.

"I love STEM," he admits. "It's what my interest lies in, so that's why I wanted to do this. I love talking with high school students. I think education is important, and encouraging them to get interested, and telling them about what STEM fields look like and the opportunities that lie further on."

Goenka also had an ulterior motive: he wanted to be involved with the camp in order to experience some of the activities himself. "I wanted to experience all of this as well…After I found out more about it and knew that we'd be going to different departments around campus, I was intrigued, and I wanted to do that myself. I'm really interested in NCSA; I've never been there; we get to go to the Blue Waters [Supercomputer]."

What kind of impact did the camp appear to be having on the students? According to Goenka, it was very positive.

"I think they are doing fantastic. Some of them are pleasantly engaged. They are asking questions and taking notes. I hope they go back and do research on this with all their binders and the notes that they've gotten from the professors and graduate students. I think it's good; I think they're learning a lot and I hope they will learn in the next week as well. They seem interested. Their faces light up when they interact with the students and they see feedback, so that's very good."



I-STEM camper Lauryn Cross shows off her Scratch program to Jaden Johnson.

Participant Impact

"I think it's impacted all of them. Listening to a lot of the lectures and lot of the pictures that they're seeing, the videos that they're seeing. All of them have been impacted. They haven't all been impacted by every single topic, but they've all been impacted. All of them have reached out and said they liked something that we've done. I think that was the most important part. It wasn't for all the students to like every topic, it was for you to like one topic or one thing within that topic, and I think that's definitely been done." – Shawn Hampton, UHS Academic Coach, on the camp's impact.

I think this is important for them because they need to see how the real world works. Right now in high school, I feel like they're just prepping them. But to actually see how lectures go, and see how things are on campus. If some of them want to go to U of I, for a STEM major, they already know where their classes are, and they're getting a view of what some majors will deal with. And so they're getting a sense of if they would like to do nanotechnology or work with computer science, or learn about the brain neurology. I think it's pretty important for them to get a sense of what they want. They're liking it, so I'm loving it. – I-STEM Mentor Amber Shields on the camp's impact.

I-STEM mentor Amber Shields prepares to experience Scratch.

"When I first came on campus, and we were doing the science trip that we did, I found it really interesting, and I kind of wanted to be a part of it. I like science and biology…. At first I was a little shaky not to go, but Coach Hampton pushed me to come here, and I think it was a good decision." – Sergio McClain on how he got involved in the camp


UHS Academic Coach Shawn Hampton watches as Lauryn Cross solders a circuit.

UHS STUDENT ATHLETES GEAR UP FOR MECHANICAL SCIENCE AND ENGINEERING DURING MECHSE DAY

August 16, 2017

A 24-year-old woman, Magdalena, who had bone cancer as a child and thus had an arm amputated needs a prosthetic in order to maintain her livelihood. This was the scenario presented to the 27 UHS student athletes as a part of MechSE Day. So the day's main hands-on activity involved making a prosthetic device. And while the students learned a bit about prosthetics and Mechanical Engineering during the day's events, they also learned some things about teamwork and what being a MechSE undergrad might be like.

Sharing their expertise on MechSE Day was a team of professors and students from MechSE: Associate Professor Elif Ertekin, Assistant Professor Mariana Kersh, and grad students Kazem Alidoost, Jason (Woojae) Kim, and John Shanley, who shared about current research in their field and the elements that go into making prosthetics. Then the high schoolers got to make a prosthetic of their own. And knowing that competing will always spur students on to greater achievement, the instructors divided the students into teams and made the activity a competition to see who could make the best prosthetic arm. The challenge? Design and build an arm for an amputee that operated using pressurized air from an air tank and included a hand with fingers that could pick up a pair of sunglasses…all in the shortest amount of time possible.

Trey Walker and Donavyn Gulley work to design a prosthetic.

Embracing the challenge, students tackled the project. And, of course, they thoroughly enjoyed the fun of competing. And while doing so, they also learned a bit about the thought processes behind designing prosthetics.

MechSE Assistant Professor Mariana Kersh instructs the campers on prosthetic design.

While working the kinks out of their design, the UHS students tried many different approaches (some worked, and others didn't) to design and build a working prosthetic. But if and when the teams reached an impasse, luckily, the instructors, quite knowledgeable about the mechanics of prosthetics, were right in the classroom with them, so students were able to pick their brains regarding what might make their devices work better. As a result, most of the teams came up with some innovative, working prosthetic arms.

MechSE grad student, John Shanley, watches as UHS student Jacob Barker helps design his team's prosthetic device.

What's the point of exposing younger students to a one-day clinic on prosthetics? According to MechSE's Mariana Kersh, it's beneficial to bring high school students to events like this on campus in order to expose them to engineering. **"Depending upon where they're coming from, they may or may not have been exposed to the applications that are available within engineering. It has to start early."**

She adds that it's also important that students at the high school level learn that engineering is "a really broad and interdisciplinary world these days." Plus, she believes that exposing young people to the myriad applications and career opportunities within the different engineering disciplines (such as prosthetics?) might increase the number of students, especially young women, who want to be involved. She recommends starting early to show younger students, especially girls, "that there are other options other than just the typical guy working on an airplane."

Kersh says events like the camp also serve as a "light at the end of the tunnel" and help students "learn that there is this bigger picture."

She says that high school students "have to come in with a bit of passion and a bit of curiosity and inspiration about the things that they want to study. A lot of them may know that they're good in math or that they like science, but they don't really know where that's going to take them," she continues. Kersh envisions the event as helping to show them the possible routes early, and helping to keep them on track.

Plus, she insists that in order for students to avoid pitfalls and successfully navigate college with its ups and downs, they need to have a clear vision of what they want to achieve, and why. She believes that having the goal of helping others as part of their motivation can help to keep students anchored. **"It's not about the degree per se," she says, "it's about what you're going to do with it in order to help" that can help them to get through distractions and getting discouraged when they don't do well on a test, because they've learned that 'There's this bigger picture that I really learned about,**

Ertekin poses with the team that won the Prosthetic Device competition.

and that's what is driving me.' It's hard to have that vision as an 18-year old," she admits.

MechSE grad student John Shanley agrees with Kersh that it's beneficial to bring high school students onto campus to events like the camp to familiarize them with the possibilities open to them: "It's great to open their eyes up to the opportunities that are out there.

Plus, he enjoys giving high school students opportunities he wishes he had had when he was their age. **"I had no idea what biomechanics was," he recalls. "I was someone who knew that I wanted to be an engineer, and I still didn't know about it. It's great to see what opportunities are out there, especially for people like myself a few years ago who don't know what the options are. I was good at math, and I didn't know what to do with that. Well, this is one of the applications that you can have, so it's a good start."**

Shanley intends to go into industry in bioengineering once he completes his Masters' degree. His goal is to work for a company that makes devices that help people and improves the quality of their lives. "First, I just like the idea of being able to help someone and secondly, and I think it's the industry with the most interesting problems. You can go ahead and continue to optimize things that people have been working on for centuries now, like mechanical

Elif Ertekin watches as Christopher Cross works on his team's prosthetic.

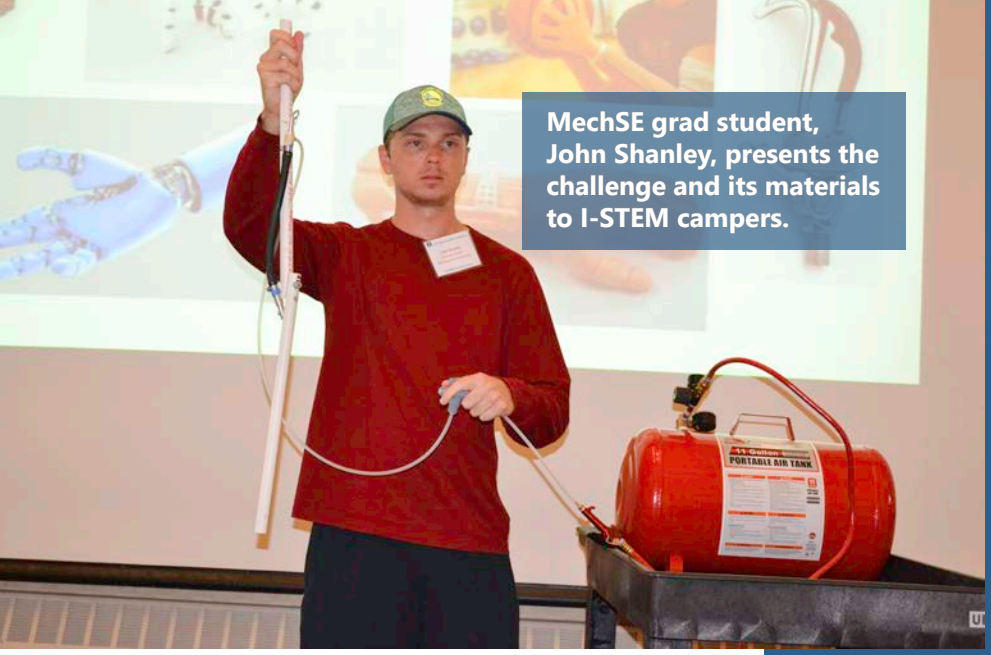
engines and systems like that, and there are people making real break-throughs there too, and that's cool. **But there's so many different problems, and there's such a diversity of places that you can apply your skills to really make a difference, and I just think that there's a greater amount of opportunity there and that's just exciting to me."**

Kazem Alidoost, a fifth year MechSE PhD student, who would like to go into academia once he gets his degree, has been involved with the MechSE summer camp for two years. Plus, this past spring, he took ENG 599 with Professor Ertekin, Sharlene Denos, Joe Muskin, and others, and was really impacted. "That was just a really great class," he acknowledges. "I think I'll take it again this next spring just to go back to the high school, because I think we spent a lot of time talking about how important outreach is and the beneficial effects that it can have."

He was involved in outreach in his own community where he grew up, but now would like to make a difference here too. **"I think it's important to try to make an impact where you are and identify with your current community."**

Alidoost also praises the *Illinois* faculty and students who volunteer for the various outreach programs, saying, "I think having students and faculty here at *Illinois* who do this because they care means a lot to the people."

UHS athlete Kyartan Earvin shows off his team's finished product.



MechSE grad student, John Shanley, presents the challenge and its materials to I-STEM campers.

"Growing up," he acknowledges, "my parents were always talking about going to college and studying engineering or medicine, and so I think for me, it was always a natural thing."

Since coming to *Illinois* to school, he's discovered that most of the people he's met were not that fortunate. "So I think it's just important to bring people so they can see what's out there," he says.

He also believes activities like I-STEM's camp are good because they make youngsters comfortable and show them that they too can do STEM.

"They feel like they can come here, and they see that they are capable, and that they can do it. Just to show that everything is accessible to them, that we want them here, and that they can accomplish whatever they want."

Similarly, Assistant Professor Elif Ertekin hopes to help the students see themselves here, doing what she and the others are doing. "I think that being involved in camp activities and getting other people excited about why it is that we do what we do and showing younger students who will be next generation of engineers what we do so that they can start to imagine themselves also here and doing the same thing, is really important and valuable."

And according to Ertekin, that was one of her main goals in doing the camp—to help the high school students see themselves doing engineering.

"A lot of the modern research shows that in order to be able to choose a certain career path, you have to be able to envision yourself being that person and doing that job in the future. So right now, by trying to give the young people hands-on experience, working directly with graduate student researchers and faculty, I think that really helps them imagine themselves doing this as a part of their careers in the future."

Ertekin adds that she also likes to do activities like the I-STEM camp because they help her remember why she fell in love with engineering in the first place.

"I do things like this because I think it's really important to remember the big picture of the work that we're doing in our day-to-day research. When you are doing research all the time, it's easy to sometimes forget why we got involved in the work that we're doing."

Participant Impact

"There are a lot of new things about science I never knew about because I'm not really into that type of thing... it is pretty good. I learned a lot of new things about atoms and all that." – Zach Glass

MechSE PhD student Kazem Alidoost coaches camper Alarea Jackson through prosthetic design.

DURING NCSA DAY, UHS STUDENTS EXPERIENCE DATA VISUALIZATION, SUPER COMPUTERS, AND RESEARCH

August 18, 2017

UHS students enjoying a tour of the National Petascale Computing Facility.

Where's the Popcorn? That was all that was missing when 27 UHS student athletes sporting 3D glasses lounged in the cushy, theater-quality seats of NCSA's viewing room to preview some of the Advanced Visualization Laboratory's (AVL) high-resolution, cinematic-quality, 3D data visualizations. They were at the National Center for Supercomputing Applications for NCSA Day, the final day of the first-ever, I-STEM Summer Camp: A Multidisciplinary Program. During the Friday, August 18th visit, students also toured the National Petascale Computing Facility and met the Blue Waters Super Computer up close, and also discovered more about what NCSA does while attending a panel discussion hosted by several NCSA researchers and programmers.

NCSA Managing editor, Barbara Jewett, and Education and Outreach Coordinator, Olena Kindratenko, welcomed the student-athletes to the NCSA. With regards to why she and her NCSA colleagues participated in the camp, Jewett admits:

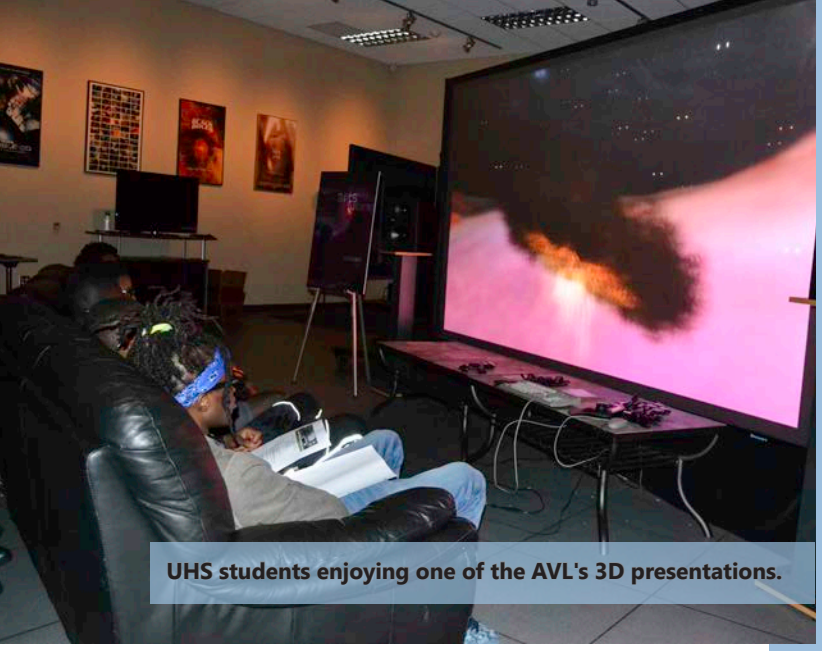
"We love having students here. And we love sharing what we do."

During the AVL presentation, students experienced several documentaries that, with the help of Blue Waters, used huge data sets, such as those obtained through the Hubble Telescope, to produce visualizations of the data. Some of the documentaries were even narrated by Hollywood celebrities Leonardo DiCapprio and Benedict Cumberbatch. Plus, students saw a documentary called *Seeing the Beginning of Time* that explored "hundreds of millions of years of galactic evolution."


AVL Multimedia Technology Specialist, Jeff Carpenter, talks to a camper about NCSA's scientific research.

Barbara Jewett touts the benefits of NCSA's AVL:

"Our advanced visualization lab does awesome work. To come here and show things in 3D that are real science, that's pretty awesome. And that just turns people on and interests them. So it's a fun way to show people what science could do."



UHS students enjoying one of the AVL's 3D presentations.

Jeff Carpenter, a Multimedia Technology Specialist at the AVL, explains how their visualizations differ from those created in Hollywood. “It's not just ‘We think this’ or ‘We think that’ or that we made this up. What we do differently than they do in Hollywood, our stuff, while we use the same tools, are not necessarily as flashy as the things you're going to see in Guardians of the Galaxy or anything else, like Star Wars or whatever. That's an artistic thing. It may be made to look like real science. But we're using the actual data. That's our basis.”

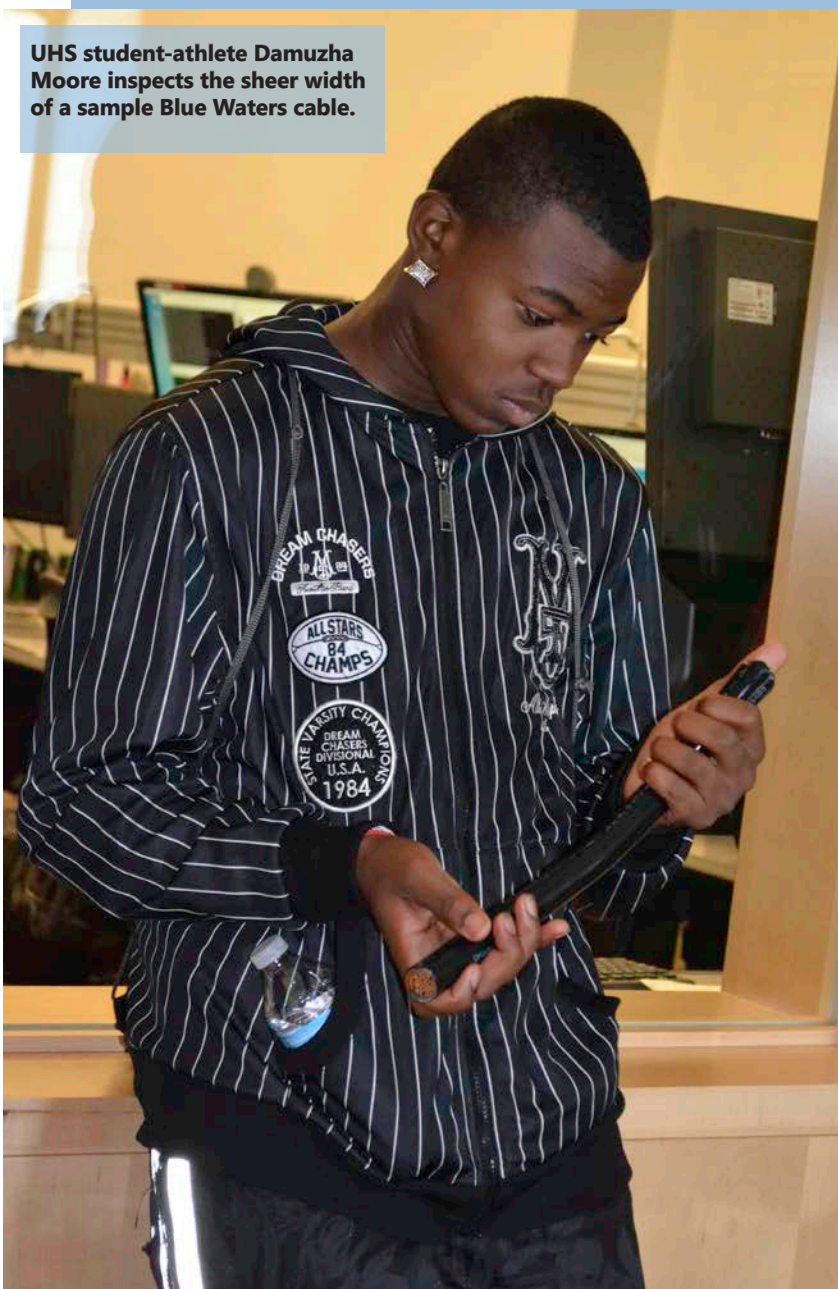
Next students attended a panel featuring several NCSA scientists who shared more about some of the research going on there: AVL research programmer Kalina Borkiewicz; Eliu Huerta, a Physics and Astronomy Research Scientist in the Relativity Group; Dan Lapine from the Scientific Computing Services Group; and Adam Slagell of NCSA’s Cybersecurity Group, After lunch, students toured the National Petascale Computing Facility to experience Blue Waters, one of the most powerful supercomputers in the world.

Jewitt indicates that one of the benefits of taking young people to see the facility’s super computers is to expose them to possible careers: to “show them what you can do in the field of computer engineering, computer programming, software engineering; there's even a thing called storage engineering and network engineering to help people do the internet, to save their data."

"So there's so many ways you can be involved in science, engineering, computer science, without actually being a hands-on scientist studying a deep scientific subject,” Jewitt adds.

Jewett adds that events like I-STEM’s camp are important: **“Because you never know what is going to change someone’s life. And it is very important that we encourage young people to explore careers and the other opportunities that are available to them in the areas of math and science. And by exposing them to what is available on campus, we can stimulate their interest.”**

As an example, Jewitt shares an anecdote about her daughter, a chemistry Ph.D. student. “She got her interest in chemistry from freshman chemistry the very first day,” Jewett explains, “when the instructor poured two solutions together, and they turned pink! Pink is her favorite color and she was very interested in exploring what you could do with things that made pink. And now she's very involved in chemistry education.”



UHS student-athlete Damuzha Moore inspects the sheer width of a sample Blue Waters cable.

NSCA Managing Editor, Barbara Jewett, presents to the campers during their tour.

"You just never know," she continues. "It could be they go on to be a scientist or be an engineer, or perhaps join an organization like NCSA and help promote science through visualization, through data management, through communicating science either as a science journalist or as a visualization programmer. There are so many opportunities and things you can do with science."

"Plus, let's face it," she adds, "science affects our daily lives. All the food we eat; all the products we use; the air we breathe; the science that grows things. So science is in everything. So just the exposure to it and getting people involved in science is really important."

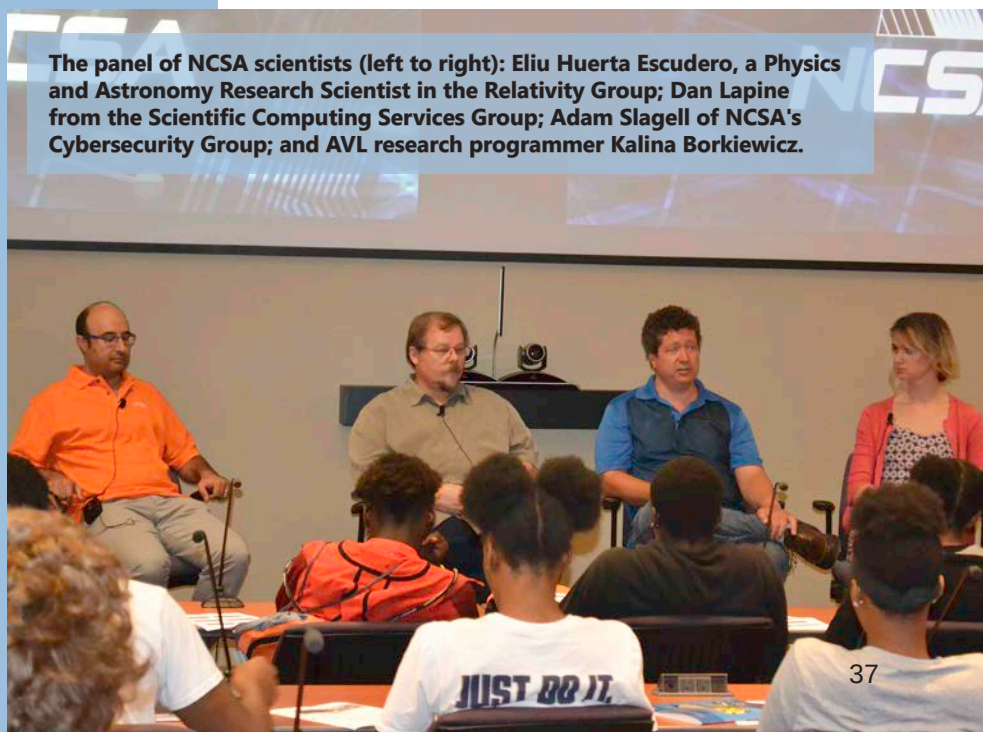
The AVL's Jeff Carpenter echoes Jewitt's sentiment about communicating the importance of NCSA's scientific research: "We're showing the things that are in the science. And by being able to communicate the science to people, hopefully they'll have an understanding of what goes into that research—that it is real, that there is value to it. And we should try to understand not only the universe, but our place in the universe and how we can maybe have an impact on how it has an impact on us."

Carpenter adds that it's important not only for kids, but to show a larger audience why the science done at NCSA is important, and how what they do makes a difference. He stresses the importance of having an educated populous:

"If people understand science, they're not going to be taken in by pseudo-science, fake science, or bad information. I think that's where it's important, if you can show people that it's real, if you can get them to understand, this is data; it's done in a scientific way."

Carpenter adds that he really believes in the STEAM aspect of STEM. (In STEAM, Art is emphasized, along with Science, Technology, Engineering, and Mathematics.) He says that at the AVL they call themselves a Renaissance team, in the same way that Leonardo Da Vinci was considered to be a Renaissance man, stressing the importance during the Renaissance of both technology and art. He claims that without the vehicle of art, **"You couldn't communicate the technology," but also stresses the importance of the technology: "If it's just art, there's not function behind that. Both are increased and are better when combined together."**

Carpenter also believes that effectively portraying the scientific data requires using both creativity and intuition: **"Pure science without looking at it from an artistic or creative side is less than when together because you can use your intuition. Creativity is not just drawing and painting visuals. Creativity is also the spark of imagination where we can look at the data and we can understand it in a different way through our imagination, through our creativity. 'Well, what is happening? Why is that happening?' It's that intuition, that spark of bringing it to the data itself. So then that's where the art comes from and the benefits."**



The panel of NCSA scientists (left to right): Eliu Huerta Escudero, a Physics and Astronomy Research Scientist in the Relativity Group; Dan Lapine from the Scientific Computing Services Group; Adam Slagell of NCSA's Cybersecurity Group; and AVL research programmer Kalina Borkiewicz.

Participant Impact

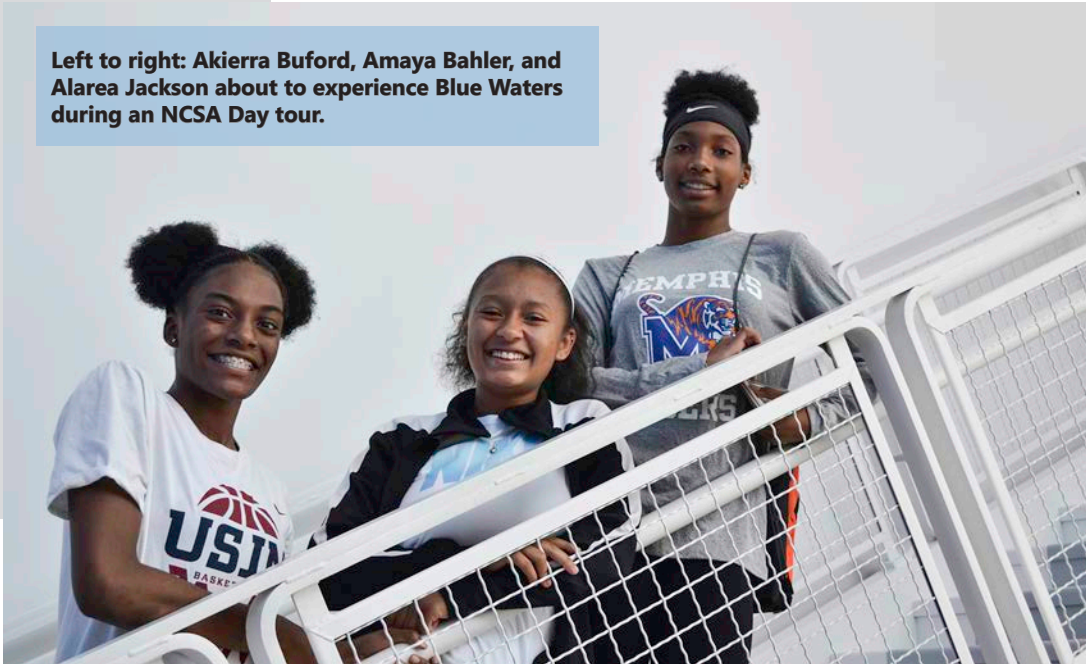
"I learned a bunch of things. One of the most important things I learned is to be open minded. Be open to other things." – Jeremie Bokata on how the I-STEM Camp impacted him

"I wanted to experience all of this as well. I wanted to go around after I found out more about it and knew that we'd be going to different departments around campus, I was intrigued and I wanted to do that myself. I'm really interested in NCSA; I've never been there; we get to go to Blue Waters." – Kushal Goenka on why he participated

"I know it's been positive just by the feedback that they've been giving. And the smiles on their faces. They come back every day. And that's the biggest thing, that's how I measure success for this camp, that they're coming back every day. And I know they're telling their friends about it and posting it to social media. But most importantly, I know that they're bringing it to their homes. They're telling mom and dad and grandma and grandpa and brother and sister. They're getting them excited about their education. It's revitalizing their education. It's rejuvenating their education. And now they get to see the big picture of why they're doing chemistry and math and all those other subjects in their high school. They can see what it's going to come out to be when they get to college." – Coordinator Joe Cross on the impact of the camp

Left to right: Jeremie Bokata and Kushal Goenka experience Blue Waters during an NCSA Day tour.

Left to right: Akierra Buford, Amaya Bahler, and Alarea Jackson about to experience Blue Waters during an NCSA Day tour.



DR. JOE CROSS SEEKS TO EMPOWER DIVERSE YOUTH DURING I-STEM SUMMER CAMP

A former student-athlete of the men's basketball team at the University of Illinois (1999–2001) and current researcher in education policy, organization and leadership, I'm often asked to give talks to groups of parents, teachers, and coaches about collaborative ways to empower our diverse youth. As a product of the institution, it is my desire to provide youth in our community the opportunity to engage with the amazing sciences being conducted at the University of Illinois. The I-STEM Summer Camp addressed this issue by providing the space for these athletes to immerse themselves in the type of educational experiences that are available to college athletes on the *Illinois* campus.

The coordination of a two-week summer camp between I-STEM and ten different STEM departments and units on campus to converge scholarly activity sessions for 27 high school athletes was a very challenging experience for everyone involved. We developed an active, hands-on learning experience for these young athletes which: (1) exposed them to various STEM majors to increase awareness of possible career/college paths; (2) built teamwork and laboratory inquiry skills in a variety of STEM disciplines; and finally (3) allowed students to directly experience ongoing STEM research to take back to their high school classrooms.

I believe that student athletes are an under-represented group in STEM fields, but present a distinct skill set (leadership, commitment, motivation, drive, teamwork, etc.) that can be used to address significant problems in science and society. This initiative directly speaks to the nationwide need to engage this unique group in the innovative, multi-disciplinary research within STEM. It is critical that today's student-athlete engagement has direct familiarity with STEM research as a life-long venue to intrigue their intellect and guide in their academic and athletic success today and far into the future. The core content fully captured the imagination and creativity of the participating student-athletes, opened completely new ways for them to think about sport and science, and fundamentally enhanced their ability to make personal choices regarding their pursuit for higher education. Most important of all, we had fun!

"It's beneficial because they get to see what it's like on a college campus, and they get to see what it's like to interact with faculty and professors who are really prominent in their fields. Today we were at chemistry; yesterday we were at aerospace engineering. And they get to meet with and interact with professors and directors and graduate students. So they won't be afraid to talk to these individuals when they get to college and interact with their peers, because these are their peers, and it's a different environment. And we're doing research, and we don't want them to be afraid of the word research." – Joe Cross, Ph.D., I-STEM Camp Coordinator, on the impact of the camp.

Dr. Joe Cross (left) enjoying Jeremiah Hamilton's work during Math Day.

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I-STEM Education Initiative

313 Noble Hall, 1209 S. 4th Street, Champaign, IL 61820

www.istem.illinois.edu; phone: 217.333.9625; fax: 217.244.3949