

“Thanks to my PROMES experience I see students all the time, I hear their stories, but it was important to actually conduct a research study that rises above the anecdotal. We need to analyze the data gathered and really understand the problem.”

- JERROD HENDERSON

UH Professor Seeks Broader

'WINDOWS OF OPPORTUNITY'

for Black Male Engineers

BY RASHDA KHAN

Producing graduates with STEM – science, technology, engineering and mathematics – capabilities continues to be a vital issue for the future of the United States. Growth in engineering and other STEM occupations is vastly outpacing the supply of skilled workers.

Meanwhile, African-Americans continue to be underrepresented in the STEM workforce and in academia. According to the “2017 Women, Minorities and Persons with Disabilities in Science and Engineering” report by the National Science Foundation, white males constitute about 49 percent of the workers in science and engineering jobs, while African-Americans make up about 3 percent of that workforce.

Just under 8 percent of science and engineering doctorates were earned by underrepresented minorities in 2014. A paltry 2.5 percent of engineering faculty nationwide are African-American males.

Jerrod Henderson, instructional assistant professor at the UH Cullen College of Engineering, has joined forces with Erik Hines, associate professor of counselor education at the University of Connecticut’s Neag School of Education, to work on a solution. They’re both co-principal investigators of a new project titled “Collaborative Research: Windows of Opportunity – Understanding Black Male Engineers in the Pursuit of Advanced Degrees,” which received nearly \$400,000 in funding over three years from the NSF.

“I’m really interested in seeing an increase in the number of underrepresented folks in STEM,” said Henderson, who was the only African-American faculty in the chemical engineering department at the University of Illinois at one point. “I don’t want to always be the only one.”

Henderson’s research focuses on engineering education and the participation of underrepresented groups in the STEM fields. He is the director of the Cullen College’s Program for Mastery in Engineering Studies (PROMES), which has received national recognition for its efforts to increase student success and retention in STEM through mentoring, teaching, research and other programs and initiatives.

“Thanks to my PROMES experience, I see students all the time. I hear their stories. But it was important to actually conduct a research study that rises above the anecdotal,” Henderson said. “We need to analyze the data gathered and really understand the problem.”

The two researchers will be studying the experience of African-American male students in the context of three different types of institutions: Prairie View A&M University, a historically Black university; University of Connecticut, which is a primarily White institution; and UH, which is a Hispanic-serving institution.

“People throw that word around – diversity – but there are places that are diverse but not inclusive,” Henderson said. “UH happens to be a diverse and inclusive place from my ex-

perience. But I’m interested in what happens to students of color once they’re in engineering in different environments.”

The project is focused on three research questions:

1. What factors influenced Black males to pursue graduate degrees in engineering?
2. What assets and strengths are possessed by Black males who persist or plan to continue in engineering beyond undergraduate studies?
3. What role does academic self-concept and engineering identity play in the intent to pursue advanced degrees among Black males?

Henderson hopes their research data will help recruitment and retention efforts of educational institutions and help create real upward movement in getting underrepresented groups involved in STEM opportunities. “We’d like to produce or disseminate best practices for engaging this sub-population of underrepresented people to think about graduate school,” he said.

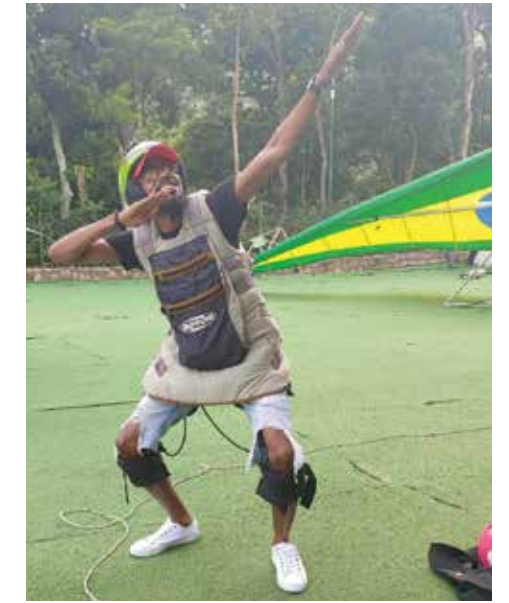
In the last year of the grant, the researchers are planning to bring a conference centered on African-American males and higher education in engineering to the University of Houston campus. 🌟



GOING PLACES:

UH PROMES is Tackling Global Challenges

By RASHDA KHAN



While many people dream of seeing the world one day, a group of UH Cullen College of Engineering students recently returned from Brazil as part of the first engineering faculty-led study abroad experience through the Program for Mastery in Engineering Studies (PROMES).

The students' learning adventure included leaping off a cliff to go hang-gliding, visiting the famous Museu Afro Brasil as well as a favela (a Brazilian shanty town), learning to speak Portuguese and presenting their research and creative solutions inspired by the National Academy of Engineering's Grand Challenges to the faculty and students of the University of Sao Paulo among other things.

The NAE's 14 "Grand Challenges," put together by a committee of global experts, are those that impact the world and need to be addressed. These include: making solar energy economical; providing energy from fusion; developing carbon sequestration methods; managing the nitrogen cycle; providing clean water; restoring

and improving urban infrastructure; advancing health informatics; engineering better medicines; reverse-engineering the brain; preventing nuclear terror; securing cyberspace; enhancing virtual reality; advancing personalized learning; and engineering the tools of scientific discovery.

The aim of the PROMES study abroad trip was for students to "understand the Grand Challenges that Brazil faces in the context of Brazilian culture, technological advances, economy, workforce and its K-12 population," said **Jerrod Henderson**, director of PROMES, who led the group of 24 students on the trip.

He wanted the students to see real-world situations and come up with solutions, as well as take advantage of the cultural opportunities offered by the trip.

"It was unique being immersed in another country and seeing how our work can impact the world," said Emilio Ames, a mechanical engineering junior at the

Cullen College, who has always dreamt of traveling abroad and jumped on the opportunity. He challenged himself to speak a little more Portuguese each day he spent exploring Brazil.

"We visited some amazing laboratories that opened my mind to all the possibilities to take my skills international," Ames said. "I hope I can do some work outside of the U.S. one day."

Stephanie Fose, a junior majoring in chemical engineering, shared her favorite experience from the Brazil trip: "Spending the afternoon on the Copacabana beach in Rio as a group, surrounded by the ocean with a view of the mountains and the Copacabana strip, and then going to dinner at a churrascaria. This was after visiting a laboratory focused on ocean engineering."

Fose said the trip was a chance to grow both her academic and cultural knowledge and be global citizen.

The aim of the PROMES study abroad trip was for students to understand the Grand Challenges that Brazil faces in the context of Brazilian culture, technological advances, economy, workforce and its K-12 population

"Given the opportunity, I would one-hundred percent participate in it all over again," she added.

Henderson is already working on the next PROMES study abroad trip. He recently received a \$20,000 Access Grant from the Council on International Educational Exchange (CIEE) to for a faculty-led program to Ghana and plans to go next year with a group of 20 students.

The PROMES program was selected by CIEE for "its innovative focus on the role engineering will play in solving global challenges like access to clean water and healthcare, renewable energy, and more" in the context of a developing nation.

Study abroad opportunities are not only fun and educational, but also invaluable "life-changing experiences," Henderson said.

"There is significant research linking increased student success and retention to students who have experiences such as learning abroad and undergraduate research," he said. "I want to help provide as many opportunities to our students as possible. In addition, engineering is a global industry. I think experiences like these will give our students a competitive edge."

The Program for Mastery in Engineering Studies (PROMES) was established at the University of Houston in 1974 for

the recruitment, retention and academic development of Hispanic, African American and Native American students in the Cullen College of Engineering. Today PROMES is open to all students in the college, and its mission is to provide a positive learning environment that supports the needs of undergraduate students.

"I am excited to see faculty incorporating initiatives from the Office of the Provost, such as the Global Citizens Credential, into their own programs," said Paula Myrick Short, UH senior vice president for academic affairs and provost. "Last year, PROMES won the Regent's Academic Excellence Award for uniting academic support with a sense of community for these students. It is heartening to see the progress they have made over the last year." 🌟

BREAKING DOWN WALLS TO BUILD FUTURES:



**REAL-LIFE SUPERHEROES
INSPIRE BOYS TO BE
STEM LEADERS**

“

**MENTORS ARE
ABSOLUTELY LIKE
SUPERHEROES.**

”

- JERROD
HENDERSON

If Houstonian Juan Becerra, a father of three boys, could have any superpower, it'd be to look into the future. He'd use it to do everything right and lift his boys up as high as possible. He believes that all parents dream of giving their children a better life than their own.



His father had a sixth grade education and his mother reached only second grade. "Growing up I always knew my father wanted us to be better off and the same thing applies to me," Becerra says. "I was lucky to graduate high school. I did better than my father and my mother, but now I want [my kids] to do better than I did. I want them to grow."

He hopes they will go to college, apply themselves and gain the skills and knowledge needed to ride the wave of technological advances to future opportunities.

To make that future happen, Becerra and his 10-year-old son, Joshua, are participating in an innovative after-school program at the University of Houston Charter School called the St. Elmo Brady STEM Academy – made up of the highly-prized disciplines of science, technology, engineering and mathematics.

The Academy, which aims to engage underrepresented minority boys in STEM activities and issues, is named after St. Elmo Brady, the first African-American man to earn a Ph.D. in chemistry from the University of Illinois in 1916. He went on to teach and mentor several students during his lifetime.



⚡ ABOUT ST. ELMO BRADY ⚡

The St. Elmo Brady STEM Academy is named after the first African-American in the U.S. to receive a Ph.D. in chemistry. Born in Kentucky, St. Elmo Brady earned his doctoral degree from the University of Illinois in 1916. As a student, he was a member of Phi Lambda Upsilon, the chemical honor society, and was among the first to be included in Sigma X, the Scientific Research Society. Brady went on to teach and conduct research at Tuskegee University, Howard University and other colleges. He strived to build strong undergraduate curricula and boost fundraising at historically Black colleges. Brady was also known for advancing the field of spectroscopy.



*This page: Juan Becerra and his 10-year-old son, Joshua
Opposite page: Jerrod Henderson (left) and Rick Greer*

The original St. Elmo Brady serves as a superhero inspiring hope and possibility for the two founders of the program: **Jerrod Henderson**, instructional assistant professor at the UH Cullen College of Engineering, and **Rick Greer**, a graduate student in the UH College of Education.

ORDINARY PEOPLE DOING EXTRAORDINARY THINGS

The UH St. Elmo Brady STEM Academy encompasses a partnership across disciplines and programs, allowing different skills, expertise and resources to work together for a common goal. It brings together the University of Houston's Cullen College of Engineering, College of Education, College of Natural Science and Mathematics, Charter School and teachHouston, a program that prepares students to teach math and science.

University of Houston undergraduate and graduate students help create the curriculum, teach the boys twice a week in after-school

lessons and work with them on Saturdays for hands-on sessions. In return, UH students are gaining teaching experience and getting the opportunity to make a difference in the local community.

“It’s a great partnership, which not only lets the fourth and fifth graders grow, but also our UH students,” Henderson says. “It expands everyone’s world.”

Role models are at the root of the Academy’s success and another unique component. The program stresses the involvement of role models, preferably the boys’ fathers, grandfathers or other close male relatives. In addition, the college students who are involved in the program also act as role models and mentors.

“Mentors are absolutely like superheroes,” says Henderson, who knows the value of a good role model from personal experience.

From sixth grade through graduating high school, Henderson participated in a program called Mentoring and Educational Network for Technical and Organizational Readiness (MENTOR) in North Carolina. Thanks to MENTOR, Henderson attended his first Black Engineer of the Year Awards, decided he wanted to be an engineer and met his personal mentor, Nathaniel Vause.

When Henderson graduated with his doctorate in chemical and biomolecular engineering from the University of Illinois, Vause – who is the founder of MENTOR – drove up from North Carolina with three students he was mentoring at the time to celebrate the event.

For Greer, who says he grew up without a male role model, the mentor/mentee relationship between Henderson and Vause is a major inspiration behind the St. Elmo Brady Academy model.

“They [Henderson and Vause] still talk to this day. If we can cultivate that bonding and mentoring in our program, that would be perfect,” says Greer.

BREAKING THROUGH BARRIERS

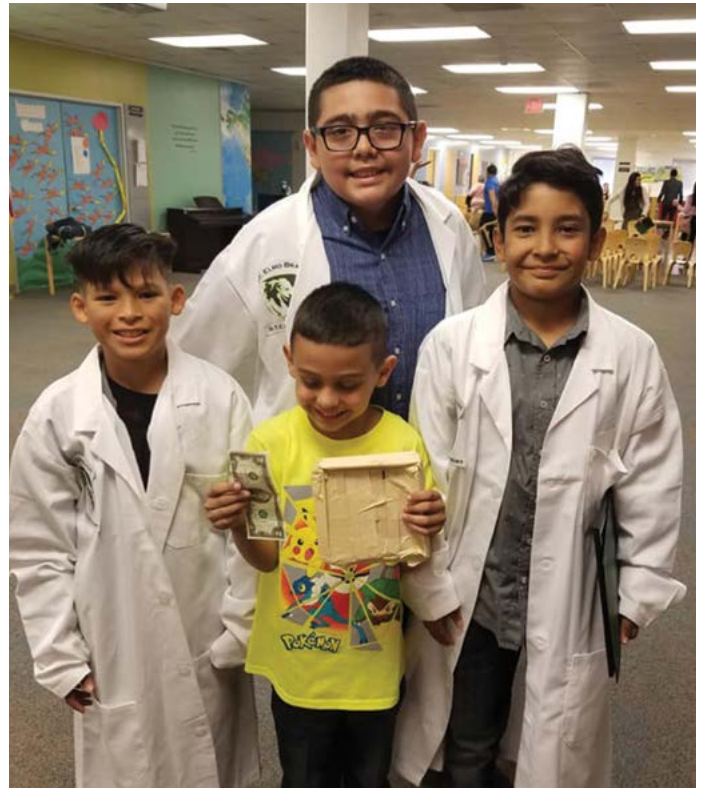
STEM fields are driving U.S. economic growth and show no signs of slowing down.

Employment in STEM occupations has grown 79 percent – from 9.7 million jobs in 1990 to 17.3 million in 2016, vastly outpacing employment in non-STEM sectors, according to the Pew Research Center.

There’s more good news: data from the U.S. Bureau of Labor Statistics project employment in computer occupations could grow by half a million by 2024, and roughly 65,000 new engineering jobs will be available in the same timeframe.

But there’s also a downside: growth in engineering and other STEM occupations is outpacing the supply of skilled workers.

“The future of the engineering profession depends on our ability to attract more underrepresented students into STEM fields,” says



Joseph W. Tedesco, Elizabeth D. Rockwell Dean of the UH Cullen College of Engineering.

African-Americans and Hispanics are underrepresented in the STEM workforce. According to the 2017 Women, Minorities and Persons with Disabilities in Science and Engineering report by the National Science Foundation, White males constitute about 49 percent of the workers in science and engineering jobs, while African-American and Hispanic males make up only 3 percent and 4 percent of the workforce, respectively.

Just under 8 percent of science and engineering doctorates were earned by underrepresented minorities in 2014.

Very much like superheroes themselves, Henderson and Greer are facing this challenge head-on, focusing on solutions and making a difference through the Academy.

THE ORIGIN STORY

Henderson and Greer started the program five years ago when they were both working at the University of Illinois at Urbana-Champaign and piloted it at the Don Moyer’s Boys and Girls Club. Initially, they paid program expenses out of their own pockets, but as word spread private donations and public funds began flowing in.

“There is research indicating that by the time students – particularly African-American and Latino males – get to the eighth grade, they’ve already identified that they don’t like math and science,” says Greer, who specializes in K-12 education.



Students and mentors in St. Elmo Brady STEM Academy conduct hands-on experiments and solve complex problems

Henderson points out that there are many reasons for this – from poverty and lack of encouragement to disparities in the U.S. educational system.

MAKING A DIFFERENCE

Henderson and Greer hope to bridge these gaps.

“The main reason for this program is to help change that narrative and get these kids on the path to become STEM leaders,” says Greer. “One way we do that is by exposing our students to these opportunities, meeting professionals and other students in the STEM fields, and really trying to get them excited about math and science.”

The National Science Foundation awarded the team a three-year, \$1 million grant earlier this year to expand the project and continue the research. Henderson says St. Elmo Brady STEM Academy should be in four Houston elementary schools by the end of those three years.

The Academy is the latest offering in the Cullen College’s repertoire of outreach programs aimed at inspiring underrepresented groups to enter STEM fields. Two such programs – G.R.A.D.E. (Girls Reaching and Demonstrating Excellence) Camp and Girls Engineering the Future (sponsored by Chevron) – focus on encouraging young girls to pursue careers in engineering. Researchers at the Cullen College track the impact of these programs annually, reporting that a much higher percentage of the participants go on to study STEM fields in college when compared to their peers.

Henderson and Greer have seen St. Elmo Brady STEM Academy have a similar impact on young, underrepresented male students. They will be tracking its impact in the Houston community over the years.

The team – which now includes Mariam Manuel, a science master teacher with teachHouston, and Virginia Snodgrass Rangel, assistant professor in the UH College of Education – also has a very specific research focus tied to the program: how STEM identity develops among young boys of color who have access to this after-school program.

SUPERHEROES IN ACTION

The first Saturday Becerra accompanied Joshua to St. Elmo Brady STEM Academy, he walked into a room full of books. “I had some preconceptions about the program,” he admits, adding that he expected a lot of lectures and textbook-learning because “that’s what I have always thought about science.”

“IT’S A GREAT PARTNERSHIP, WHICH NOT ONLY LETS THE FOURTH AND FIFTH GRADERS GROW, BUT ALSO OUR UH STUDENTS. IT EXPANDS EVERYONE’S WORLD.” - JERROD HENDERSON

Instead, he saw young boys – his son Joshua included – solving complex math problems and explaining how they did it, making catapults, designing spacecraft, solving problems, having fun and, most importantly, thinking analytically.

“My favorite parts are the experiments and Saturdays – that’s when they do the coolest things,” Joshua says. “Sometimes, if I’m lucky, I get to keep the experiments.”

One project involved the boys creating a rocket of sorts that had to land with a toy astronaut figure inside a cup. The goal was to make sure the astronaut did not fall out or “get ejected” during landing. Joshua and his team came up with a design that had padding underneath the bottom to cushion the landing.

It worked.

Another team challenged Joshua’s team. While the challenger’s craft fell apart, the astronaut stayed inside the cup. So was it a tie?

Joshua explained that just because the goal had been achieved didn’t mean success, because the craft wasn’t “designed to break apart,” so it missed the larger goal.

"It was a proud moment for me," Becerra says. "He had an opinion, based on fact and logic. The group setting they're in, they learn to have opinions and to put their thoughts out and contribute to the group. I think that's an important piece of the program."

In the latter part of 2018 Joshua will participate as a fifth grader. Both father and son are looking forward to the second year of the program.

"Back when I was in elementary school, they didn't have all the technology and programs they have now. It just wasn't part of the curriculum," Becerra says. "It's our responsibility as parents to give them the opportunity to grow when it's there. Yes, it's a time commitment. It's not easy, it involves Saturdays... but at the end of the day, it's worth it."

Seeing participants excited about the program makes it worth it for the Academy's two founders. Greer's favorite memory of this journey stems from the pilot program. It involved building mousetrap racecars.

"Fathers were literally on their hands and knees on the ground, working on their cars with the students," Greer shares. "It was a powerful moment for me."

Henderson agrees. "That was the seed for us," he says. "That's when we knew we had something to expand upon."

““
THE POSSIBILITIES ARE ENDLESS. ””

- JERROD
HENDERSON



JOINING FORCES TO BEAT THE ODDS

Henderson, who is also director of PROMES – the Program for Mastery in Engineering Studies – has long-term ambitions for St. Elmo Brady STEM Academy. He is thinking in terms of pipeline, supply and demand, and impacting the national STEM sectors.

According to the New American Economy Research Fund analysis, the United States "has a persistent and dramatic shortage of STEM workers." In 2010, an estimated 5.4 STEM jobs were posted online for every one unemployed STEM worker. By 2015, such postings outnumbered unemployed STEM workers by almost 17 to 1.

In 2016, STEM employers still faced the issue: 13 jobs posted online for each unemployed worker – roughly 3 million more jobs than the number of available professionals who could fill them.

The UH team of researchers hope St. Elmo Brady STEM Academy is a model that can be duplicated in other areas around the country. Currently it's being used in Champaign, Illinois and Houston, but there's some interest in taking it to Connecticut and North Carolina as well.

"We have an enormous opportunity to impact that pipeline in a key place – the city of Houston – by working with fourth and fifth graders," Henderson says. "We impact them here, and that will translate eventually to making a decision to come to a college of engineering, to become graduates in STEM, who will then impact the U.S. economy and the global economy."

It seems that Henderson's superpower involves looking into the future as well.

"The possibilities are endless," he says with his trademark grin. ⚡