

Creating Pathways to Engineering through Sponsored Summer Camps

Dr. Racheida S Lewis, University of Georgia

Racheida S. Lewis, Ph.D. is an Assistant Professor at the University of Georgia in the Engineering Education Transformations Institute (EETI) and the Department of Electrical and Computer Engineering. Dr. Lewis believes in creating a diverse engineering field and strives to do so through connecting with teaching, and mentoring future engineers. She has devoted her life to this mission through her leadership and lifetime membership in the National Society of Black Engineers. Ultimately, Dr. Lewis aspires to bridge together research and pedagogy within the academy to improve engineering education within the field and across disciplines.

Dr. Stephan A. Durham, University of Georgia

Dr. Stephan A. Durham serves as the Assistant Dean for Student Success and Outreach of the College of Engineering and Professor of Civil Engineering. Since joining academia in 2005, Dr. Durham graduated over 40 MS and Ph.D. students in the area of structural engineering, concrete materials, sustainability, and construction management. He has performed past studies for multiple Departments of Transportation, Federal Highway Administration, Environmental Protection Agency, and private industry. He has received numerous awards international, national, state, and institutional awards in teaching, research, and service. He teaches undergraduate and graduate courses in structural materials, construction management, reinforced and prestressed concrete design, and advanced concrete materials. His exceptional research contributions include innovative concrete materials and mixtures, infrastructure asset management, design and evaluation of pavements, non-destructive testing, and evaluation of construction practices. Dr. Durham is also renowned for his leadership in ASCE, including his service as legislative contact and advocacy captain for the State of Georgia and appointment to the Society Transportation Policy Committee. He is currently a licensed Professional Engineer in the state of Georgia.

Dr. Alison Leigh Banka, University of Georgia

Dr. Alison Banka is a Lecturer in the School of Chemical, Materials, and Biomedical Engineering at the University of Georgia. Her current educational and research interests include the incorporation of professional skills (such as teamwork and industry-relevant types of technical communication) and active learning into core engineering courses.

Creating Pathways to Engineering through Sponsored Summer Camps

Racheida Lewis, Ph.D., Assistant Professor
Stephan Durham, P.E., Ph.D., Assistant Dean for Student Success & Outreach
Hillary Tanner, Principal Lecturer
Alison Banka, Ph.D., Lecturer



Camp Inspiration and Development

- In 2022, the College of Engineering received funding from the NCR Foundation to support two week-long residential summer camps
- These camps are aimed at supporting broadening participation in engineering through
 - Improving racial diversity and
 - Gender diversity
- On average, week-long residential camps hosted by the Georgia Center @ UGA cost ~\$3000 USD
 - Cost is ~\$1,100 per student (Cost CoE ~\$25,000 per camp)
 - Cost covers camp materials, room, board, and extracurricular activities
- Our camps are free for accepted applicants

In 2022, the [blinded for review] received funding from [blinded for review] to support two week-long residential summer camps catered to broadening participation in engineering. The two camps, [blinded for review] which aims to improve racial diversity in engineering, and [blinded for review] which aims to improve gender diversity in engineering are taught by College of Engineering faculty who design and implement the week-long curriculum. Since their inception, these camps have hosted 90 high school students.

Camp Overview

B.L.A.C.K. Engineering

- Learn about the world of engineering through this impactful, one-week camp! Designed for students from underrepresented and underserved populations, this week-long residential camp uses the B.L.A.C.K. methodology – Building Leaders through Analysis, Conceptualization, and Knowledge, exploring engineering through the following lenses:
- Building - learn and practice the engineering design process through hands-on projects
- Leaders - develop and practice oral and written communication skills to become prepared as future leaders
- Analysis - understand how to analyze information and data relevant to solving engineering problems
- Conceptualization - create and design ethical engineering solutions
- Knowledge - build upon your current math, physics, and science courses to expand your understanding of these concepts in relation to engineering

Women ExCEL in Engineering

- The Women Experience Creativity, Excitement, and Learning (ExCEL) in Engineering camp is calling all future female engineers! Come build community, have fun, and explore different fields of engineering in this week-long residential opportunity for aspiring female engineers. Learn from other female engineers and work individually or in teams, planning, designing, fabricating, and testing in various group and individual projects.
- You will have plenty of formal and informal learning opportunities about life and physical sciences as we explore leadership, innovation, and the engineering design process through hands-on activities within our Engineering, Discovery Laboratory and Fabrication Design Studio spaces. Then, in the middle of the week, we'll take a field trip to a nearby lake to explore sustainability and environmental stewardship initiatives. After completing the camp, you will leave excited about engineering and filled with a passion for how you can make your impact on the world as a future woman engineer!



Camp Instructors Overview

Dr. Racheida Lewis

- Assistant Professor
 - Electrical and Computer Engineering
 - Engineering Education Transformations Institute
- Research interests in justice, equity, diversity, and inclusion (JEDI)
- NSBE Co-Advisor
- Identities
 - Black
 - Woman
 - First-gen college student
 - Pell grant eligible



Camp Instructors Overview

Ms. Hillary Tanner

- Senior Lecturer
 - Environmental, Civil, Agricultural, and Mechanical Engineering
- Interests in Active Learning and Student Retention in STEM
- SWE Advisor
- Identities
 - Woman



Camp Instructors Overview

Dr. Alison Banka

- Senior Lecturer
 - Chemical, Materials, and Biomedical Engineering
- Researches at the intersection between medicine, biology, and engineering
- AIChE Faculty Advisor
- Identities
 - Woman
 - First-gen college student
 - Pell grant eligible



Selection Process

- Applications open January 15th – March 31st
- Applicants are required to submit a response to three questions
 - Student's interest in engineering and the camp
 - Student's previous experience in STEM
 - Student's financial need
- Applications are judged by 3 people, averaged, and ranked by final score
 - The camp's lead instructor (Dr. Lewis or Mrs. Tanner)
 - Dr. Stephan Durham, Assistant Dean for Student Success & Outreach and
 - Dr. Sonia Garcia, Assistant Dean of Diversity, Equity, and Inclusion

Students are selected from an application process that is graded on the criteria of financial need, interests in engineering, and the perceived impact participating in the camp will have on their future. Applications were graded by the camp's lead faculty member, the Assistant Dean for Student Success & Outreach, and the Assistant Dean of Diversity, Equity, and Inclusion, and applicants' final scores were determined by averaging the individual scores of the graders. In 2022, each camp hosted 20 participants while in 2023 each camp included 25 participants. There has been an overwhelmingly positive response to the offering of these camps with [blinded for

review] having ~375 applicants (70 in 2022 and 305 in 2023) to date and [blinded for review] having ~120 applicants to date (46 in 2021 and 72 in 2023).

Selection Process

- Parents of accepted students are notified by April 15th with an April 30th response deadline
- We aim to reduce double dipping i.e., if a student is eligible for both camps, they are enrolled in only one
- Parents must follow procedures to register for the camp outlined by the Georgia Center

Students are selected from an application process that is graded on the criteria of financial need, interests in engineering, and the perceived impact participating in the camp will have on their future. Applications were graded by the camp's lead faculty member, the Assistant Dean for Student Success & Outreach, and the Assistant Dean of Diversity, Equity, and Inclusion, and applicants' final scores were determined by averaging the individual scores of the graders. In 2022, each camp hosted 20 participants while in 2023 each camp included 25 participants. There has been an overwhelmingly positive response to the offering of these camps with [blinded for

review] having ~375 applicants (70 in 2022 and 305 in 2023) to date and [blinded for review] having ~120 applicants to date (46 in 2021 and 72 in 2023).



Camp Participant Overview

- Primarily services minoritized students
 - Gender
 - Race
 - Socio-economic status
- ~98% of participants are Georgia residents
 - Applications have been received globally
 - Participants have traveled as far as Washington, D.C.

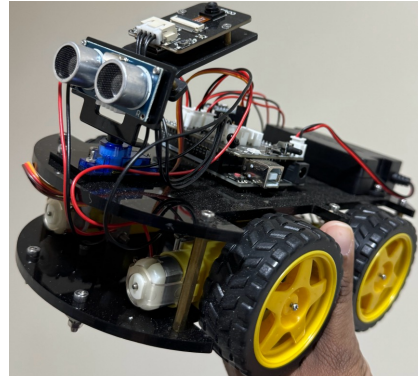


B.L.A.C.K. Camp Curriculum

- Emphasis on Electrical and Computer Engineering
 - Year 1 – Robotics
 - Year 2 – Arduino coding and circuitry
- Team building
 - Jeopardy featuring UGA, Black History, and Pop Culture facts
 - Daily challenges
- Public Speaking and Creativity
 - Design showcase

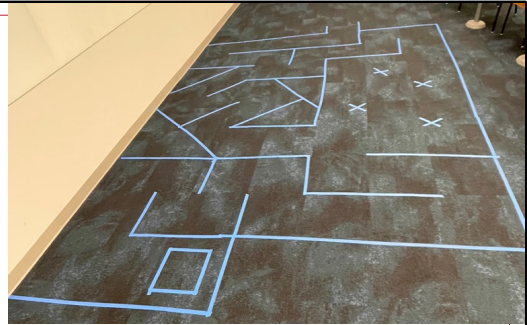
B.L.A.C.K. Camp Curriculum

- Year 1 – Robotics
 - Pros
 - Self-paced
 - Open ended creativity
 - Cons
 - Arduino boards were locked into software
 - Remotes controlled multiple cars
 - App only worked on iOS



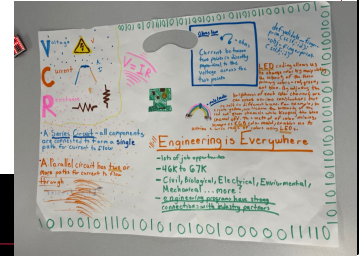
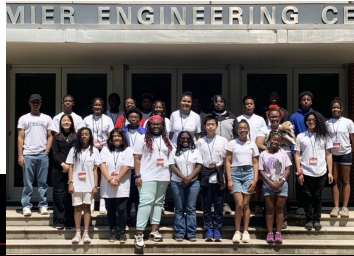
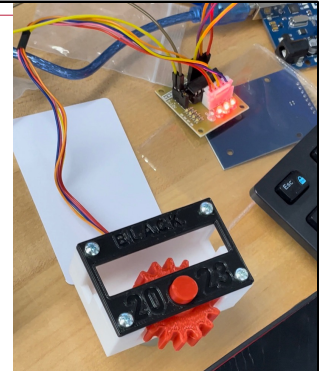
B.L.A.C.K. Camp Curriculum

- Year 1 – Robotics
 - Student Challenges
 - Building race
 - Maze navigation



B.L.A.C.K. Camp Curriculum

- Year 2 – Arduino coding and circuitry
 - Open ended creativity
 - Scaffolded learning activities
 - Single color and RGB LEDs
 - LCD Screen
 - Stepper Motor
 - Active and Passive Buzzer





Women ExCEL in Engineering Camp Curriculum

- Introduction to Engineering at UGA
- Laboratory Tours
- Water Quality Discussion, Design and Build a Water Filter
- Field trip to Lake Herrick – Water Quality Sampling
- Water Quality Testing (laboratory)
- Overview of Stormwater management, Rainfall simulator
- Strawberry DNA Extraction
- Electrical and Computer Engineering Module
- Mechanical Engineering – machine hydraulics and mini-excavator



Extracurricular Curricula (both camps)

- The Georgia Center
 - Ice Cream Social (make your own ice cream)
 - Swimming at UGA's Legion Pool
 - Movie Night at the Tate Theater
 - Trampoline Park

Parent Feedback

B.L.A.C.K. Engineering

- Great experience! My student thoroughly enjoyed himself and wished the camp was longer than a week. This was his first residential camp and the ability to stay on campus allowed him an opportunity to bond with other students and have a small taste of college life. My student raved about Dr. Lewis and Leo. Her patience and hands on approach made a lasting impression. We are so grateful for the experience and look forward to future opportunities!
- My student had an amazing time at this camp. He enjoyed connecting with other students on the same path as him with similar interests, backgrounds, and personalities. He is still talking about the camp several days later.

Women ExCEL in Engineering

- [Student] really enjoyed her experience at camp! She particularly liked the discussion on plastic pollution, as it is of special interest to her. She is planning to make this topic a part of her AP Research Paper for the upcoming school year.
- My daughter was already interested in engineering and definitely this camp reinforced her decision. It gave her access to see what the workshops and labs for engineering inside the university are like. It also gave her the opportunity to meet women engineers and girls that are interested in the field too so she can feel empowered to become an engineer in a few years.



Limitations

- We can only hold 6 camps per year due to our staffing and space (6 camps at 25 students per camp).
- Current funding only allows for 50 students per year to be supported with scholarships



Future Considerations for Summer 2024 and Beyond

- Integrate FAFSA into the application process
- Encourage essays to be completed by the student
- Seek additional funding for program and research activities
 - Tracks students post-camp
 - Does camp participation influence college major (engineering or STEM)?
 - Does cam participation influence decision to apply to UGA (and attend if accepted)?



Future Considerations for Summer 2024 and Beyond

- Expanding scholarships for DEI to our other “pay your way” camps
- New camps in 2024 under consideration
 - Additive Manufacturing (15-17 ages)
 - Intro to Engineering (11-14 ages)
 - Advanced Engineering (15-17 ages)

Acknowledgements



Foundation

Questions?

Racheida Lewis, Ph.D., Assistant Professor
Stephan Durham, P.E., Ph.D., Assistant Dean for Student Success & Outreach
Hillary Tanner, Senior Lecturer
Alison Banka, Ph.D., Lecturer