

**Georgia
Tech**



**Center for Education
Integrating Science,
Mathematics & Computing**

College of Sciences



STEM EDUCATION @ GEORGIA TECH

CEISMC

YEAR IN REVIEW 2017

A MESSAGE FROM THE EXECUTIVE DIRECTOR OF CEISMC



As I look back over everything accomplished in 2017, I am overwhelmed with gratitude for the passionate, hard-working, good-humored CEISMC staff who are so committed to bringing high quality STEM educational experiences to all students and teachers in the State of Georgia. They take on all challenges with a “let’s get it done” attitude. They can leverage resources like no other. They routinely pull off novel and ambitious events with style and grace. They are wise beyond their years and partner successfully with an outstanding array of public, private, and corporate partners to constantly push the envelope when creating innovative STEM curricula, teacher professional development and enrichment programming.

Of course, CEISMC is blessed with wonderful partners at so many levels, in so many sectors. The National Science Foundation has consistently funded our research and development efforts for decades. The Atlanta Foundation Community generously supports ambitious school reform efforts in Atlanta and Gwinnett County Public Schools. The Georgia Department of Education and Regional Educational Service Agency (RESA) network invite us to join with them on statewide efforts to improve K-12 STEM education and support for STEM teachers across the state. The Governor’s Office and state legislature actively seek our involvement in building an apprenticeship model, assessing the strength of the Georgia educational system, and disseminating best practices in STEM education. Our district and school partners challenge our thinking, help us to test innovations, and share in our successes and disappointments. Last but certainly not least, the students that we serve make us proud and exasperated, constantly surprise us with their resilience and creativity, and spur us on to greater achievements.

The Georgia Institute of Technology is a world-class, urban, technical research university with a strong commitment to the best in STEM education at all levels, including K-12. CEISMC is so fortunate to collaborate with and build upon the accomplishments of the best and brightest Georgia Tech students, staff and faculty to improve the STEM educational ecosystem and Create the Next generation of scientists and engineers.

Warm regards,

A handwritten signature in black ink, appearing to read "Lizanne DeStefano".

Lizanne DeStefano
Executive Director, CEISMC

CREATING THE NEXT®

CEISMC: STEM EDUCATION @ GEORGIA TECH

MISSION STATEMENT

The Center for Education Integrating Science, Mathematics, and Computing (CEISMC) enhances PreK-12 and postsecondary STEM education by drawing upon the expertise and scholarly contributions of the Georgia Tech community. CEISMC advocates for and leads systemic changes to increase STEM interest and achievement for all students, especially those underrepresented in STEM. CEISMC's research efforts allow for the identification and dissemination of evidence-based best practices in STEM education.

VISION

CEISMC will define and exemplify effective STEM education to maximize students' readiness to excel in a rapidly changing world. We are leaders in influencing significant curricular, pedagogical, social and policy reform efforts that will shape STEM education and workforce development.

CEISMC'S GOALS

» GOAL 1 - INSPIRING STEM ENRICHMENT AND OUTREACH FOR STUDENTS

Excite, engage, and accelerate PreK-12 students through high-quality academic and hands-on STEM enrichment programs. Partner with the Georgia Tech faculty and students, as well as businesses, nonprofits, and education communities to expose PreK-12 students to leading-edge research and 21st Century STEM careers.

» GOAL 2 - INTENSIVE PROFESSIONAL DEVELOPMENT FOR STEM EDUCATORS

Empower teachers to advance student interest and learning in STEM. Offer professional learning experiences that focus on cutting-edge STEM content and model effective, active, and inquiry-based pedagogy. Utilize digital platforms, innovative tools, social media, and online communities to create professional learning experiences that erase the geographic and temporal boundaries for learning.

» GOAL 3 - LOCAL AND SUSTAINABLE COMMUNITY PARTNERSHIPS

Cultivate sustained PreK-12 school and community partnerships to develop model sites in STEM. Engage teachers and students in on-going experiences with Georgia Tech faculty and students to improve STEM teaching and learning.

» GOAL 4 - INNOVATIVE STEM EDUCATION

Design and develop innovations that advance the educational frontier in STEM. Create effective curricula that incorporate inquiry and problem-based learning, culturally authentic practice, high standards, and advanced technologies that work in a broad array of educational settings.

» GOAL 5 - CRUCIAL RESEARCH AND EVALUATION OF STEM EDUCATION

Advance PreK-12 STEM education through educational research and evaluation. Document the impact of innovative curricula, teacher professional learning experiences, and novel STEM programs on student learning, with an emphasis on students traditionally underrepresented in STEM.

» GOAL 6 - DYNAMIC OPPORTUNITIES FOR GEORGIA TECH COMMUNITY ENGAGEMENT

Create opportunities for the Georgia Tech community to engage and serve PreK-12 students and teachers and the community at large. Assist Georgia Tech faculty in developing innovative educational initiatives inspired by their novel and creative STEM research and teaching. Initiate and coordinate outreach experiences for Georgia Tech students and staff to broaden their horizons, promote community engagement, and inspire a culture of service.

GOAL 1 - INSPIRING STEM ENRICHMENT AND OUTREACH FOR STUDENTS

Today's world demands that students acquire a greater understanding of advances in science, technology, engineering, and mathematics (STEM) from an early age. CEISMC seeks to inspire STEM exploration by providing prekindergarten through high school (PreK-12) students with summer programs, weekend workshops, community outreach, and STEM competitions that take advantage of the resources and expertise of the Georgia Tech community. Student enrichment programs engage over 11,000 young scholars in hands-on learning experiences each year, paving the way for future success in STEM.



CEISMC outreach, after-school programs, and competitions impacted more than 19,000 pre-college STEM students this year.

CEISMC Summer PEAKS Artbotics Program

» SELECT PROGRAM HIGHLIGHTS

FIRST LEGO League

The FIRST LEGO League (FLL) is an international competition for 4th through 8th-grade students that promotes creative STEM thinking through robotics. CEISMC coordinates the largest region in the country, with over 700 teams and 6,000 students. The 2016-17 Georgia competition system included 28 first-round Regional events, 8 second-round Super-Regional events, and two State Championship competitions, held at Georgia Tech and Georgia Gwinnett College.

Horizons Atlanta at Georgia Tech

Horizons Atlanta at Georgia Tech is a year-round program designed to help students close the opportunity gap and find success in school. The program also prevents the Summer Slide and assists students with setting and achieving goals for themselves including high school graduation and participation in post-secondary educational experiences. The program served more than 110 students and included an after-school component and a high school mentoring program.

KIDS Club

Kids Interested in Discovering Science Club (K.I.D.S. CLUB) is a program that is held 6 Saturdays each year designed to enhance and encourage curiosity and enthusiasm for science, mathematics, engineering, and technology. Activities included rocketry, bioengineering, squid dissection, mobile game and app development, LEGO® Robotics, and much more.

PEAKS Summer Programs

Programs Enriching Accelerated Knowledge in STEM (PEAKS) offers over 24 hands-on summer enrichment programs for future engineers and scientists. These programs provided exciting inquiry-based STEM learning opportunities in advanced topics not typically available to pre-college students in traditional school settings.

Research, Experiment, Analyze, Learn (R.E.A.L.)

An initiative of the Georgia Intern-Fellowships for Teachers (GIFT) program, R.E.A.L. provided summer research and business internships for 34 high school students from populations underrepresented in STEM. Students, supervised by GIFT teachers and Georgia Tech researchers, spent five weeks conducting experiments in university laboratories or interned at local STEM-focused businesses. R.E.A.L. is supported by the Siemens Foundation and The UPS Foundation.



» FEATURE STORY

Fair Focuses Educational Options for Latinos

The 5th Annual Latino College and STEM Fair was held on March 18th at the Georgia Tech Student Center as part of the Atlanta Science Festival. The event was hosted by Georgia Tech's GoSTEM program and the University of Georgia's LISELL-B initiative, and served to spark interest in STEM while informing Latino students and families about post-secondary education.

"As members of Georgia Tech, we are extremely proud to serve Latino students and families in Georgia, and present them with rich, interesting, and valuable experiences that might inform their educational and career decisions," said CEISMC's Diley Hernandez, the Program Director of GoSTEM. Fair attendees heard from Spanish-

speaking Georgia Tech students, faculty, and community partners; learned about academic resources such as the Hispanic Scholarship Fund; and benefited from workshops on college admission, financial aid, and preparing for college and careers. Non-Georgia Tech exhibitors such as the University of Georgia, Georgia Gwinnett College, and UPS were also present.

The fair offered a variety of demonstrations and hands-on activities; families observed the detection of cosmic-ray particles in a "spark chamber," built toy airplanes from balsa wood, and witnessed "The Magic of Chemistry Show" presented by Georgia College. In addition, a panel discussion moderated by Giancarlo Cifuentes,

anchor at Univisión 34 Atlanta, provided an opportunity for Latino community and education leaders to discuss issues affecting the education of Latinos.

"This annual fair provides participants with a unique opportunity to learn more about college, college majors, and STEM careers," said Jorge Breton, Director of the Office of Hispanic Initiatives at Georgia Tech.

"The interaction with representatives from many institutions of higher education and other exhibitors, the fun hands-on activities, the panel discussion, and the different educational workshops – these all help increase the knowledge, interest, and awareness of opportunities that are available to our community."

Steven L Taylor
CEISMC Communications Manager

GOAL 2 - INTENSIVE PROFESSIONAL DEVELOPMENT FOR STEM EDUCATORS

Through internships at Georgia Tech and Georgia businesses, CEISMC continuously provides Georgia's PreK-12 educators with opportunities to learn within real-world contexts. These experiences can be transferred to a classroom setting to instill better understanding of STEM among students and encourage excitement about STEM learning. Georgia educators are also exposed to the latest pedagogical methods through symposiums and sustained programs developed and facilitated by CEISMC, empowering teachers to engage their students with active hands-on STEM learning experiences.



Over 1,700 PreK-12 educators benefited from CEISMC's STEM professional development and internship programs this year.

CEISMC @ Georgia Tech STEAM Leadership Conference

» SELECT PROGRAM HIGHLIGHTS

Building Capacity for 3D Content, Practices and Crosscutting Skills

This project is a Department of Education Math and Science Partnership between the Fulton County Schools and Georgia Tech. CEISMC led the overall coordination for Georgia Tech and provided professional development for 25 middle school teachers. The School of Earth and Atmospheric Sciences provided professional development for 45 elementary school teachers.

Online Course, Discovering Project-Based Inquiry Learning for K-12, with the Sustainability Research Network

The National Science Foundation supported Sustainability Research Network (SRN) is a multi-institutional collective of scientists, industry leaders, and policy partners who are committed to building better cities of the future through innovations, design, technology, and policy. CEISMC offered an online course for K-12 teachers to learn about best-practices of instruction and sustainability as a unifying theme for STEM education. (NSF Award #1444745)

CEISMC at Georgia Tech STEAM Leadership Conference 2017

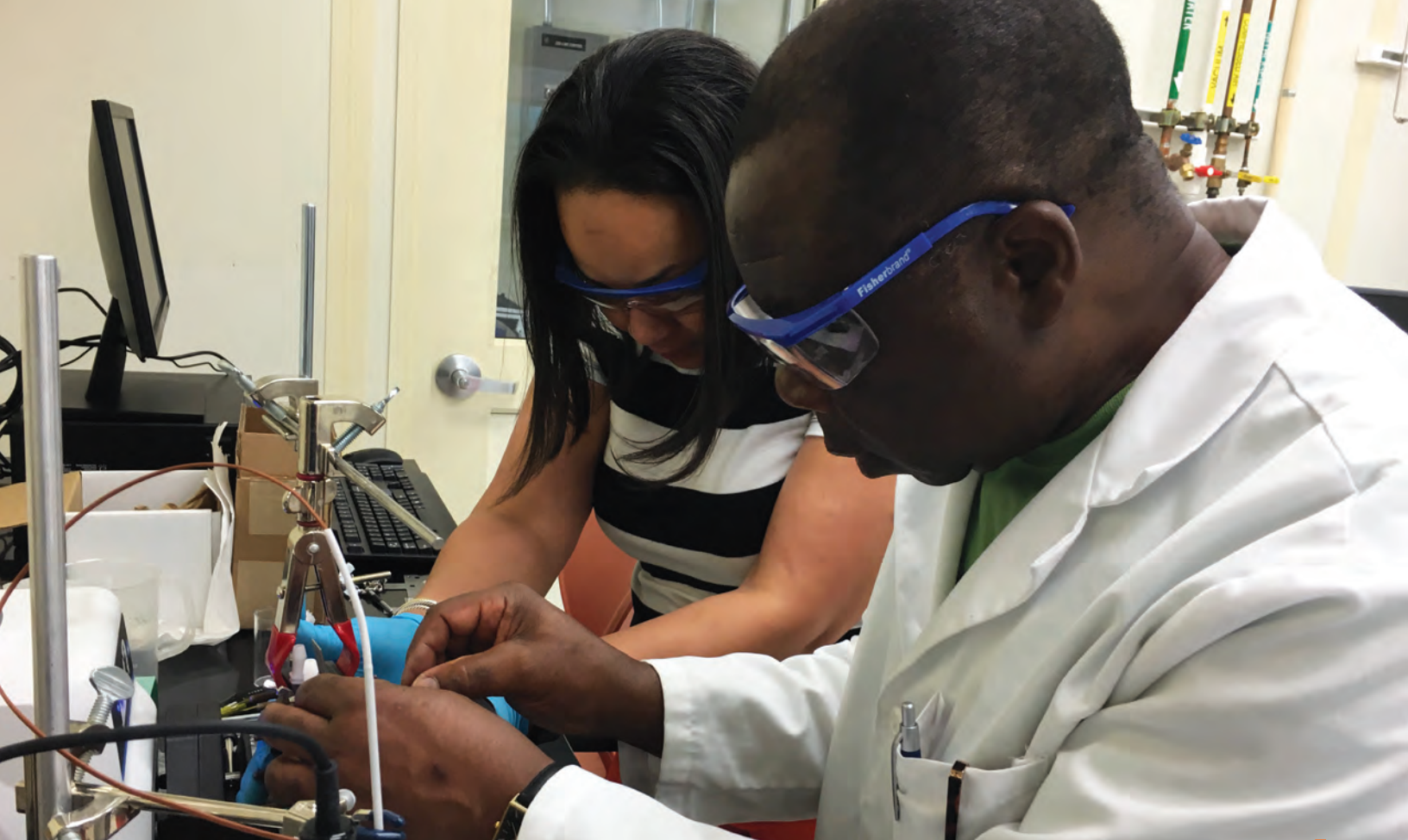
Through a partnership with the Georgia Tech Research Institute (GTRI) and the Georgia Department of Education, the conference sought to inspire STEAM education innovation. From Georgia Tech researchers to school principals, this conference offered experience in the best of STEAM education through engaging, challenging, and interactive sessions.

Georgia Intern-Fellowships For Teachers (GIFT)

GIFT, a collaborative between Georgia universities, businesses and K-12 school districts, provided 47 K-12 (STEM) teachers paid 4-7 week summer internships in research laboratories and companies. Teachers conducted experiments and communicated research findings or gained industry experience applying STEM concepts to workplace problems. They also learned about skills needed for STEM careers. Since its inception in 1991, GIFT has facilitated 2,078 internships for teachers.

Project-Based Inquiry Learning (PBIL)

This digital course that was initially developed with support from NASA offered 25 teachers the opportunity to explore PBIL in an instructor-facilitated, semi-synchronous, and highly interactive digital environment. The course supported teachers in using PBIL to enhance conceptual understanding, critical thinking, scientific reasoning, and problem-solving and included project work that participants can apply to their practice and make an immediate impact in their classrooms.



» FEATURE STORY

Faculty-Teacher Duo Combines Electrochemistry and Dance to Teach Engineering to High School Students

Marta Hatzell, an assistant professor in the Woodruff School of Mechanical Engineering, and Fred Okoh, a chemistry teacher at Arabia Mountain High School in DeKalb County, have collaborated through the Partnerships for Research, Innovation, and Multi-Scale Engineering (PRIME) Research Experiences for Teachers Program to develop an innovative new method for teaching students about the electrochemistry involved in the process of water purification.

PRIME, a collaboration between CEISMC and the Woodruff School of Mechanical Engineering, pairs K-12 teachers in the Metro-Atlanta school districts with Georgia Tech College of Engineering faculty for a seven-week mentoring period in which to design projects integrating art with STEM research.

“Current water purification techniques

can be costly and heavily energy dependent,” Hatzell said. Hoping to replace traditional purification methods such as filtering and boiling, her research group is developing a carbon electrode-based platform to desalinate water. The movement of salts generated by Hatzell’s technique, termed “capacitive deionization,” reminds Okoh of dance. “The whole movement flows like a dance choreography,” he said. Together, Hatzell and Okoh have created a lesson plan that introduces capacitive deionization to students through dance, a creative outlet they are already familiar with.

PRIME recognizes the similarities between art and engineering and seeks to connect them in a way that allows students to appreciate both disciplines. “Many students may not remember the science content they are taught by a lecture, but a hands-on experiment or

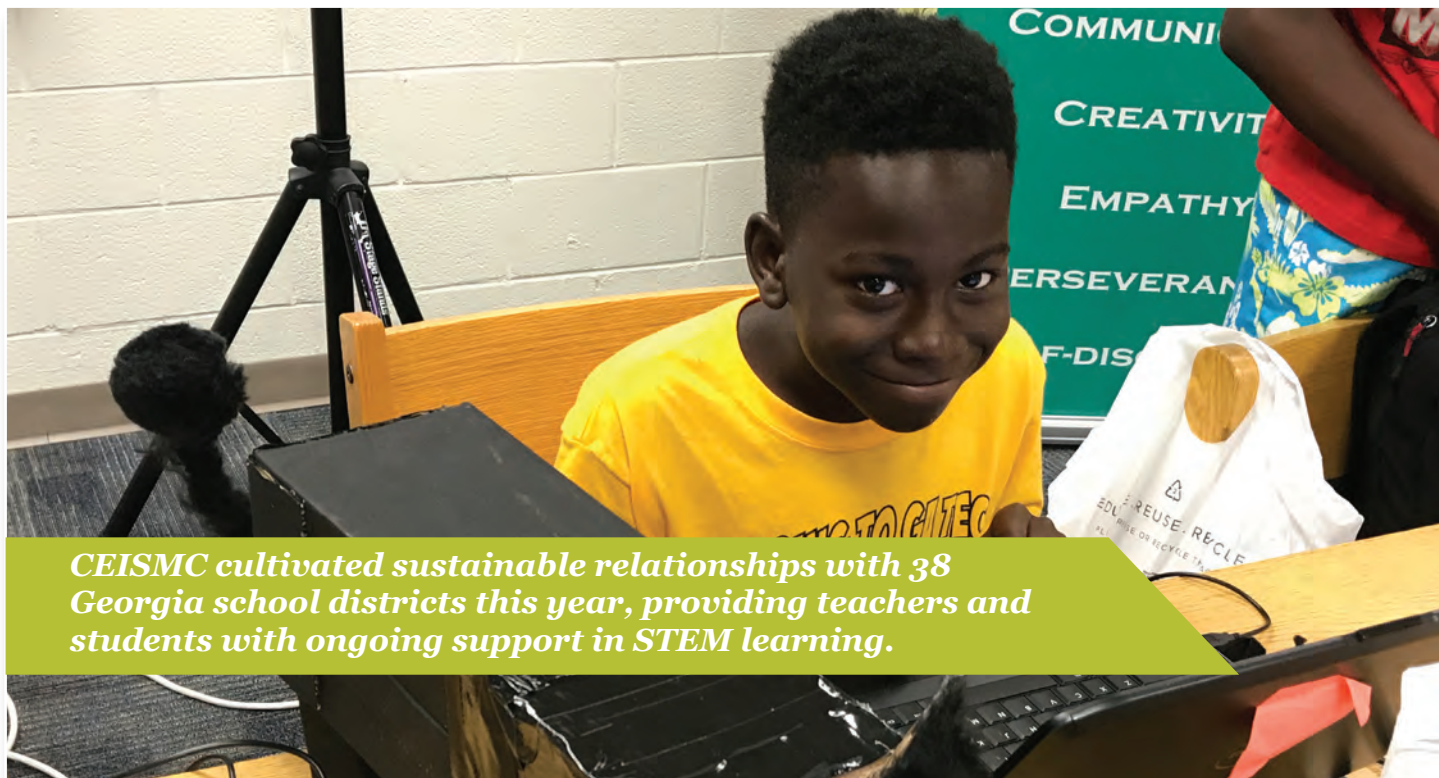
activity coupled with a creative music, dance, drama, or visual art activity is unforgettable,” said Jamila Cola, a research scientist at CEISMC and a co-principal investigator of PRIME. “PRIME teachers and students are pushed to be creative. The teachers have to carefully think about the similarities between the fine arts standards and science standards, and students are pushed to collaborate and create using their understanding of science and engineering,” she says.

PRIME is paving the way for Georgia Tech and Metro Atlanta school districts to work together to enhance STEM education. A total of 42 teachers have participated in PRIME to create original lesson plans, each incorporating different aspects of art – such as music, drama, visual arts, and dance – to introduce engineering research to elementary, middle, and high school students.

Sabiha Runa
CEISMC Communications Reporter

GOAL 3 - LOCAL AND SUSTAINABLE COMMUNITY PARTNERSHIPS

CEISMC cultivates sustainable partnerships with PreK-12 districts and schools to provide ongoing support in STEM learning. CEISMC works with school leadership and STEM teachers to develop and implement high-quality STEM education curricula that meet the Georgia Standards of Excellence. Our partnership with M. R. Hollis Innovation Academy has exposed students and teachers to cutting-edge tools as well as support for the development of after-school STEM programs of the Georgia Tech community.



CEISMC cultivated sustainable relationships with 38 Georgia school districts this year, providing teachers and students with ongoing support in STEM learning.

M. R. Hollis Innovation Academy Partnership

» SELECT PROGRAM HIGHLIGHTS

Douglas County Computer Science for All

The Douglas County “Computer Science for All” initiative worked to bring the highest-quality K–12 Computer Science (CS) education to every school in the district. CEISMC’s role was to provide guidance, assistance, and participation in creating and implementing a sustainable district CS task force, identify teacher PD opportunities such as those offered by Code.org, and answer CS program related questions as needed.

Drew Charter School Partnership

CEISMC partnered with Drew through funding from the East Lake Foundation, Bill and Melinda Gates Foundation, and the Governor’s Office for Student Achievement. CEISMC implemented the Arts and STEAM program with the First Center, a summer STEAM Academy, and professional development for teachers. In the senior academy, CEISMC provided tutors and facilitated a summer bridge program for students transitioning from 8th to 9th grade.

GoSTEM

The GoSTEM program mission is to develop a research-based model for how universities, school systems, and philanthropic foundations can partner to promote academic achievement in STEM fields for Hispanic K-12 students.

Hernandez, D., Rao, A., Rana, S., Alemdar, M., & Usselman, M. (2017, April). Paving the road into STEM for Latino students. Poster presented at the Annual Meeting of the American Educational Research Association, San Antonio, Texas.

Rana, S., Alemdar, M., Hernandez, D., Rao, A., & Usselman, M. (2017, April). Impact of mentoring program on Latino students’ college aspirations, college self-efficacy, and STEM career interest. Roundtable paper presented at the Annual Meeting of the American Educational Research Association, San Antonio, Texas.

M. R. Hollis Innovation Academy STEM Partnership

Through a partnership with M.R. Hollis Innovation Academy, CEISMC aimed to strengthen the connection between Georgia Tech and its surrounding community. The goal of the partnership is to support the development and implementation of STEM curriculum through direct involvement in the school, utilizing the varied resources available to Georgia Tech. Success of the partnership demonstrated the potential of university engagement in K-12 schools.



» FEATURE STORY

GoSTEM Provides Unique Mentorship Experience

When he was a junior at Meadowcreek High School, Juan Turcios' physics teacher suggested that he join GoSTEM, a collaborative initiative spearheaded by CEISMC. The initiative focuses on expanding STEM education resources for the Latino community in the Gwinnett County Public School District.

Turcios took his teacher's advice, and through GoSTEM he received a mentor who provided him with guidance and encouragement. "Growing up, I didn't have long-term goals," he said, "but my mentor walked me through my college and scholarship applications." Turcios' hard work paid off, and he enrolled in Kennesaw State University in 2013 before transferring to Georgia

Tech in 2016. Turcios has since applied his experiences as a mentee and has himself become a mentor through GoSTEM. To date, he has tutored over fifteen middle and high school students. Turcios has worked with talented, intelligent students, but is aware that lack of ambition or motivation can hold even the brightest students back from their full potential. "Some students have the grades but have no drive. Others do not know how to use their tools," Turcios said.

Fortunately, his experiences as both mentor and mentee have made him optimistic that mentorship can inspire any student to reach for ambitious goals. "If students see someone they can relate to perform well in classes and go the extra mile, maybe they will

believe that they can too," Turcios said.

Beyond mentorship, Turcios' future plans include an internship at Carrier Transicold in Athens, Georgia. This will be his third internship with the company, where he will focus on product engineering. Additionally, Turcios aims to further his education by pursuing an MBA or Masters degree. As he advances in his career path, he continues to receive encouragement and advice from his mentors. Maintaining those connections while continuing to coach his own students has allowed Turcios to be on both sides of inspiring lifelong relationships.

Rosemary Pitrone
CEISMC Communications Reporter

GOAL 4 - INNOVATIVE STEM EDUCATION

The K-12 educational innovation work at CEISMC aims to examine how STEM integration in education is best achieved and its implications for student learning and teacher classroom practice. CEISMC develops educational interventions that utilize culturally relevant and authentic practices to increase student engagement, motivation, and persistence in STEM. Additionally, professional development experts at CEISMC are making advances in online learning by creating highly interactive courses that promote and model inquiry learning.



In 2017 CEISMC partnered with over 90 schools in the state of Georgia, bringing innovative STEM education to hundreds of students.

CAPACiTY and EarSketch

» SELECT PROGRAM HIGHLIGHTS

4

Advanced Manufacturing and Prototyping Integrated to Unlock Potential (AMP-IT-UP)

AMP-IT-UP is an NSF funded Math and Science Partnership between Georgia Tech and the Griffin-Spalding County School System. AMP-IT-UP has created and implemented middle school engineering, math, and science instructional units that demonstrate inquiry and problem-based learning, that integrate across multiple STEM practices, and that emphasize engineering design, invention, and entrepreneurship. The AMP-IT-UP materials are available for download at ampitup.gatech.edu. (NSF Award #1238089)

Culturally Authentic Practice to Advance Computational Thinking in Youth: CAPACiTY

CAPACiTY has been developing a new curriculum for the high school Introduction to Digital Technology course that teaches computational thinking to students using problem-based and inquiry strategies that enable students to pursue questions of personal interest while mastering technical skills. The goal is to engage minorities and girls in better learning skills that will enable them to have success in later computer programming courses. (NSF Award #1639946)

EarSketch: An Authentic, Studio-Based STEAM Approach to High School Computing Education

EarSketch is a STEAM intervention that teaches computer programming through music mixing. CEISMC has partnered with EarSketch as part of an NSF DRK-12 project to create a high school Computer Science Principles curriculum that includes EarSketch, to create professional development for teachers, to implement the program in schools within Georgia, and to investigate, using systems modeling, what factors enhance or impede implementation. (NSF Award #1417835)

Edwards, D., Engleman, S., Freeman, J., Magerko, B., McKlin, T., Miller, M. (2017) Creativity in Authentic STEAM Education with EarSketch to be published in Proceeding of the 48th Association for Computing Machinery Technical Symposium on Computing Science Education

Edwards, D. (2017). EarSketch: Computer Science Taught Through Music. Georgia Business Education Association, Georgia Association of Career Technical Education, Georgia STEM Conference, International Society for Technology in Education.

K-12 InVenture Challenge

The mission of the K-12 InVenture Challenge at Georgia Tech is to instill a sense of belonging in STEM and an entrepreneurial confidence in K-12 students. The program extended the collegiate success of Georgia Tech's InVenture Prize competition to the K-12 level. Over 2,000 students from 50 schools participated in 2016-17. The state finals at Georgia Tech featured 82 top teams from participating schools.

R. Moore, S.H. Newton, A. Baskett. (2017) The InVenture Challenge: Inspiring STEM Learning through Invention and Entrepreneurship, International Journal of Engineering Education, Vol. 33(1(B)). p. 361-370.

R.A. Moore, S.H. Newton, M. Alemdar, A. Holcomb, "The K-12 InVenture Challenge: Inspiring Future STEM Innovators," Proceedings of the ASEE 2017 Annual Conference, Columbus, OH, June 25-28, 2017 (Best Teaching Paper, 3rd Place, Entrepreneurship & Engineering Innovation Division).



» FEATURE STORY

AMP-IT-UP Teachers Participate in Gulf of Mexico Research Expedition

AMP-IT-UP (Advanced Manufacturing and Prototyping Integrated to Unlock Potential) teachers from Griffin-Spalding County Schools participated in a research expedition to the Gulf of Mexico. Cheryl Wilder from Kennedy Road Middle School and Kathy Duke from Rehoboth Road Middle School are both seventh-grade life science teachers who experienced real-world research in the Gulf with ECOGIG (Ecosystem Impacts of Oil and Gas Inputs in the Gulf). The research was relevant not only for the teachers, but also for their students, who studied AMP-IT-UP curriculum modules on the Gulf ecosystems

The AMP-IT-UP program is a multi-year grant whose mission is to cultivate the next generation of creative STEM innovators. CEISMC has partnered with the School of Mechanical Engineering to design math and science modules that bring advanced manufacturing

and STEM themes to middle and high school classrooms. AMP-IT-UP teachers Duke and Wilder have taught their seventh graders three modules on ocean ecology, two of which are based on ECOGIG research. Each module profiles a member of the Georgia Tech faculty, connecting students in Griffin to the cutting-edge research being done at Georgia Tech and at the University of Georgia.

The teachers played an important role in collecting water samples on the research cruise and gained firsthand experience measuring the conductivity, temperature, and depth of water. They traveled to three different sites, and Wilder described how each site impacted her perspective on the Gulf. "It just blew my mind how you can go to one site and the water is pretty and blue, and go to another site and it is black," said Wilder. "You could smell the oil and it was a very distinct

odor," she added. Both teachers were able to collect oil samples from the Taylor Energy site, where there has been an ongoing oil spill since Hurricane Ivan in 2004. Wilder and Duke brought the oil samples back to Griffin to show to their students, who were even more excited about the classroom modules because of their teachers' experiences on the expedition.

This cruise demonstrates how AMP-IT-UP connects teachers and students in Griffin to innovative research outside of the school district. The teachers thanked AMP-IT-UP for changing the way educators approach science and for bringing new enthusiasm to the classroom. Duke said, "I want to thank the AMP-IT-UP program for making this opportunity available. It was really, really awesome."

Rosemary Pitrone
CEISMC Communications Reporter

GOAL 5 - CRUCIAL RESEARCH AND EVALUATION OF STEM EDUCATION

Researchers within CEISMC pursue questions related to K-12 engineering education and its relationship to science education. The CEISMC Educational Research and Evaluation Group utilizes a mixed method approach employing both qualitative and quantitative data sources to determine the impact of numerous K-12 programs and interventions; the evaluation of these interventions focuses on measuring student outcomes and teacher professional development impact on classroom practices. CEISMC researchers also assess the impact of educational interventions on students' mastery of 21st century skills such as collaboration, teamwork, problem-solving, and creativity.



CEISMC researchers investigated the impact of educational interventions utilizing a mixed method approach.

Drew Charter School Partnership - HORIZONS Atlanta at Georgia Tech

» SELECT PROGRAM HIGHLIGHTS

Drew Charter School 21st Century Literacy in the Making (21 CLM) - Evaluation

Funded by the Georgia Governor's Office of Student Achievement (GOSA), the 21CLM program aims to enhance project-based learning in STEAM disciplines through innovative maker space resources, digital literacies, and teacher professional learning opportunities. As the external evaluator for this grant, the CEISMC Educational Research and Evaluation Group utilized both quantitative and qualitative research methods to inform program development and report on the program's progress.

Gale, J. D., Cappelli, C., & Bryant, C. (2017, June). STEAM Trunks: Enhancing K-8 Project-Based Learning through Mobile Makerspaces. Proceedings of the 2017 American Society for Engineering Education Annual Conference, Columbus, OH.

Drew Charter School Gates Foundation Grant - Evaluation

The CEISMC Educational Research and Evaluation Group served as the external evaluator for the Drew Charter School (DCS) Gates Foundation grant. Using a participatory approach, this evaluation research used case study methods to investigate relationships between project-based learning in STEAM disciplines and college and career readiness among Drew Charter School's Senior Academy students.

Integrating Team Science into the STEM Graduate Training Experience

This NSF Research Traineeship (NRT) award in the Innovations in Graduate Education (IGE) Track to the Georgia Institute of Technology will develop materials to train graduate students to work in teams and by measuring the effectiveness of these materials. The project takes a novel approach to curriculum development by drawing on best practices in team training from a wide range of sources. (NSF Award #1623419)

Program to integrate mobile, hands-on experiments into the ME, AE, and ECE curricula

The goal of this project is to develop portable hands-on engineering lab experiments for use by students outside of traditional engineering laboratories in classrooms or dorm rooms. The modules to be developed will feature moving parts and fluidic and thermal components that are typically found in mechanical and aerospace engineering systems. This project is evaluated by the CEISMC Educational Research and Evaluation Group. (NSF Award #1626362)

Recruiting and Retaining Teacher Leaders in Physics and Chemistry

The CEISMC Educational Research and Evaluation Group serves as the external evaluator for the National Science Foundation funded Robert Noyce Scholarship Program. The program was developed to address the need for more Science, Technology, Engineering, and Mathematics professionals to pursue teaching careers in K-12 schools. Overall, the primary evaluation question is, "To what extent has the program been successful in achieving its goals?" (NSF Award #1035451)



» FEATURE STORY

CEISMC Receives NSF Grant to Examine Factors Influencing Teacher Retention

CEISMC has been awarded a two-year National Science Foundation (NSF) grant of \$426,500 for a study titled, “An Exploratory Study: The Role of Social Networks and Self-Efficacy in the Retention of Noyce Teachers.” The study will examine retention of participants of the Robert Noyce Teacher Scholarship Program in schools considered to have high needs. “This is a potentially groundbreaking study which could revolutionize how we train and support STEM teachers in the future,” said Lizanne DeStefano, executive director of CEISMC.

More than 300 NSF-funded Noyce programs operate across the U.S. and each shares the core mission to recruit and prepare highly effective K-12 STEM educators to teach in high-needs academic environments. High-needs schools typically have a high student population that is below the poverty line, low retention of teachers and administrative personnel, and employ some teachers that are uncertified or are teaching outside of their field.

Participants in Noyce programs must remain in a high-needs school for at least

four years after graduating. Once placed, teachers may find that the challenging learning environment, lack of resources, diminished curriculum support, or remote school location hampers their ability to thrive, and may decide to relocate or switch to another career; however, it is uncommon for Noyce teachers to renege on their four-year commitment.

The study population includes only early-career teachers or those who have taught full-time for five years or less, and seeks to understand how colleagues, school administrators, mentors, and others in a social network affect teachers’ ability to continue to work in a high-needs environment. It will analyze whether a teacher’s belief in their ability to teach a subject well or achieve a goal helps them remain in their assigned schools; it will also analyze where this self-efficacy comes from, how it is acquired, and its relationship to teachers’ networks.

“Through this study, CEISMC will be filling an important gap in the literature about teacher retention in high-needs schools,” says Meltem Alemdar, the study’s principal investigator, CEISMC associate director, and senior research

scientist. “Social network analysis is a very useful method to study the dynamics of people’s interactions. We have been using it in some small studies, and we are excited to work with large data sets.” The study will develop a validated survey of teacher personal networks. The goal is to use the survey to guide the orientation and training of new participants to the Noyce programs to better prepare them for their role as STEM teachers in high-needs schools. In addition, the study will update the Noyce Teacher scholar database, which will be publicly available through the study’s website.

This will be the first major grant for Research Associate Christopher Cappelli, who is a co-principal investigator. He looks forward to being a part of this project and using his skills in coding, modeling, and analyzing data. Shaheen Rana, a research associate at CEISMC, will do literature reviews, survey development, and data collection. “It’s exciting to bring together all the different interests and expertise we have and figure out how those fit together,” says Jessica Gale, the study’s co-principal investigator and CEISMC research scientist.

Steven L. Taylor
CEISMC Communications Manager

GOAL 6 - DYNAMIC OPPORTUNITIES FOR GEORGIA TECH COMMUNITY ENGAGEMENT

CEISMC partners with Georgia Tech faculty to develop initiatives that support teacher STEM knowledge. Many of these projects are supported by the U.S. Department of Education through the Math and Science Partnership (MSP) program and the Improving Teacher Quality state grants.



CEISMC creates dynamic opportunities for community engagement by partnering with over 200 faculty and staff at Georgia Tech.

Georgia Tech Science Olympiad 2017

» SELECT PROGRAM HIGHLIGHTS

Biologically Inspired Sustainable Building Design Challenges for Middle School Engineers

CEISMC, in partnership with the Center for Biologically Inspired Design (CBID), will develop middle school lesson plans (with the support of a GIFT teacher) integrating sustainable building challenges with biologically inspired design methods. Situated in Living Building Challenge data and design challenges, these lesson plans will be developed for and released to Georgia science and engineering teachers, including schools with underrepresented populations in STEM fields.

Distance Math Dual Enrollment Program

The Distance Math Program provides advanced mathematics courses to high school students who have successfully completed the AP Calculus BC course and exam. High school students enrolled alongside Georgia Tech students in Linear Algebra and Multivariable Calculus, received all instruction through distance learning technologies, and earned Georgia Tech credit.

Georgia Tech Science Olympiad

The High School Regional Science Olympiad Tournament is hosted each year at Georgia Tech. The Science Olympiad is a nationally recognized program for enhancing science education and interest in science. In the Spring of 2017, CEISMC hosted a Division C regional tournament for 16 teams of high school students from the metro Atlanta area. Winning teams advanced from regional to state to national competitions.

Gwinnett County MSP

With support from CEISMC, Georgia Tech faculty and graduate students, in collaboration with teachers and administrators from the Gwinnett County Public Schools (GCPS), designed and conducted Elementary Science and Mathematics Endorsement classes for elementary teachers in grades 3 – 5. In addition, CEISMC assisted with the coordination and implementation of the academic year and summer activities, including professional learning days, field trips, portfolio grading, along with classroom and cohort visits.

Newton County MSP

The Newton MSP Project includes two cohorts of teachers who participate in a two-year program of study. The professional learning planned for each year includes a minimum of 60 hours of instruction, facilitated by Georgia Tech faculty with CEISMC, and 20 hours of additional support through professional learning communities, classroom observations and feedback, and assistance from school and district level instructional coaches as needed.



» FEATURE STORY

Mathematics Employment Experience for High School Students

Georgia Institute of Technology's School of Mathematics has selected eight high school students to take part in a summer employment experience. They will be computing sunrise and sunset times, a classic trigonometry and geometry problem.

School of Mathematics Assistant Professor Kirsten G. Wickelgren developed the program as part of her NSF CAREER grant to emphasize that mathematics is a career option. "Employing high school students to do math is a direct way of to communicate this option," Wickelgren says. The experience could attract talented students to pursue higher math or

mathematics research in their careers. Participating students from Creekside High School, Fairburn, Georgia, are John Igieobo, Ashauna Pearson, Steven Sanchez, and Dae'Shawn Taylor. They will be accompanied by mathematics teacher Alicia Scott.

From Westlake High School, Atlanta, Georgia, are Tatyana Cook, Micah Dabney, Naomi Davis, and Aaron Woolfolk, accompanied by mathematics teacher Latricia Gladden.

The students will do a four-week internship. The first week will be held in the School of Mathematics at Georgia Tech, and the last three weeks will be

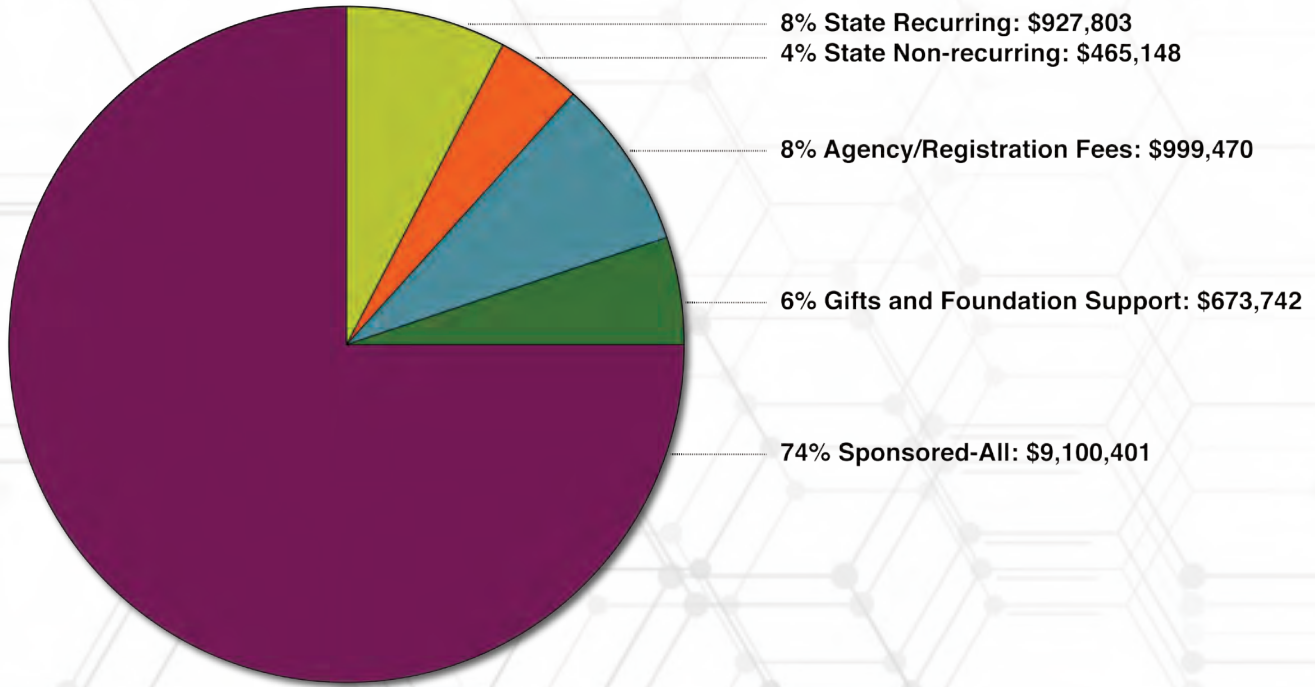
held at the high schools. Funding for the program comes from Wickelgren's NSF CAREER grant and from the Georgia Intern-Fellowships for Teachers (GIFT) a program implemented by the Center for Education Integrating Science, Mathematics, and Computing (CEISM). CEISM's Douglas Edwards and Marion Usselman are assisting Wickelgren in organizing this summer internship.

At the end of the internship, students will present a capstone project.

Maureen Rouhi
Communications Director
College of Sciences

FUNDING AND SPONSORS - FINANCIAL YEAR 2017

TOTAL FUNDING: \$12,166,563



88% OF CEISMC FUNDING IS FROM EXTERNAL SOURCES

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- Code.org
- East Lake Foundation
- Georgia Tech College of Sciences
- Gates Foundation
- General Electric
- Georgia Department of Education
- Georgia Power
- The Goizueta Foundation
- Google
- Governor's Office of Student Achievement
- Gulf of Mexico Research Initiative
- Living Building Pilot Projects: Living Building Academic and Research Council
- National Science Foundation
- SIEMENS Foundation
- UPS
- Voya Financial
- Westside Future Fund

BUSINESS AND NONPROFIT PARTNERS

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- Univision 34 Atlanta
- Voya Financial
- Wells Fargo
- West Atlanta Watershed Alliance Outdoor Activity Center
- Year Up
- YMCA of Metro Atlanta
- Zoo Atlanta

CEISMC AT A GLANCE 2017

19,000 +

PRE-COLLEGE STEM STUDENTS REACHED BY CEISMC OUTREACH, AFTER-SCHOOL PROGRAMS, AND COMPETITIONS

Georgia Tech 

1,700 +

PREK-12 EDUCATORS BENEFITED FROM CEISMC'S PROFESSIONAL DEVELOPMENT AND INTERNSHIP PROGRAMS

14

EXTERNAL COLLEGE AND UNIVERSITY COLLABORATED WITH CEISMC

10,000 +

PROFESSIONAL DEVELOPMENT HOURS WERE PROVIDED TO K-12 STEAM TEACHERS

12

GEORGIA TECH UNITS ENGAGED IN CEISMC STEM EDUCATION PROGRAMS

38

SUSTAINABLE RELATIONSHIPS CULTIVATED WITH GEORGIA SCHOOL DISTRICTS TO PROVIDE TEACHERS AND STUDENTS WITH SUPPORT IN STEM LEARNING

19

GEORGIA TECH SCHOOLS AND DEPARTMENTS WORKED ON PROJECTS WITH CEISMC

90+

SCHOOLS IN THE STATE OF GEORGIA PARTNERED WITH CEISMC TO BRING INNOVATIVE STEM EDUCATION TO HUNDREDS OF STUDENTS

200+

FACULTY AND STAFF AT GEORGIA TECH PARTICIPATED IN DYNAMIC OPPORTUNITIES FOR COMMUNITY ENGAGEMENT PRODUCED BY CEISMC

88%

OF CEISMC FUNDING IS FROM EXTERNAL SOURCES

42

BUSINESSES AND EXTERNAL ORGANIZATIONS PARTNERED WITH CEISMC TO PROVIDE PROGRAMS, CURRICULA, AND RESEARCH IN STEM EDUCATION

EDUCATION PARTNERS

GEORGIA TECH COLLEGES AND SCHOOLS

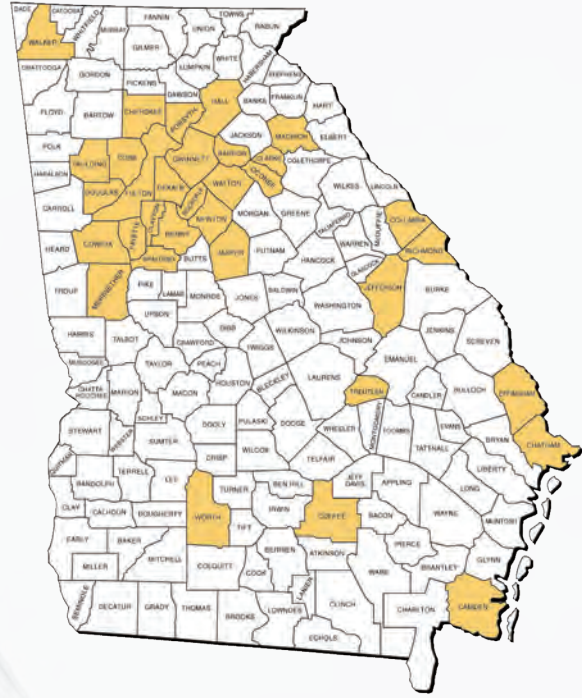
College of Design – School of Architecture
College of Design – School of City and Regional Planning
College of Design – School of Music
College of Engineering – School of Biomedical Engineering
College of Engineering – School of Aerospace Engineering
College of Engineering – School of Chemical & Biomolecular Engineering
College of Engineering – School of Civil and Environmental Engineering
College of Engineering – School of Electrical and Computer Engineering
College of Engineering – School of Industrial and Systems Engineering
College of Engineering – School of Materials Science and Engineering
College of Engineering – School of Mechanical Engineering
College of Liberal Arts – School of Literature, Media, and Communication
College of Liberal Arts – School of Public Policy
College of Sciences – School of Biological Sciences
College of Sciences – School of Chemistry and Biochemistry
College of Sciences – School of Earth and Atmospheric Sciences
College of Sciences – School of Mathematics
College of Sciences – School of Physics
College of Sciences – School of Psychology

GEORGIA TECH UNITS

Georgia Tech Center for Biologically Inspired Design
Georgia Tech Office of Development
Georgia Tech Office of Graduate Studies
Georgia Tech Office of Hispanic Initiatives
Georgia Tech Office of Institute Diversity
Georgia Tech Office of the Provost
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Georgia Tech Professional Education
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Georgia Tech Research Institution
Georgia Tech Serve-Learn-Sustain
Georgia Tech Society of Hispanic Professional Engineers Jr. Chapter
Georgia Tech Robert C. Williams Museum of Papermaking

EXTERNAL COLLEGES & UNIVERSITIES

Atlanta Metropolitan State College
Brenau University
Carnegie Mellon University
Chattahoochee Technical College
Emory University
Georgia College & State University
Georgia Gwinnett College
Georgia State University
Howard University
Kennesaw State University
Shorter University
University of Georgia
University of West Georgia
Valdosta State University



CEISM'S 2017 STATEWIDE REACH

SCHOOL DISTRICTS

Atlanta Public Schools
Barrow County School System
Camden County Schools
Cherokee County School District
City Schools of Decatur
Clarke County School District
Clayton County Public Schools
Cobb County School District
Coffee County School System
Columbia County School District
Coweta County School System
DeKalb County School District
Douglas County School System
Effingham County Schools
Fayette County Public Schools
Forsyth County Schools
Fulton County Schools
Griffin-Spalding County School System
Gwinnett County Public Schools
Hall County Schools
Henry County Schools
Jasper County School District
Jefferson City Schools
Madison County School District
Marietta City Schools
Meriwether County Schools
Newton County Schools

MEET THE CEISMC TEAM



CEISMC FALL STAFF RETREAT 2017

CEISMC STAFF AWARDS AND RECOGNITIONS IN 2017

ASEE: BEST TEACHING PAPER, 3RD PLACE, ENGINEERING & ENTREPRENEURSHIP DIVISION

Meltem Alemdar - Associate Director for Educational Research & Evaluation, **Roxanne Moore** - Director, K-12 InVenture Prize, and **Sunni Newton** - Research Associate II

GEORGIA POWER PROFESSOR OF EXCELLENCE 2017

Lizanne DeStefano - Executive Director, CEISMC

GEORGIA TECH 2017 OUTSTANDING STAFF PERFORMANCE SERVICE TO THE COMMUNITY AWARD

Sirocus Barnes - Program Director, Horizons at Georgia Tech

ITEEA ANNUAL CONFERENCE: SPECIAL RECOGNITION AWARD

Jeff Rosen - Program Director, Engineering & Robotics

INSTITUTE DIVERSITY, FACES OF INCLUSIVE EXCELLENCE 2017

Meltem Alemdar - Associate Director for Educational Research & Evaluation, **Sirocus Barnes** - Program Director, Horizons at Georgia Tech, and **Diley Hernandez** - Senior Research Scientist

THE NATIONAL CENTER FOR WOMEN & INFORMATION TECHNOLOGY 2017 ENGAGEMENT EXCELLENCE AWARD

CEISMC EarSketch Team - **Doug Edwards** - Research Associate II and **Jason Freeman** - Professor, Georgia Tech School of Music

2017 STEM FOR ALL VIDEO SHOWCASE: RESEARCH & DESIGN FOR IMPACT FACILITATORS' CHOICE AWARD

Meltem Alemdar - Associate Director for Educational Research & Evaluation, **Jeff Rosen** - Program Director, Engineering & Robotics, **Steven Taylor** - Communication Manager, **Marion Usselman** - Associate Director for Development and Educational Innovation, **Bill Wepfer** - Eugene C. Gwaltney, Jr. Chair of the Woodruff School of Mechanical Engineering and Professor, and **CEISMC's Educational Research and Evaluation Group**

UNIVERSITY SYSTEM OF GEORGIA 2017 CHANCELLOR'S SERVICE EXCELLENCE BRONZE INDIVIDUAL OF THE YEAR

Sirocus Barnes - Program Director, Horizons at Georgia Tech

THIS REPORT WAS EDITED, DESIGNED, AND PRODUCED BY ANNA FOLGER, ROSEMARY PITRONE, AND STEVEN TAYLOR. THE CEISMC COMMUNICATIONS GROUP WOULD LIKE TO EXTEND A SPECIAL THANKS TO GEORGIA TECH INSTITUTE COMMUNICATIONS, THE GEORGIA TECH COLLEGE OF SCIENCES, AND THE CEISMC STAFF AND LEADERSHIP.

CEISMC

STEM EDUCATION @ GEORGIA TECH

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