

Mini-Workshop Series for Minority Serving Institutions with ECE Programs

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Kenneth Connor is an emeritus professor in the Department of Electrical, Computer, and Systems Engineering (ECSE) at Rensselaer Polytechnic Institute (RPI) where he taught courses on electromagnetics, electronics and instrumentation, plasma physics, electric power, and general engineering. His research involves plasma physics, electromagnetics, photonics, biomedical sensors, engineering education, diversity in the engineering workforce, and technology enhanced learning. He learned problem solving from his father (who ran a gray iron foundry), his mother (a nurse) and grandparents (dairy farmers). He has had the great good fortune to always work with amazing people, most recently the members and leadership of the Inclusive Engineering Consortium (IEC) from HBCU and HSI ECE programs and the faculty, staff and students of the Lighting Enabled Systems and Applications (LESA) ERC, where he was Education Director until his retirement in 2018. He was RPI ECSE Department Head from 2001 to 2008 and served on the board of the ECE Department Heads Association (ECEDHA) from 2003 to 2008. He is a Life Fellow of the IEEE.

Dr. Craig J. Scott, Morgan State University

Dr. Craig J. Scott received his Ph.D. and B.S. in Electrical Engineering from Howard University and a M.S. in Electrical Engineering from Cornell University. He is currently serving as professor and chairperson of the Department of Electrical and Computer Engineering at one of the nation's preeminent public urban research institutions, Morgan State University. His career spans over twenty-eight years of progressive scholarly experience in such areas as research administration/ implementation, pedagogical innovation, international collaboration, strategic planning, promoting community engagement and academic program development. He instructs courses in computer vision, computer graphics, electromagnetics and characterization of semiconductor materials.

Russell Korte, George Washington University

Russell Korte is an Associate Professor of Human and Organizational Learning at The George Washington University. Dr. Korte studies the socio-cultural systems in the professions and organizations, along with the effects of these systems on learning and performance in school, business, and industry. This work specifically focuses on the professional socialization of engineering students, faculty, practicing engineers, medical students, and teachers, as well as the entrepreneurial efforts on innovators to change organizations. Prior to GWU, Korte was at Colorado State University and the University of Illinois at Urbana-Champaign where he helped design and implement an innovative first year engineering program. Korte has over 15 years of experience in marketing and advertising, including the introduction of new products for various clients, and he started his own consulting company 20 years ago. Additional research interests include theory, philosophy, social science, workplace learning and performance, entrepreneurship, socialization, professional education, and organization studies.

Dr. Barry J. Sullivan, Electrical & Computer Engineering Department Heads Association

Barry J. Sullivan is Director of Program Development for the Inclusive Engineering Consortium. His 40-year career includes significant experience as a researcher, educator, and executive in industry, academia, and the non-profit sector. He has developed and delivered continuing education courses in communications technologies, and he guided the technology strategy for a start-up company delivering packet voice services. He was a full-time member of the faculty of the Department of Electrical Engineering and Computer Science at Northwestern University for more than six years, and has taught there as an adjunct faculty member. He also worked as a member of technical staff at Bell Laboratories. He received the B.S.E.E. and M.S. degrees from Marquette University, and the Ph.D. degree from Princeton University, all in electrical engineering.

Dr. Sullivan has served as an associate editor of the IEEE Transactions on Signal Processing, publications chair of the International Conference on Acoustics, Speech, and Signal Processing, and local arrangements

chair for the Digital Signal Processing Workshop. He was also editor of THE BRIDGE, the magazine of Eta Kappa Nu. He has published over forty papers on topics in signal reconstruction and image processing.

Prof. Miguel Velez-Reyes P.E., University of Texas at El Paso

Dr. Miguel Velez-Reyes is the George W. Edwards Distinguished Professor in Engineering and Chair of the ECE Department at University of Texas at El Paso. He received his BSEE degree from the University of Puerto Rico at Mayaguez (UPRM) in 1985, and his SMEE, and PhD from MIT in 1988 and 1992 respectively. He was a faculty member of the UPRM ECE Department from 1992 to 2012. He is the UTEP Campus Coordinator for the NOAA Center for Earth Systems Science and Remote Sensing Technology. He was the Founding Director of the UPRM Institute for Research in Integrative Systems and Engineering, and Associate Director of the NSF CenSSIS ERC. His research interests are in integrating physical models with data driven approaches for information extraction using remote or minimally intrusive sensing. He has over 160 publications. He is Fellow of SPIE and the Academy of Arts and Sciences of Puerto Rico. Received the Presidential Early Career Award for Scientists and Engineers award from the US President in 1997. He chairs the SPIE Conference on Algorithms, Technologies and Applications for Multispectral, and Hyperspectral Imaging. He is board member of the Inclusive Engineering Consortium (IEC).

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Abstract: The [REDACTED] planned a full-day workshop for its members in March 2020 to test ideas developed within the organization to more fully and productively engage joint PWI-MSI teams in the US education and research enterprise. [REDACTED] is a novel collaboration among nearly 20 MSIs, most of whom participated in an NSF funded multi-year, engineering education project. This new organization was built on the idea that this collaboration can be leveraged and moved to the next level to provide higher capacity building at each of the consortium members. The hypothesis is that there are windows of opportunity open through establishment of research and educational collaborations between its MSI members with PWI research-intensive institutions. This is especially true since its member institutions serve a unique population of minority students. [REDACTED] is developing the infrastructure and programs to facilitate collaborations between faculty, students and staff in its member departments, based on lessons learned from the previous educational program and, more generally, on the Science of Team Science. It is also addressing how best to build a different type of team structure with PWIs, industry, and other external constituencies. For each type of partner, a process is being defined and tools are being addressed. The purpose of the planned workshop activities was to test the collaboration process and tools by actively engaging partner faculty with PWI department heads and other faculty.

The COVID-19 pandemic disrupted the original plan to hold an in-person workshop. There was no choice but to transition to an environment where interactions, engagement, and networking could still be achieved, albeit virtually. Discussion topics were developed for a series of online, mini-workshops, to be held over several months, with contents and aims similar to the original project. The notable exceptions related to the switch to online education experienced by all partners when their campuses closed in the spring and the urgent need to address anti-racism in engineering education.

The overall [REDACTED] vision is to be a collaboration of Minority Serving Institutions Working as One to Advance the ECE Enterprise. It is organized as a virtual super department with broadly based strengths in education, scholarship and service. Collectively, it can function as the equal of any ECE program, accomplish more and have a greater impact on its students, faculty and staff through access to resources and opportunities not available individually. It is essential that both its partners and representatives of PWIs work together to realize its grand vision of research and educational collaboration of teams from its partners working as equals with faculty, staff and students from PWIs.

This workshop series is a major step in testing out ideas developed within the organization to more fully and productively engage joint PWI-MSI teams in the US education and research enterprise; graduate more and better prepared minority engineers; increase efficiency and productivity at MSIs; and develop a sustainable and effective infrastructure to support minority students, faculty and staff at all universities. In time, the group will grow and the model being developed can be replicated and implemented for other disciplines.

Introduction

██████████ is a novel collaboration among nearly 20 MSIs, most of whom participated in an NSF funded multi-year, engineering education project. This new non-profit organization, founded in early 2019, was built on the idea that this collaboration can be leveraged and moved to the next level to provide higher capacity building at each of the consortium members, by enhancing both their research and educational enterprises through collaboration rather than solely working independently. A key aspect of this collaboration is the hypothesis that there are windows of opportunity open through establishment of research and educational collaborations not just within ██████████ but also between its MSI members and PWI research-intensive institutions. This is especially true since its member institutions serve a unique population of minority students. ██████████ is developing the infrastructure and programs to facilitate collaborations between faculty, students and staff in its member departments, based on lessons learned from the previous educational program and, more generally, on the Science of Team Science. It is also addressing how best to build a different type of team structure with PWIs, industry, and other external constituencies. For each type of partner, a process is being defined and tools are being addressed. The ██████████ planned a full-day workshop for its members in March 2020 to test ideas developed within the organization to more fully and productively engage joint PWI-MSI teams in the US education and research enterprise.

The COVID-19 pandemic disrupted the original plan to hold an in-person workshop. There was no choice but to transition to an environment where interactions, engagement, and networking could still be achieved, albeit virtually. ██████████ partners have considerable experience meeting virtually because they are not physically located sufficiently closely to enable regular (i.e., at least monthly) meetings. They do manage to meet in person at least once each year, but rely mostly on regular online meetings to sustain their network. To replace the planned March 2020 meeting, discussion topics were developed for a series of online, mini-workshops, to be held over several months, with contents and aims similar to the original plan. The notable exceptions related to the switch to online education experienced by all partners when their campuses closed in the spring and the urgent need to address anti-racism in engineering education.

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Because ██████████ partners played a key role in helping position the ECE community to implement the type of online instruction necessitated by the COVID-19 pandemic through their Experiment Centric Pedagogy (ECP) project and to sustain its robust collaborative community during these difficult times, three of the mini-workshop sessions were dedicated to the impact of COVID on

teaching and student mentoring. These sessions also enabled IEC faculty to be better prepared to participate in online meetings with their counterparts from all engineering disciplines and universities because they had already shared their ideas, problems, concerns, etc., among themselves. This workshop series is a major step in testing out ideas developed within the organization to more fully and productively engage joint PWI-MSI teams in the US education and research enterprise; graduate more and better prepared minority engineers; increase efficiency and productivity at MSIs; and develop a sustainable and effective infrastructure to support minority students, faculty and staff at all universities. In time, the group will grow and the model being developed can be replicated and implemented for other disciplines.

In addition to COVID, the social justice movement motivated by the death of George Floyd also led ■■■ to rethink part of the workshop series. In the summer of 2020, ■■■ leadership posted the following statement on their website.

The world witnessed George Floyd's horrific death captured with cell technology. The blatant disregard for his life and that of so many others like Ahmaud Arbery, Sandra Bland, Michael Brown, Philando Castile, Eric Garner, Botham Jean, Atatiana Jefferson, Trayvon Martin, Tamir Rice and Breonna Taylor is inexcusable and demands justice. Systemic racism must stop!

We use this moment to call on all ■■■ members to reflect on the brutal murder of innocent African Americans and to consider ways to change our institutions. We can no longer tolerate racism, discrimination or any form of implicit bias as they leave an indelible impression on their victims. Hence, the problem is perpetuated. While it is encouraging to witness an umbrella of people from diverse cultures and backgrounds across the country and around the world condemning these appalling transgressions, the most important thing for us is what we do henceforth.

■■■ members are committed and compelled by our mission to make a stand together along with all academic institutions in treating everyone with equity and respect, regardless of race, religion, ethnicity, sex, gender identity or orientation, age, disability, citizen status, or national origin. We extend an open invitation to all those who wish to participate by first showing unity and love for each other. We also understand that these interactions may invoke feelings of discomfort, but we must be extremely candid with ourselves and one another to move forward.

To this effect, our organization commits to:

1. Developing a deeper understanding for ourselves of the root causes of racism, discrimination or any form of implicit bias, and developing plans to eliminate them from academic settings.
2. Exploring and implementing best development, recruitment, support, and mentoring practices to increase the numbers and rank of underrepresented minority faculty at partner institutions.
3. Finding ways to increase the enrollment, retention and persistence to degree of underrepresented minority students in higher education, and provide financial, academic and professional development support systems for them from matriculation to the time they graduate and join the workforce.

4. Partnering with local K-12 school systems, especially those serving marginalized groups in our society, to develop talented minds, support them and transition them to higher education.
5. Recognizing and celebrating national and state holidays in recognition of individuals and groups who have fought for social justice.
6. Creating an annual national [REDACTED] event to engage our communities on how Electrical and Computer Engineering promotes social, economic, and environmental justice.
7. Reaching out to institutions from across the higher education spectrum to establish conversations about racism, how it impacts lives and careers, and how we can partner together to eliminate it.
8. Starting and maintaining ongoing conversations with our own minority and non-minority faculty, staff, and students on how each of us can promote equity by examining and improving our policies, procedures, strategic plans, and key indicators.
9. Identifying and acquiring the resources needed to implement our initiatives.

The mere existence of the [REDACTED] shows that society has a long way to go, and we are committed to moving forward to achieve our goals for a better, more inclusive and just society.

Given this commitment to action more than words, it was decided to dedicate at least one workshop to exploring anti-racism practice in ECE. The sessions described below are the first in a sequence of four two day sessions focused on this topic.

Mini-Workshop Series

Each of the workshops was limited to 60-90 minutes to minimize the impact on the participants' ability to deal with challenges of teaching during COVID. Recordings of the workshops and prep information can be found on the [REDACTED] website.

Session 1: RAPID Grant on Online Teaching and Collaboration and Sharing Spring Teaching Experiences (May 2020) Funding was obtained from NSF to collect data on the transition to remote teaching necessitated by COVID-19. This project was introduced to the [REDACTED] community during this first workshop session to both prepare them to participate in the study and to lay the groundwork for an open discussion on how everyone was dealing with the pandemic. The [REDACTED] community has built up a great deal of trust through their years of working together so everyone benefitted from the rather blunt discussions at this session. This was planned for 60 minutes, but most attendees stayed engaged for an extra 30 minutes.

Session 2: IEC-R1 Collaborations (The View from HBCUs and HSIs) (July 2020) The topic of this session, planned for the original March 2020 in person workshop, was addressed by [REDACTED] faculty who had previously participated in large-scale research collaborations within NSF Engineering Research Centers at the hosting R1 institutions. In essentially all cases, MSI partners were not fully integrated into the overall research effort and were definitely not at the table when the original proposal was written or when the research plan was being developed. Early involvement or establishing genuine pre-existing relationships is one of the most important issues that must be addressed if successful collaborations between MSIs and R1s are to be

realized. Everyone must be treated as equal partners and involved from the beginning, especially during the planning and pre-proposal stages of the solicitation. Generally, there were some benefits to the MSIs such as gaining acceptance as viable contributing partners, but substantive improvements in research capabilities and infrastructure were rare.

Session 3: Reopening Plans for the Fall (July 2020) For this session, the leader of the ECEDHA Lab Pros Network gave a brief presentation on their well-attended meetings focused on the delivery of lab and design courses. As noted above, the pedagogical tools that enable ECE programs to do remote labs are available, at least in part, because of the ECP project and [REDACTED] leadership wanted to encourage member faculty to participate in the Lab Pros meetings. This presentation also set up the open discussion of fall plans. As with the previous session on teaching during COVID, the 60-minute session was extended to 90 minutes to accommodate the very vigorous exchange of ideas, problems and opportunities.

Session 4: SCR₂ Mentor Summer Experiences (August 2020) The SCR₂ Mega REU/RET site focused on Smart Cities research is a grant involving [REDACTED] member faculty with [REDACTED] as the lead institution. This very large site supported a large cohort of students and teachers during the summer of 2020, with all doing their research remotely. This workshop was an opportunity for the graduate student mentors, who guided the student and teacher research projects, to share their experiences of doing research with no one physically on campus. A decision was made by project leadership to reduce the size of the program but it ended up at least 2/3 as large as when it was done in person at 3 different universities in the summer of 2019. Both students and teachers gave the program high ratings (the same or slightly better than the year before) except in the area of student-to-student interactions. The two most often cited reasons for the success of the online-only research experience were that students and teachers were encouraged to sit in on the meetings of projects other than their own and that there were regular social events. The graduate student mentors had the highest level of engagement with the REU students and RET teachers, so their feedback was very valuable. Based on this experience, a hybrid program will be offered in the summer of 2021 that will enable students and teachers to work either on campus or remotely.

Session 5: Minority Faculty Experiences at R1 Institutions (October 2020) Six African American ECE faculty from Predominantly White Institutions were invited to share their career experiences. Each created a 10-20 minute video which was posted on the [REDACTED] website a few days before the meeting. The session began with a short presentation on the video highlights, followed by an open Q&A. The stories shared were very powerful, demonstrating many opportunities lost by the panelist's home institution. Mentoring was identified as a critical issue and a variety of examples were presented that showed the impact of both good and bad mentoring. The presentation and the Q&A both helped to motivate the Anti-Racism workshops being offered by [REDACTED] spring 2021.

The next two sessions were organized and presented by [REDACTED] and [REDACTED] leadership.

Session 6: Team Science Part 1 (October 2020) Teamwork and task work are two critical components in successful collaborations, and both are needed in the forming and performing stages of team development, as they are tied together. Oftentimes individuals dive into carrying out tasks; however, getting to know each other and building relationships first are essential to establishing high-performing teams. This leads to the concept of psychological safety, a key ingredient in which team members feel comfortable in freely speaking out and sharing ideas, even if they appear outlandish. Psychological safety can be attained with trust. Sometimes professionals and students are operating as groups and not as teams, impacting their effectiveness. Senior/capstone design is one example where this frequently occurs. Part 1 of this workshop provided a means for faculty to begin to understand and practice some of the concepts of team science through topics of common interest.

Session 7: Team Science Part 2 (November 2020) Given topics of mutual interest and an avenue to do so, faculty can work together, share ideas, and suggest innovative, possible solutions to problems that can be better addressed with collaboration among several institutions rather than a single one, even with very limited time to do so. This is what transpired in the second workshop on team science. Discussions were lively. Imagine what can happen over a longer period of time. This bodes well for the potential of coalescing many more faculty for sustainable and continuous efforts to solve long-standing engineering problems. It is exciting to envision the role that the ■■■ can play by effectively utilizing team science for the benefit of students and faculty in addressing the numerous engineering challenges.

Session 8: Anti-Racism Practice in Engineering: Exploring, Learning & Solutions (ARPELS) (February 2021) The two anti-racism sessions required participants to be self-reflective, and were a tremendous learning experience. Reviewing anti-racist principles and the meaning of anti-racism served to set the operating basis for the workshop. An individual is either a racist or anti-racist. There is no in-between. To be anti-racist requires one to be active and intentional, employing fairness and equity, while non-racist connotes complicity. Racism is indeed relevant to engineering, and impacts faculty and students alike. Anti-racism can be on both a personal and system level, and is learned. So, it is a choice that one makes. The workshop presenter summarized anti-racist frameworks and practices, processes for change, strategies, and best practices. Breakout sessions were very engaging as participants shared ideas and suggested solutions to disparities. Continuing these conversations and discussions can be a catalyst for action, and can eventually lead to systemic changes. The following quotes are a sample of participants' comments demonstrating the workshop's positive impact:

- "Thanks for such an impactful and eye-opening workshop" (Female ECE professor from the Pacific Northwest)
- "Is anyone else saying, wow?!?" (Female ECE professor from the Northeast)
- "I learned even more in this second session than the first!" (Male ECE professor from the Southwest)
- "Thank you for a great workshop!" (Female NSF Program Officer)

There were three other ■■■ workshop series (with a total of 8 workshops) offered during fall and winter of the 2020-2021 academic year. One was in collaboration with an EECS trade

association and two were for NASA-INCLUDES planning grants: iCASE and ECE@HSI. All 16 workshops were well attended and often ran as long as two hours to accommodate very active Q&A. These workshops have enabled IEC to continue to grow in size and in new directions.