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Anti-Racism Practice in Engineering: Exploring, Learning & Solutions (ARPELS)

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Abstract

Recent events have brought systemic racism and racial injustice in all facets of society into sharp focus. The Inclusive Engineering Consortium (IEC), a recently formed consortium of HBCU, HSI, and TCU ECE programs, recognizes the need and opportunity this has created to stimulate action on creating a more just and welcoming environment for underrepresented minorities in engineering education. IEC members are compelled by our mission to make a stand together in treating everyone with equity and respect, regardless of race, religion, ethnicity, sex, gender identity or orientation, age, disability, citizen status, or national origin. Accordingly, and in response to both national calls for racial justice and exigencies in higher education around equity and representation, we delivered a series of capacity-building workshops in 2021 to 1) promote an understanding of inequitable patterns and 2) introduce participants to frameworks that help to counter them. Actionable steps were identified to mitigate the deleterious effects of exclusion in engineering education and to facilitate collaboration of individuals and institutions in a way that enables tangible change.

The IEC Social Justice Workshop Series (Anti-Racism Practice in Engineering: Exploring, Learning & Solutions or ARPELS) was organized to occur before and after the 2021 Electrical and Computer Engineering Department Heads (ECEDHA) conference series in March 2021 to disseminate results and recommendations to representatives of over 230 ECE departments from the US and Canada, and recruit participants for additional sessions. The overarching goals of the 3-part workshop series were 1) building capacity in understanding and embracing anti-racist methods; 2) inspiring self-reflection and organizational review around equity and inclusion and 3) launching transformational change at both the individual and systems levels.

All sessions were organized similarly. Each began with an overview of the key session topic, followed by breakouts where participants could identify concrete steps to respond to issues raised. Sessions were conducted over two days—Tuesday and Thursday—to allow time for reflection between the opening and closing segments. Session 1 focused on building an understanding of anti-racism and its relevance to engineering. Session 2 focused on forging equitable partnerships, especially between IEC MSI member programs and Predominantly White Institutions (PWIs). Session 3 began with a panel discussion of 5 African-American academics representing different levels of administration and addressed issues raised by the panel. The first three sessions (winter and spring 2021) were followed by an additional workshop session (fall 2021) focused on catalyzing research teams with partners from MSIs, PWIs and industry. For all four sessions, the key measures of success came from the lively and fruitful discussions reported on from the breakouts, which provided many excellent ideas that are being implemented by IEC to fulfill its mission of enabling its member programs to address together the issues they are unable to handle alone.

Introduction

The Inclusive Engineering Consortium (IEC) is collaboration of 20 ECE programs at Minority Serving Institutions (MSIs), similar programs at several Predominantly White Institutions (PWIs), and several industrial partners. Founded in 2019, this non-profit enables its member educational institutions to produce more diverse and better prepared electrical and computer engineers through collaboration. It grew out of an NSF funded multi-year project to develop and implement Experiment Centric Pedagogy (ECP) in 13 HBCU ECE programs. [Ref 1] While working on that highly successful project, the participants realized that collaboration with one another and, potentially, with others could enhance all aspects of their education and research enterprises in ways that were difficult or impossible to achieve independently. IEC offers a new problem-solving lens to address problems-issues-opportunities by joining forces when more resources are required than are available locally and/or when a more global approach is inherently better.

Initially, IEC activities have been focused on network-building and exploring how best to build and sustain partnerships. During the ECP project [Ref 2], it became clear that the primary goal to 'create a sustainable Network of engineering faculty at Historically Black Colleges and Universities to focus on the development, implementation, and expansion of' (ECP) was the key goal for IEC, except with a much broader impact. The ECP network grew from a series of regular in-person and online workshops and informational meetings, so the same approach was planned for IEC. Unfortunately, the COVID pandemic forced a change in plans. A large meeting that was supposed to occur in combination with the annual ECEDHA meeting in Orlando (March 2020) was cancelled. This required that the organization re-think its approach which resulted in a series of mini workshops throughout the remainder of 2020 [Ref 3]. The purpose of the original Orlando workshop and the mini workshops was to explore policies, ideas, infrastructure, training, etc. to support effective partnerships. In practice, the mini workshops also had to address COVID related issues.

The series of mini workshops helped the organization to identify some guidance for future online workshops and a key topic for future workshops on how best to build productive partnerships between MSIs, PWIs and industry. Logistically, breaking workshop sessions into two 90 minute or 2-hour meetings made it easier to fit into participant's schedules and gave them time to think about what they learned on day one so they could contribute more on day two. Giving participants a limited homework assignment ahead of day one also helped, as did reviewing key highlights of previous sessions. Because there were 7+ mini workshops, there was almost always information to be reviewed. It worked better to begin by promoting an understanding of the topics being addressed followed by introducing frameworks that help address them. Time was set aside to discuss what was learned and, especially, to identify actionable next steps. Regular communication tools such as weekly email updates, quarterly newsletters and active participation in other meetings, such as those sponsored by ECEDHA, also helped maintain interest in the series and recruit participants for future sessions. A new series of workshops on Anti-Racism Practice in Engineering: Exploring, Learning & Solutions (ARPELS) was organized along these

lines. The key related meetings were sponsored by ECEDHA and were chosen because the attendees represented the most obvious candidates for potential multi-university collaborations.

The topic of the ARPELS series came from several sources. First, during the first year of COVID, the death of George Floyd caused IEC to commit to 9 goals [Ref 4], including:

- 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.

- Exploring and implementing best development, recruitment, support and mentoring practices to increase the numbers and rank of underrepresented minority faculty at partner institutions.

- Creating an annual national IEC event to engage our communities on how electrical and computer engineering promotes social, economic and environmental justice.

- 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.

- 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.

This response called for action, not just words, so the decision was made to develop a workshop series in the general area of social justice. After a series of discussions, both internal and external to IEC, a more specific focus on Anti-Racist Practices, particularly in the context of expanding opportunities for historically minority faculty and students in electrical and computer engineering, was identified. Because of the overall goal of IEC to facilitate collaborative approaches to the job of ECE faculty as educators and scholars and the response of the IEC community to the mini workshops [Ref 3], particularly those specifically on teamwork led by Russell Korte of George Washington University, the plan for the new workshop series was based on addressing anti-racism in the context of the science of team science [Ref 5]. The questions that guided the preparation and delivery of each session were: 1) What does an equitable partnership look like? 2) How do you go about establishing it? 3) What are the important dimensions? 4) How can we advance success across the board for both parties? These questions were also specifically addressed in session 2.

Session 1 focused on building an understanding of anti-racism and its relevance to engineering. Participants prepared by completing background reading and a pre-session survey. Breakout discussions on the second day addressed disparities identified on day 1.

Session 2 focused on forging equitable partnerships, especially between IEC MSI member programs and Predominantly White Institutions (PWIs). Participants came prepared to discuss a series of questions on equitable partnerships (discussed below).

Session 3 began with a panel discussion of 5 African American academics representing different levels of administration: an engineering school dean; an associate provost; an NSF program director; a graduate school dean and senior vice provost for academic affairs; and a vice-chancellor of diversity, equity and inclusion. Breakouts addressed issues raised by this outstanding panel.

The three sessions (winter and spring 2021) were followed by an additional workshop session (fall 2021) focused on catalyzing research teams with partners from MSIs, PWIs and industry. Participants discussed strategies, funding opportunities and lessons learned from the previous sessions on how to establish equitable partnerships to address four emerging technologies and associated research opportunities. Each breakout was facilitated by distinguished researchers who helped define the area and described key new areas for research. In each case a new working group was formed to build both collaborative educational and technical research capabilities.

For all four sessions, the key measures of success came from the lively and fruitful discussions reported on from the breakouts, which provided many excellent ideas that are being implemented by IEC to fulfill its mission of enabling its member programs to address together the issues they are unable to handle alone.

Participants in each session were encouraged to build their background in diversity and anti-racism by watching or reading the following:

- Picture a Scientist – A documentary available on NOVA [Ref 6]
- Faculty Diversity – What colleges need to do now [Ref 7]
- Responses to 10 Common Criticisms of Anti-Racism Action in STEM [Ref 8]
- Lecture and Discussion on How to be an Anti-Racist (Ibram X. Kendi) [Ref 9]
- How to be an Anti-Racist (Ibram X. Kendi) [Ref 10]

Training on anti-racist methods was developed and delivered by Dr. Delia Saenz, who also facilitated the self-reflection and discussion sessions.

ARPELS Workshop Sessions

Each of the general sessions were recorded (not the breakouts) and can be watched on the IEC website [Ref 4], which also contains guidance on what is addressed in each session video. What follows is a summary of each session.

Session 1: Principles of Anti-Racism (9, 11 February 2021)

The first session reviewed anti-racism practices, promoted the sharing of experiences, provided an opportunity for self-reflection and the identification of action steps. The questions addressed were: 1) What does anti-racism mean? 2) How is it relevant to my work? 3) What can I do to promote equity? 4) What can be done in my unit? During the session, participants learned about the importance of focusing on outcome disparities and understanding the role of structural barriers/conditions that serve to maintain these disparities. As well, discussion of differential patterns of access and participation were linked to systemic, and not simply interpersonal, forces.

Breakout discussions on the second day addressed disparities identified on day 1 in relation to one's role as an engineer. Specifically, participants were guided through a structured reflection of their own role in dismantling unfair practices and policies.

The stage was set by the AURA theory of change – in order to advance sustainable change, we need to create a context for Awareness, Understanding, Reflection (self & unit) and Action. Nurturing relationships and understanding that lead to personal growth were promoted through CROP norms: Center the voices of BIPOC participants; Respect others; Open-mindedness; and Perspective-taking.

Race and Racism were reviewed with specific attention to their relevance to engineering and the underrepresentation of women and minorities. Race is a socially constructed category system with no basis in biology. Racism is a system comprised of racial inequities, policies that create and maintain inequities, and racist ideas that justify these policies. Anti-racism is comprised of a set of anti-racist policies justified by anti-racist ideas that produce racial inequity. You can choose to be anti-racist by focusing on the ABCs of anti-racist practices: Attitudes (stable beliefs/dispositions); Behavior (actions, often guided by attitudes/values); and Consistence (the notion that our behaviors will match our espoused attitudes).

Day 1 ended with a review of goals: consider all groups equal in competence and motivation, identify policies in our ambit that violate the norm of fairness, and commit to change ourselves and the systems of which we are part to ensure equity across all members.

Day 2 was primarily a discussion of applying anti-racist frameworks and practices to change ourselves and the systems we work and live in. Participants were encouraged to address the needed elements of advancing change (the 3Rs: Resolve, Resources, Responsibility), the process components for change (education, data collection, communication/messaging, resource (re)allocation, accountability), strategies and methodologies (focus: diversity, climate, equity). Best practices examples to help individuals look at their organizations in a more equitable context included investment, diversification, policies, climate, data and creating an ecosystem.

Session 1 was reviewed at the ECEDHA Summit (23, 25 March 2021) to introduce ECE department heads to ARPELS and recruit participants for the remaining sessions.

Session 2: Forging Equitable Partnerships (21, 23 April 2021)

The second session focused on forging equitable partnerships, especially between IEC MSI member programs and PWIs. The topics discussed were: 1) What does an equitable partnership look like? 2) How do you go about establishing it? 3) What are the important dimensions? 4) How can we advance success across the board for both parties? Key issues such as missions of different types of institutions, student success, access to resources, and specific ways to initiate focused partnerships were explored.

On day 1, participants were reintroduced to the CROP norms, discussed above, to promote positive productive interactions. Material on effective group work from the IEC mini workshop series [Ref 3] was reviewed, addressing 1) group characteristics and establishing groups; 2) what

a group or team is; 3) sharing a common goal, with examples for MSI-PWI; 4) social aspects of a group; and 5) structure and clarity around tasks and personal engagement.

On day 2, a summary of a report [Ref 11] published by the National Academies Press in 2019 that emphasized how MSIs can contribute to the overall need for STEM professionals was presented, followed by a discussion of how MSIs differ from PWIs. Basic steps in crafting partnerships were reviewed: 1) Identifying areas of collaboration 2) Connecting authentically, establishing rapport 3) Discussing joint interests, significance 4) Identifying available resources 5) Cross-institutional challenges 6) Facilitating tools – time for practice. The final activity of the day was an interactive question and answer session on helpful tips to connect authentically when entering into a partnership.

Session 3: Panel of Administrators/Leaders Discuss Anti-Racist Practice in Engineering (18, 20 May 2021)

On day 1, a panel of African American academic administrators and leaders discussed changes during their tenure and identified impacts, barriers and transformations. They specifically addressed: 1) What has been transformational? 2) What are the biggest barriers? 3) What has had a large impact? 4) What are the biggest challenges faced now and previously? 5) What are the outcomes? The panelists described programs and initiatives they have led in their own careers to broaden participation of underrepresented persons at every level of higher education (undergraduate and graduate student levels, faculty success, grant writing). They shared successes and pitfalls and highlighted high impact efforts that are replicable and sustainable. Breakouts provided opportunities to address issues raised by this outstanding panel, to brainstorm collaborative ideas across institutions.

On day 2, panel presentations from day 1 were reviewed and participants divided into breakout groups to identify 1-2 promising best practices, keeping in mind the 3Rs (Reality, Relationships, Resources) discussed above.

IEC Catalyst Workshop: Making Better Engineers Through Social Justice (26, 28 October)

Building on the three ARPELS sessions, MSIs from IEC, PWIs and industry partners came together to discuss strategies and research opportunities and to establish equitable partnerships that address emerging technologies and research opportunities. The goal of this workshop session was to create 4 or 5 technical groups, with members from all three participating groups, that would prepare white papers on potential topics for collaborative research projects, to be shared with the organizations presenting opportunities on day 1.

On day 1, IEC MSI member highlights were presented, followed by opportunities and resources for support, with an emphasis on programs focused on MSIs. Breakout session 1 addressed the tech pipeline: what industry needs from future engineers and session 2 addressed retaining and preparing engineers of color.

On day 2, building equitable partnerships and increasing the pipeline to address technical topics in ECE were reviewed. Participants were divided into 4 technical breakouts, facilitated by

established leaders from PWIs. Topics addressed were: 1) Semiconductors; 2) Applied AI, Cybersecurity and Cloud Computing; 3) Beyond 5G; and 4) Green Energy. Each of the groups reported out followed by an open forum.

Workshop Session Discussions

The information addressed in the sessions came from the presenters, question and answer periods and breakouts. Everyone contributed in some way.

Session 1: Principles of Anti-Racism

The outcomes for this session will be briefly summarized, with selected excerpts, because they have previously [Ref 3] been described. Essentially every idea presented was reinforced in the subsequent sessions, most notably that the language of anti-racism provides a powerful context for the experiences of faculty and students. '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… Continuing these discussions and discussions can be a catalyst for action, and can eventually lead to systematic changes.' Responses from participants were consistently positive. 'Thanks for such an impactful and eye-opening workshop.' 'Is anyone else saying wow?!?' 'I learned even more in this second session than the first.' 'Thank you for a great workshop.'

Session 2: Forging Equitable Partnerships

Participants and the workshop leader shared positive and negative experiences, which was helpful as it captured, by examples, the reason for the workshop. The importance of setting guidelines and expectations upfront was emphasized. If there is no clear guidance, the team doesn't work well.

A clear case was made that diversity and inclusion allows teams to take on bigger problems; produce more creative solutions; and engage different skill sets to create quality solutions. In the business world, with women and minorities in management, greater growth and more profit are the outcomes. A societal case was made for diversity as well.

Breakout groups identified several areas for collaboration: 1) senior design, especially having a common showcase for student work; 2) curriculum modules, especially involving industry; 3) engaging industry in collaborations involving students and faculty from both MSI & PWI with co-advisors from both institutions; 4) helping students be industry ready, particularly addressing rapidly changing technology through rapid response curriculum development teams with contributions from both industry and the academy, with free access to all; and free up education from limitations imposed by the term schedule. ERCs have course content developed that can serve as models, addressing all issues.

A participant gave an example that in meetings there is a moderator to assure that interactions follow the norms described above. If someone starts to use microaggressions or starts overtalking, there may be a pause. The person is not always called out, but there may be a pause,

and then that person will be talked to after the meeting. If you have some level of privilege, do your part to speak up, self-reflect.

Training is important for both faculty and students if they are to make teams work. It is important to "break the ice" and "check in." The social aspect is important. Those in leadership should be trained in inclusive practices and bring more people into the conversation. Leadership can come from each of us, it doesn't have to just come from those holding an official leadership position. It is incumbent on each of us to speak up and speak out.

Each group reflected on why it is valuable to collaborate and how to do it, the value of the MSI-Industry-PWI partnership, and how IEC can play a role in facilitating/supporting partnerships.

Session 3: Panel of Administrators/Leaders Discuss Anti-Racist Practice in Engineering

Karen Butler-Purry, Assoc. Provost at TAMU - Discussed a Sloan Minority PhD Program and an NSF LSAMP Bridges to the Doctorate program. For these doctoral focused programs, the first semester is most important in retaining students, success was almost assured if they made it through the first semester. It is very critical to have core faculty engaged with the program. Institutionalization is the most challenging aspect to such programs. Success can be achieved if you have committed people and systems in place. Institutionalization is always a challenge. Deans and provosts must be part of the process.

Christine Grant, NSF Program Director – She shared her life experience of 40 years in the profession, starting at Georgia Tech, then NC State as the only woman of color in the school at the beginning. The language of anti-racism provides context for experiences. It is important not to wait 30 years for self-reflection. Diverse faculty should be engaged with as individuals, not collectively. Organizations must enact policies to address racism. Faculty must develop networks of support and facilitate such networks.

Renetta Tull, Vice Chancellor at UC-Davis – Empower leaders in order to change mindsets. Moving the needle requires action. The Impact of societal influences can't be separated from the impact on the individual psyche. It is important that the act of developing new programs is not a panacea, we have to pay attention to the system itself, and the people who have the power to make change. Reflect on the history of your own institution to inform future strategy for advancement. Acknowledge the history of engineering in terms of inclusion.

Stephanie Adams, Dean at UT-Dallas – For doctoral students, invite underrepresented students to a 'bootcamp' for basic skills in communications, preparation for careers in academia, and better coping skills. It is best to engage students early. Bring in students by cohort from the start. A data driven approach to DEI in departments is critical. Benchmark against peers and aspirants. Set a clear vision. Solicit buy-in. Require accountability in leadership in achieving DEI goals, as well as appropriate resources that match priorities. If you can't be the source of change, then move aside for someone who knows what to do.

Mark Smith, Dean at UT-Austin – A Big change towards addressing racism is identifying it as an issue and giving visibility to it. Make a DEI statement be part of the promotion and tenure

package and annual faculty reviews. Chairs and directors must also be asked about DEI, particularly how it is integrated into the reward process. Search committees must include DEI seriously. Sharing student experiences is important in terms of their journey through the graduate experience. Compile these into a book and use it as a resource on lessons learned. Complement with videos to set the stage for discussion.

Breakout Reports – Diversity and inclusion should be a part of faculty evaluations and departmental assessment and planning. Use connections with other organizations to increase diversity engagement and data collection. Use the P&T rubric to work across boundaries and increase inclusivity. Have faculty address who they do research with, who they publish with, who they collaborate to teach classes. Search committees should include a diversity advocate to make sure it is looking without bias at each candidate and that the candidate seems to reflect a diverse pool. There is a need to address systemic racism issues and the relationship between PWI and HBCUs. Everyone should be open to discussing issues like racism. Information should be provided to potential collaborators at the beginning of discussions about joint activities.
Not enough potential students or faculty have MSIs on their radar. There is a need for collective outreach to reach a much larger audience at all levels from K-12 through college so that there is a real, informed choice that includes MSIs.

IEC Catalyst Workshop: Making Better Engineers Through Social Justice

The technology group breakouts were led by Farinaz Koushanfar (UCSD) for Applied AI, Cybersecurity and Cloud Computing, Rashaunda Henderson (UT-Dallas) for Beyond 5G, Joe Chow (RPI) and Ardelia Clarke (NREL) for Green Energy, and Tsu-Jae King Liu (UC-Berkeley) for Semiconductors. Each group was given a template to be filled out by a scribe (IEC staff). What follows is a simplified version of the template, which was developed based on the best ideas identified and explored during the previous three sessions. The complete template has some additional sub-topics and space for responses.

IEC Catalyst Workshop - Technology Group Breakout Template (Simplified)

Norms for participation: the **CROP** acronym. (See above)

4 Key Questions/Issues about group work in general to prepare for equitable partnerships

- What is a Group/Team?
- Sharing a Common Goal
- Social Aspects of a Group
- Structure and Clarity Around Tasks & Personal Engagement

Goals:

- Build a Community of Practice. What exists now and what needs to be added?
- Identify short and long-term opportunities for collaboration in education and research

Group Topic: Semiconductors, Applied AI, 5G, Cybersecurity & Cloud Computing, Green Energy

List Facilitator, Scribe, Presenter, Participants.

Discussion Notes, Plans for future meetings, Report out bullets.

Collaboration Template (Guidance developed at previous workshops): 1) Identify area(s) of collaboration (sample areas: learning modules, senior design, joint speaker series, student/faculty/staff exchanges, research, joint advising, industry internship, DEI training, skills building) 2) Connect and establish rapport by having each participant provide their name, discipline, area of specialization, tidbit of individuating information. 3) Discuss collaborative interests with potential collaborators—what domains, what activities & significance. Elucidate aspirational goals. 4) Identify resources: individual and institutional. 5) Collaborative engagement—how will you ensure regular communication, psychological safety (trust, respect, openness to novelty), a growth mindset, mutual benefit, accountability? 6) Cross institutional challenges—what are the barriers and facilitators? Address stereotypes/expectations, resources, grant policies, IDC rates, intellectual property, other constraints. 7) Facilitating tools: How can IEC be of service: hub for networking, training, dissemination?

The responses from each of the groups were similar in their major issues. The R1 PWIs had more and better resources to support research, including, especially, faculty time. MSIs have a much stronger focus on undergraduate education and advising and much larger teaching and advising loads. Typical teaching assignments for strong R1 schools are one or two courses per term. At MSIs, it is more often four courses per term. There is a great deal of untapped talent at MSIs and students at MSIs have more limited opportunities to do research and, thus, get on a productive pathway to an advanced degree. Everyone agreed that it is only through equitable partnerships that the students, staff and faculty at MSIs can more fully engage in the ECE education and research enterprise while still maintaining their present focus and strengths and honoring their traditions in teaching and advising. The workshop participants were passionate about the potential of effectively and equitably working together. So much so that interest in becoming affiliate members of IEC has grown significantly, with several new ECE programs and related programs joining IEC since the Catalyst Workshop. The technical groups are also beginning to form, with the Applied AI, Cybersecurity, and Cloud Computing group leading the way.

For all four sessions, the key measures of success came from the lively and fruitful discussions reported on from the breakouts, which provided many excellent ideas that are being implemented by IEC to fulfill its mission of enabling its member programs to address together the issues they are unable to handle alone. Evaluation measures indicated that participants gained knowledge/skills, felt the content was relevant to their contemporary careers and current institutions, and wanted to learn more about anti-racism frameworks and practices.

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