THE ENGINEERING IDEAS INSTITUTE

SESSION 3:
JUSTICE, EQUITY, DIVERSITY & INCLUSION

Summit 9 Report
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Session 3
**Justice, Equity, Diversity & Inclusion**

**Session 3 Overview**

During the ECL-USA Summit 5 in Kansas City we learned that, with respect to attracting young women and under-represented minorities (URMs) to pursue degrees and careers in engineering, the “system is stuck.” Although, the number of graduates from engineering programs has increased substantially over the last 15 years, the percentage of those graduates who are women has not budged -- it is stuck at about 20%. URM’s have experienced a similar dynamic.

This session of the Engineering Ideas Institute explored why the system is stuck and possible leverage points for unsticking it (removing barriers, fostering enablers, changing mindsets and unconscious biases, etc.). Our inquiry into this wicked problem (adaptive challenge) looked through a variety of lenses, including K-12, university, practice, as well as the overall system. We also benchmarked the experiences of a related profession (architecture) as a means of reflecting on conditions and opportunities within the engineering community.

In this session, we also explored the imperative for justice, equity, diversity and inclusion within the engineering community considering what we are learning from our experiences flowing out of the recent George Floyd and Black Lives Matter protests.
Rachel Attebery is Director of Operations at Diode Ventures, the infrastructure development arm of Black & Veatch. Her BS is in Chemical Engineering, and she is a licensed Professional Engineer in Kansas. Prior to joining Black & Veatch, she worked in manufacturing, oil and gas, and information technology. She is an advocate for overcoming unconscious bias in the workplace. You can hear her TED talk at this link - https://www.youtube.com/watch?v=4FRkdA8ymB8.

Peggy Layne retired as Assistant Provost for Faculty Development at Virginia Tech, where she led initiatives to increase gender equity in faculty hiring, development, retention, and advancement. Layne was president of the Society of Women Engineers in 1996-97. She is the co-editor of SWE’s annual review of research.

Rosa Sheng is a Principal at SmithGroup, Studio Leader of Higher Education and Director of Equity, Diversity, Inclusion. She was AIA SF Past President and Founding Chair of Equity by Design. Rosa’s thought leadership has been recognized for catalyzing a national movement for equitable practice in Architecture with research and public speaking at TEDxPhiladelphia, Cannes Lions Festival, Harvard, Stanford and KQED/NPR.
Synopsis of Provocations

**REFLECTIONS ON DIVERSITY AND INCLUSIVITY**

Rachel Attebery, PE
DIRECTOR OF OPERATIONS, DIODE VENTURES

Rachel Attebery began her provocation with a reminder of how long the issues of gender and racial inequality have been with us. The 1964 Civil Rights Act guaranteed protection against discrimination in employment based on race, color, religion, sex or national origin. Legislation in subsequent years has added protection against discrimination on the basis of age, pregnancy, and disability. The 1963 Equal Pay Act guaranteed equal pay for equal work. With respect to equal opportunity, women now represent over 50% of the workforce. However, despite the long-standing legal guarantees of equality, equity (actual results) has not been achieved. Data from 2019 demonstrates that there is still a significant pay gap between men and women in equivalent positions.

Attebery then explored issues related to the lack of qualified candidates from women and under-represented minorities in engineering.

**BROKEN RUNG.** Despite some increases in entry-level positions, major barriers and obstacles remain for women in progressing to management and leadership positions. According to the 2019 “Women in the Workplace” report, the biggest obstacle for women is the first step into management-level positions, the “broken rung” in the ladder. The study found that for every 100 men promoted or hired at the manager level, only 72 women were hired or promoted to manager.

**MISSING THE “E” IN STEM.** According to Attebery, the number of women interested in STEM fields is increasing. Engineering, however, is falling behind the other STEM disciplines in attracting women. Follow through on early interest in a STEM career primarily depends on the influence of parents and mentors. Unfortunately, the absence of role models can be an inhibiting factor diverting young women’s interest away from engineering. The “broken rung” described above can contribute to a vicious cycle where the lack of women in management and leadership positions reduces the potential number of women available to be role models and mentors.

**MEANING AND PURPOSE.** A key point for the engineering community is that the system is more stuck with respect to the core engineering disciplines than for other STEM careers and for certain engineering disciplines, such as environmental and bio-medical. An important observation from Attebery is that one reason for this is that women do not see the meaningfulness of engineering. As we have heard from multiple ECL-USA provocateurs, young men and women are increasingly prioritizing purpose and meaning in their careers. As Attebery stated, “engineering needs to connect what we do to why it matters.” The disciplines of environmental and bio-medical engineering appear to be more successful in making this connection.
REFLECTIONS ON DIVERSITY AND INCLUSIVITY

Attebery concluded her provocation with her thoughts on what we can do to overcome bias, particularly unconscious bias. She noted the importance of inquiring reflectively, personally and with others, about how you treat people. Seek feedback and be willing to ask yourself hard questions. And, make a commitment to change. She then powerfully summarized her own personal, intentional choices.

“DO THE BEST YOU CAN UNTIL YOU KNOW BETTER AND WHEN YOU KNOW BETTER, DO BETTER.”
– Maya Angelou

1. *Admit ignorance.*

2. *Choose to start with love.*

3. *Value relationships ahead of politics.*

4. *Choose to be a role model for the next generation.*

5. *Refuse to be an angry voice and instead demonstrate creating safe, equitable environments for those that are within my power to lift up.*
Peggy Layne began her provocation by stating that she has been working on diversity in engineering for 30 years -- which, for her, is somewhat discouraging given the familiar statistics highlighting lack of progress that she cited.

- The percentage of bachelor’s degrees in engineering earned by women has been stuck at about 20% since 2000.
- Percentages are higher in environmental, bio-medical, biological and agricultural engineering, while the core disciplines lag.
- The percentage of engineering degrees earned by under-represented minorities is also stuck.

In the engineering workforce:
- The percentage of women is stalled out at about 12%, the lowest of the STEM fields.
- The percentage of under-represented minorities is about 15%.

Source: AAUW, 2015, Solving the Equation
DIVERSITY IN ENGINEERING CONTINUED

Layne also summarized the latest Society of Women Engineers research.

› Boys and girls have generally equal interest in engineering, and there is not a gender achievement gap in math.

› With respect to engineering as a career choice, academic preparation is a small factor. Girls’ perception of readiness and family influence are more important factors.

› In engineering education, women do not drop out at a higher rate than men.

› In the workforce, family formation and parenthood have a greater impact on women:

WOMEN ARE MORE LIKELY THAN MEN TO LEAVE THE WORKFORCE AT THE BIRTH OF A FIRST CHILD.

SUPPORTIVE CULTURES AND SUPPORTIVE POLICIES ARE IMPORTANT, INCLUDING THE CREATION OF AN ENVIRONMENT WHERE WOMEN DON’T HAVE TO FEAR CAREER SLOW-DOWNS BECAUSE OF WORK-LIFE CHOICES.

Reiterating the theme of the session, Layne stated that we are stuck despite 40 years of effort. Her observation from her many years of work is that we need to transform the cultures of engineering organizations. We need to root out the institutional structures that perpetuate bias.
Rosa Sheng’s provocation summarized the work of the architecture community in addressing the issues of equity, diversity and inclusivity. AIA started their Equity by Design initiative in reaction to diversity statistics like those for engineering and from a recognition that a more diverse population represents opportunity. AIA’s research is based on surveys that began in 2014 and continued with additional surveys in 2016 and 2018. These surveys have revealed important “pinch points.”

- Cost of an architectural degree with higher debt incurred by female and black students.
- Hiring practices.
- Cultural practices that require spending years “paying your dues” prior to engaging in more meaningful work.
- Licensure issues.
- Work-life integration issues for working parents.
- Glass ceiling to opportunities in management and leadership.
- Equity issues in pay, particularly at the design principal level.
- Creativity bias – perception that the “great” architects are primarily men.

The 2018 survey of over 14,000 members of the architectural community focused on understanding career paths and perceptions of career success. Data from this survey showed that personal values and personal growth are the most important drivers for all architects. Metrics of career success are most influenced by culture and relationships, engagement and impact, and work-life balance. AIA is now focusing their activism on these metrics.
One example of this activism is the development of the AIA Guides for Equitable Practice (https://www.aia.org/resources/6246433-guides-for-equitable-practice), which offer research and best practices across a wide range of the business practices related to equity, diversity, and inclusion. Sheng emphasized that these guides should be applicable to engineering businesses as well.
**LEARNING FROM ARCHITECTURE CONTINUED**

The activism is also extending into programs that work to ensure a comprehensive view of diversity and inclusion, moving from gender and race to social class background, lived experience, LGBTQ, and other facets of people’s lives. Sheng described the evolution of thinking needed to acquire inter-cultural intelligence (ICQ) – moving from denial to defensiveness to minimization to acceptance to adaptation and, finally, to integration. She also described a similar continuum of development to becoming an anti-racist, multi-cultural organization.

![Intercultural Development Continuum](image)

In the final part of her provocation, Sheng sought to shed the light on aspects of design that perpetuate injustice and result from ignorance of the lived experiences of all types of people.

- Disproportionate health and wellness impacts of COVID-19 on minority populations driven by working conditions, economic inequality, and housing conditions.
- Impacts of red-lining which continues to impact health and wellness, social mobility, and life span decades later.
- Equity and accessibility issues for nursing mothers.
- Restroom accessibility for the LGBTQ community.
- Accessibility for the disabled.

Sheng’s closing challenge was to understand another continuum- that of moving from the injustices of the past and beyond the status quo of the present to a future of justice and liberation.
GROUP EXERCISE - DIVERSITY, INCLUSION, & EQUITY CHALLENGES

To complement and deepen the learning from the provocations, Kyle Davy led participants in an exercise designed to explore the “stuckness” of the system using a polarities framework illustrated by the diagram below.

**System & Environment**

**Cultural**
Beliefs, Values, Norms, etc.
- Barriers & traps
- Unconscious biases
- Stereotypes
- Work environment
- Job pressures
- Harassment & bias
- Micro-agressions
- Power dynamics
- Glass ceilings / fences

**Structural**
Structure & Dynamics
- Role definitions & policies
- Expected capabilities
- Career & developmental paths
- Demographics
- Gatekeepers
- Pay / compensation / rewards
- Work / family balance options
- Access to tools / classes / opportunities

**Personal**
Mastery
- Capabilities / Skills
- Personal Goals / Purpose
- Motivation
- Beliefs About The Field
- Self Efficacy
- Identity
- Growth Mindset & Grit

**Interpersonal**
Relationships
- Parents / Family
- Teachers (K-12)
- Faculty (Higher Ed)
- Mentors / Guides
- Support/Encouragement/Guidance
- Feedback
- Assignments
- Oppty’s/Responsibilities
- Modeling

Note: Apply @ Three Levels of the System:
- K-12
- Higher Education
- Work
GROUP EXERCISE - DIVERSITY, INCLUSION, & EQUITY CHALLENGES CONTINUED

Small groups were assigned one quadrant of the grid for their inquiry and were asked to choose one level (or more) of the system (K-12, Higher Educ., Practice/Work) to work on. They were then tasked with exploring the following questions.

- What barriers, points of friction, or factors causing inertia are present within your assigned quadrant? What are major factors causing the system to push back against or be stuck with respect to change efforts?
- What mental models/mindsets are present that contribute to friction/inertia?
- What are possible leverage points for unsticking the system? Which are most significant?
- What are current “best practice” initiatives / interventions that you know about that appear to be successfully shifting the system?
- What might be particularly important lines of inquiry that could/should be pursued to help “unstick the system”?

Group discussion centered around common factors and insights.

K-12 EDUCATIONAL SECTOR.
- Biases in testing.
- Teachers with limited to exposure to engineering that fosters the “engineering is hard” myth.
- Need to create awareness of engineering role models from diverse backgrounds.

HIGHER EDUCATION SECTOR.
- Need for diverse faculty which requires overcoming the myth of meritocracy.
- Support systems that provide mentoring, but also insure access to food and housing for minority students.
- Partnerships with employers.

PROFESSIONAL WORKPLACES.
- Need for more proactive recruiting of women and under-represented minorities.
- Unbiased applicant evaluation systems.
- Support systems that provide coaching and mentoring.
- Support for non-linear career paths.
- Flexible policies.
- Overcoming biases related to the “ideal worker.”

ACROSS ALL SECTORS.
- Our individual responsibility to call out injustices.
- Need to change the public perception of how engineers contribute to society.
TEN LEVERAGE POINTS FOR CHANGE:

1. Biases, many unconscious, are major drivers of behavior across all the polarity grid quadrants. Surfacing and shifting biases at all levels will require sustained efforts (personal work, training, mentoring and coaching, communicating positive role models, etc.).

2. Emphasize the potential to do meaningful work and to “change the world” through engineering.

3. Use formal training and development programs to build leadership and personal mastery skills, (increasing self-awareness, emotional intelligence, and the ability to engage in difficult conversations and constructive conflict, etc.) to drive both personal and cultural change.

4. Publicize more success stories and positive role models drawn from the ranks of women and URM engineers. For many students, “You have to see it to be it.”

5. Support basic needs of URM students as they move through educational systems (transportation, resources to take advantage of opportunities, remote learning, WIFI, etc.)

6. Prioritize mentoring at all levels. Build on successful programs like ACE Mentor, extending those concepts to higher education and work/practice levels.

7. Create more inclusive/equitable workplaces through development of work environments that support family and children choices and “non-linear” career paths.

8. Fix the “broken rung” in the career ladders within engineering organizations, creating a positive reinforcing dynamic where increased numbers of women and URM in management and leadership positions inspire more young women and URM’s to choose engineering careers.

9. Increase the candidate pool for recruiting students, faculty, and workers by reaching outside of traditional geographies and organizational partners—“fish from a bigger pond.”

10. Change recruiting policies and practices to access and bring on-board more women and URMs—sanitize race/gender biases in recruiting practices.

BONUS:

11. Recognize that the COVID crisis is unsticking the system in many compelling ways, unfreezing past practices and behaviors and pointing toward new ways of learning, working, and being that could significantly impact diversity, inclusion and equity. However, there is a need to proactively and speedily identify and spread lessons learned from the COVID experience to drive that change. Waiting too long will allow the system to refreeze into “business as usual” practices and attitudes.

Finally, one critical takeaway was that we are focusing too much on isolated technical fixes that can be defeated by structural issues or interpersonal issues. As represented by the polarity matrix, the challenge of diversity, inclusion, and equity within engineering should be viewed as a “wicked problem” that demands change efforts that recognize the complexity and interconnectedness of that system.
REFLECTING ON ANTIRACISM AND THE BLACK LIVES MATTER MOVEMENT

The final portion of the session included a brief discussion on what we are learning about the future of engineering from our experiences this summer surrounding the Anti-Racism and Black Lives Matter movements. To frame the discussion, the group viewed the video – “Black Engineering Faculty Speak” https://www.youtube.com/watch?v=c3qzaTq9ZkU

KEY POINTS FROM THE GROUP DISCUSSION ARE SUMMARIZED BELOW.

Reflections from provocateurs:

The book **How to Be an Antiracist** is a must-read. We must recognize our own racism.  
- Rosa Sheng

Engineering is a mirror of society.  
- Peggy Layne

The impacts of slavery are still felt today.  
- Rachel Attebery

Open discussion:

- The practice of engineering impacts racial inequality in many ways, i.e. bulldozing of neighborhoods for urban freeways.
- There are close ties between engineering practice, public policy, and racial inequality.

In his book *How to be an Antiracist*, Ibram Kendi asserts that racial inequality is rooted in a powerful collection of self-interested racist policies embedded across society. Recognizing, confronting, and changing those policies is fundamental work required to create a more just and equitable society.

Engineers and the engineering community have helped shape and implement many of those policies – sometimes blindly and unwittingly, but at other times purposely and with eyes wide open. Looking to the future, we can own and acknowledge our part in helping to create these inequities and choose to join with others to change policies, address inequities, and build a healthy, thriving future for society.

**WE HAVE MORE LEVERAGE AND POWER THAN WE THINK. WE NEED TO USE THAT POWER IN DIFFERENT WAYS TO CREATE ADVANTAGES FOR ALL.**

"WHEN YOU SEE SOMETHING THAT IS NOT RIGHT, NOT FAIR, NOT JUST, YOU HAVE TO SPEAK UP. YOU HAVE A MORAL OBLIGATION TO SAY SOMETHING: YOU HAVE TO DO SOMETHING."

– CONGRESSMAN JOHN LEWIS, 2020
THE ENGINEERING IDEAS INSTITUTE
SESSION 3 – KEY TAKEAWAYS

› Engineering organizations need to think beyond technical fixes and transform their cultures to one of equity and inclusiveness.

› The engineering community needs to shift the public’s perception of engineering, stressing the importance of engineering in addressing the challenges of the future such that we attract young people of all backgrounds to engineering.

› There are close ties between the public policy that impacts engineering practice and racial inequality. We can work to change those policies.

• Admit our own bias and ignorance.

• Choose to start with love.

• Value relationships ahead of politics.

• Refuse to be angry voices.

• Create safe, equitable environments for those that are within our power to lift up.

• Choose to be a role model for the next generation.

› We all have an individual responsibility to call out harassment, unfair treatment, and bad policies.