Refuse, Refute, Resist: Alt-Right Attacks on Engineering and STEM Education Diversity Scholarship

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Abstract

Recently, white supremacists rebranded as the “alt-right” have waged a national media campaign targeting critical education scholars, including STEM education diversity research and our commitments to equity, inclusion, and social justice. Many campuses have been besieged by white supremacist activity seeking to incite violence and attract media attention.

In this climate, many of today’s students are encountering conversations around difference, power, and privilege amid a flurry of alt-right propaganda, exposed in a new way to overtly racist, sexist, homophobic, transphobic, xenophobic, Islamophobic, or ableist ideas through new media. This is a high-stakes, low-safety environment for all learners, presenting particular challenges for instructors.

This paper calls for a return to first principles, for us to make the case again and anew for the importance and value of diversity, inclusion and social justice, and especially the importance of dismantling white privilege and white supremacy, in higher education and in engineering. This paper thus revisits the arguments for STEM diversity made in past decades and re-examines them in the light of re-invigorated white supremacist movements in the United States and Europe. It reviews the literature on proven successful strategies for countering hate activities in classrooms and on campuses. It calls for the explicit incorporation of these in engineering curricula without delay, and for widespread professional development of instructors, building on the success of the recent ASEE and NSF sponsored Safe Zone workshops.

Introduction: STEM Diversity and the Alt-Right

Diversity in engineering, and in science, technology, engineering, and mathematics (STEM) more broadly, has been at the heart of the engineering education and STEM education research agenda for several decades. I use the term “diversity” here in an umbrella fashion to denote scholarship on diversity, inclusion, social justice, equity, multiculturalism, liberation, privilege, and other related framings, aware of the important differences among them and debates surrounding different conceptualizations. I am interested in all categories of identity and their intersections, including ability, age, class, ethnicity, gender, gender identity and expression, nationality, race, religion, sexual orientation, veteran status, and more.

The present times have put much of our progress in the area of STEM diversity at grave risk. Over the last decade, a movement has grown up that puts a new face on old and familiar white supremacist ideas. Using social media tools and focusing in part on campus communities, the alt-right has gained mainstream exposure through its support of Donald Trump’s presidential candidacy and administration. The Trump White House has incorporated policy ideas, rhetoric, and individual leaders from numerous hate groups.1 There has been some debate about whether the term alt-right masks the group’s clear ties to hate such that some have advocated not using
the term and preferring “white supremacists,” “white nationalists,” “neo-Nazis” or similarly specific terms. However, the alt-right has a distinct character and is being tracked in its current instantiation by groups like the Southern Poverty Law Center. It is important to understand alt-right ideologies and tactics and compare them to that of other hate groups and movements.

The alt-right has focused a significant amount of attention on college campuses. In some ways this is a familiar extension of attacks on certain social science and humanities scholars dating back to at least the 1970s when women’s studies, African-American Studies, Latino/a Studies, Native American Studies, and other fields were being formed. By the 1990s the war on so-called political correctness was in full swing and the academy was being cast as liberally biased because it sought to create inclusive campus climates for diverse groups of students.²

Indeed, this is at the heart of why higher education has become such a target for the alt-right. The Southern Poverty Law Center notes that

> College campuses are clearly on the frontline of the alt-right’s battle against multiculturalism. They are targeted for a simple reason: They embrace diversity, tolerance and social justice. They strive for equality and have created safe spaces for students of every gender and identity. College campuses are home to the highest ideals of human rights. These values are soft targets for the alt-right. College students are curious and receptive to new, even radical, ideas. And universities, by definition, welcome free speech and philosophies of every stripe. Publicly funded schools, in fact, may not prohibit free speech. It’s an opportunity the alt-right and other extremists are enthusiastically exploiting to attack egalitarian values and recruit students to their cause.³

This is part of a broader right-wing ideological agenda around defunding higher education and reserving education for elites.⁴ These attacks on higher education appear to have already swung public opinion significantly; a recent Pew survey showed only 30% of Republicans now have a positive view of higher education, a rapid decline from just two years ago.⁵ It is not surprising that what remains supported is an instrumentalist valuing of higher education solely as credentialing. We must not shy away from returning to first principles, making the case again for broadly accessible higher education and the value of an educated populace as a public good.⁶

Numerous alt-right and right-wing groups have targeted scholars who work on issues of diversity, inclusion, and social justice. Many scholars are experiencing harassment, including threats of violence and death for them and their families. This targeted harassment has escalated in the past year, and at many universities, it has been difficult to protect scholars fully.⁷ Critical education scholars have been singled out in a focused series of attacks; their senior colleagues have collaborated on a statement of support and committed to protect and defend these scholars, serving as an important model for other scholarly communities.⁸

While STEM diversity scholars have not typically found themselves the targets of white-supremacist groups in the past, there appears to be a new effort on the alt-right to incite social media mob attacks to attempt to censor or discredit research on STEM diversity. Scholars targeted so far for their publications and public comments on STEM-related topics include
engineering educators Stephanie Farrell\textsuperscript{9} and Monica Cox,\textsuperscript{10} math educators Rochelle Guitierrez,\textsuperscript{11} Esther Wilder,\textsuperscript{12} Piper Harron,\textsuperscript{13} and Luis Leyva\textsuperscript{14} (who also does work in engineering education research), biological anthropologist Kate Clancy,\textsuperscript{15} feminist science studies scholars Banu Subramaniam and Angie Willey,\textsuperscript{16} and myself.\textsuperscript{17}

These renewed attacks make crystal clear the presumptions of racial and gender inferiority that lie at the core of alt-right belief systems.\textsuperscript{18} The fundamental argument is that women and minorities are less qualified for engineering (or other kinds of access) and do not merit inclusion. The slant of the attacks on STEM diversity scholars drives toward a common false narrative in which STEM diversity scholars want special dispensation for students (or for themselves) because those individuals would otherwise struggle to remain in STEM (due to their presumed inferiority, for which no evidence is provided).\textsuperscript{10,11,12} Any suggestion of bias against underrepresented groups in STEM fields (for which there is ample evidence in the literature) is dismissed, mocked, or met with shock and outrage. STEM diversity researchers, often insiders to STEM themselves, are misrepresented as outsiders launching attacks on STEM itself.

Rochelle Gutiérrez,\textsuperscript{19} in a commentary on her own experience of alt-right harassment, reflects on the positionality of the math education community in relation to rightwing attacks on diversity scholarship in the academy. She notes that she herself had been publishing without backlash for nearly two decades, specifically calling out White supremacist capitalist patriarchy, building on five decades of math equity scholarship in her discipline. She asks, why now? While the tools of social media have produced some new vehicles for these attacks, and contributed to a dehumanizing environment in which attacks can take on an especially personal and especially violent tone, this nonetheless does not explain the delay in targeting math equity (or STEM diversity) scholars when others in the academy have been attacked for decades. Crucially, she notes, “we have convinced ourselves that ’equity’ is a strong enough agenda when maybe revolution should be the goal” (11), and “perhaps we believed, like others, that our scholarship was neutral or absent from politics” (13). She suggests that these attacks are happening now because the work of math equity scholars has gained enough momentum and refocused on institutional and structural change, so as to post a real challenge to systems of White supremacist capitalist patriarchy. She also notes that the attacks have created opportunities for scholars to come together and organize in new and broader way.

Our field’s debates about how best to approach the enhancement of diversity, inclusion, and social justice in engineering education are healthy, vibrant, engaging, and must continue. For this to happen, we need to be able to test new ideas in our publication venues and at conferences like CONECD without fearing for our personal or professional security. It is not simply about the principle of academic freedom, which protects faculty expertise and scholarly authority. We need to make clear that research on diversity in engineering education continues to be a central grand challenge for engineering and STEM, a priority that deserves primary focus for funding and publishing because it is crucially important for our collective future. It goes to the heart of the mission of many of our institutions, especially public universities and land grant institutions who seek to serve the broad population. We are not, as the alt-right would depict us, some cadre of
conspiracy theorists off in a corner chattering about things that defy conventional wisdom or broad academic consensus in our field. Diversity is a central call to action in our discipline.

Students entering college today have not necessarily been raised in environments that teach basic knowledge or awareness of diversity, inclusion, and social justice. Many have likely been raised with exposure to violent white supremacist rhetoric, toxic masculinity, homophobia, Islamophobia, anti-Semitism, and other forms of bias. The possibilities for safe enough spaces for open conversations about identity, diversity, and inclusion are limited and require concerted effort. The stakes are tremendously high, especially for students who are members of targeted groups.

It is time to return to first principles, to return to previous times in our history when stakes have been similarly high or higher, and make the case again. We need to meet our students where they are, speak with relevance to the current situation, and at the same time begin from page one, assuming nothing about prior knowledge or values commitments. From where we sit in 2018, we have the opportunity to incorporate lessons learned from past efforts, to use the most effective curricula and pedagogy, and fight for the values we hold dear. The alt-right is trying to instill values of hate in our students, values that run contrary to those of our institutions and our profession. We need to band together and say Not in Our Town, Not on Our Campus.20

Review of Arguments for Diversity, Inclusion, and Social Justice in Engineering

At their core, arguments supporting diversity, inclusion, and social justice are ethical arguments; they contain a moral “ought,” and articulate an aspirational state for which we strive. Some arguments are made from appeals to enduring principles like equality, while others appeal to more expedient goals like personal success in industry. We need to have at the ready both a critical ability to analyze others’ arguments and a creative capacity to articulate effective arguments of our own.

Many of the arguments presented by the alt-right and other detractors lack strong logical grounding; they contain distortions of facts to develop straw arguments, employ ad hominem attacks and schoolyard name calling, and assert without proof the inferiority of some groups relative to others. See, for example, the Helmer letter from ASEE Prism21 which asserts that not all diversity is good because LGBT people are disease-prone, and need to be saved by Jesus. Or the Campus Reform article which presents Luis Leyva as having “complained” about white, heteronormative masculinity in mathematics and:

According to Professor Luis Leyva, children are implicitly taught from an early age to associate innovative problem-solving with masculinity while viewing conformity and "meekness" as feminist traits.14 [sic]

The piece contains so many typos it is unintelligible and Leyva’s actual argument is rendered unrecognizable. There was a time when we would have ignored or dismissed such arguments as invalid, and such shoddy and sloppy writing as drivel. However, many students struggle with information literacy and are still developing their ability to evaluate the quality of information and argument; we cannot afford to ignore this reality.22
It is crucial in our educational mission to teach explicitly the institution’s and profession’s values, how to identify and assess relevant facts, and how to critically evaluate an argument. Our teaching of critical thinking in engineering needs to expand to include information literacy and broader conceptions of criticality. Our arguments, if they are of high quality, will win the day, if we take the time to lay them out clearly for students. The time has come we when can no longer take multicultural arguments for granted as commonly accepted knowledge, such that it suffices to lightly reference them in the introductions to our research on diversity in STEM. This requires a deeper, concerted effort to truly understand our students and the debates of the day in which they are immersed through social media, and to meet them not just intellectually but also affectively in an engaged educational process.

Below I have collected numerous arguments that have been part of the case for diversity in STEM, and I categorize them loosely using classical divisions for types of ethical arguments. I have not undertaken a systematic review here, as the goal of the paper is to present the range and types of argument available, not to consider their frequency of use or any empirical findings related to them. Scholars such as Juan Lucena and Amy Slaton have previously characterized historical shifts in diversity arguments. The histories presented by both tell us that during the civil rights era and into the 1970s, arguments based in social justice and equal opportunity were more prevalent. Beginning in the 1980s, there was a clear shift in rhetoric toward concerns around national economic competitiveness in relation to the emergence of Japan as a global technological and economic force. With the rise of neoliberalism in the last decades of the 20th century, and as we moved culturally toward a so-called post-racial era and witnessed the erosion of affirmative action policies, the “business case” for diversity has come to prevail. However, all of these arguments remain relevant and important in making the case for diversity in STEM, and different arguments will prove decisive in different settings.

**Consequences: Utilitarian and Instrumentalist Arguments**

I begin with utilitarian and instrumentalist arguments for STEM diversity because they are the prevailing justifications used in our present time. One of the most common of these is “the business case” – that is, an argument that *diversity is good for the bottom line*. First, there is research that suggests that *diverse teams are more creative* and produce a wider range of solutions, and are therefore more likely to come up with the “best” solution. Such a team would in turn challenge more homogenous teams to raise their games and increase their performance. In addition, multicultural skills are sought after by industry; engineering students can no longer afford to ignore interpersonal skills in their professional preparation.

The presence of more diversity within a firm or institution will lead to that organization being more attractive to a wider range of individuals, and provide additional advantages for recruiting the best talent. In other words, *diversity produces excellence*. Good diversity practices enable an organization to pursue and recruit optimal talent. Taken together, the body of evidence suggests that *diversity provides a strong return on investment (ROI)*. Another part of the business case is that *diversity is key to maintain our global competitiveness*, because there is or will be a workforce shortage of STEM talent, or because changing US demographics means that we can no longer afford to lose white females and people of color of all genders to other fields.
Some of the problems with these arguments are that they can essentialize race- or gender- based characteristics of talent; the idea that every member of a particular race, ethnic group, or gender necessarily “thinks differently” (in particular ways) from members of another group is problematic. Similarly, there is a shallowness to some diversity efforts that celebrate difference without addressing inequities in any way, what Slaton has called the “ethnic cookie day” approach to diversity. Those who study the functioning of diverse teams know that merely collecting diverse individuals is not sufficient; we must also consider relations of power, psychological safety, and other dynamics among individuals. There is a great deal of debate about the STEM workforce shortage and American competitiveness that hinges on both the details of labor economics and the specific workforce landscapes in specialized industries. Despite these finer points, the overall arc of these arguments remains compelling. We need talent, and we ought not to exclude it. It is entirely possible to value, welcome, and reward contributions of talent from all locations and identities without essentializing that talent.

**Duties and Rules**

A second category of justification falls under those things we consider to be duties, responsibilities, and rules or obligations. For example, several Codes of Engineering Ethics include statements that support diversity and forbid discrimination on the basis of multiple categories of identity or condition. *Engineering professionals have a duty to treat all people fairly and not engage in discriminatory acts.* The IEEE Code of Ethics requires members “to treat fairly all persons and to not engage in acts of discrimination based on race, religion, gender, disability, age, national origin, sexual orientation, gender identity, or gender expression” while the ASCE has recently added a new canon and three accompanying guidelines that require:

- Engineers shall, in all matters related to their profession, treat all persons fairly and encourage equitable participation without regard to gender or gender identity, race, national origin, ethnicity, religion, age, sexual orientation, disability, political affiliation, or family, marital, or economic status.
- Engineers shall conduct themselves in a manner in which all persons are treated with dignity, respect, and fairness.
- Engineers shall not engage in discrimination or harassment in connection with their professional activities.
- Engineers shall consider the diversity of the community, and shall endeavor in good faith to include diverse perspectives, in the planning and performance of their professional services.

Recently, ABET adopted a new set of student outcomes which includes: “An ability to function effectively as a member or leader of a team that establishes goals, plans tasks, meets deadlines, and *creates a collaborative and inclusive environment*” [emphasis mine]. Those of us in accredited engineering programs now have an obligation to educate students for this learning outcome. Compliance with statutes such as Title VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and the Americans with Disabilities Act of 1990 all require particular actions from us as educators in ensuring equitable and accessible learning and working
environments on our campuses. Such compliance is also required as part of most professional codes of ethics. These rules are established to protect particular rights held by individuals.

More broadly, (most of) our engineering ethics codes further require us to “hold paramount the health, safety, and welfare of the public,” which would imply a duty to uphold this principle for all groups. In cases of environmental justice, for example, where impacts fall disproportionately on communities of color or poor communities, the paramountcy clause would require us to act.

Broader normative ethics principles such as the Golden Rule (or related principles such as the Hillel Rule or the Platinum Rule) might also establish a duty to treat others as (or better than) we would like to be treated, and to not do those things which we would not like done to us. This would include treating others with mutual respect, not treating others as inferior, etc. It might also entail a duty to create an inclusive and welcoming climate for others, if this is indeed what we would want for ourselves.

**Fairness and Justice Framings**

Rights can be seen as operating under duty ethics, as they can be established under the law, but they also have a clear relationship to justice and fairness frames within the ethics space, which can at times be more expansive than the duty framing affords. Consider for example, a comparison between compliance with the requirements of the Americans with Disabilities Act and a broader vision of the social model of disability that would demand more of us in establishing truly accessible spaces for people with disabilities. In the same way, there are laws establishing Equal Opportunity and/or Affirmative Action, and while we have a duty to comply with those laws, it is also helpful to remember the principles of fairness and justice that the laws are intended to address. For example, the best practices we employ to ensure equitable consideration in job searches are not only those narrowly defined by the law, but also those that serve the spirit of the law in the broader sense.

Notions of justice vary widely; for many focused on race, class, gender, sexual orientation, and other identities, power and privilege are essential elements to consider in any discussion of diversity and equity. Conceptualizations of equal opportunity can sometimes omit critical considerations that reveal how un-level the playing field actually is. Stephen Secules has argued for an historical approach to understanding diversity, inclusion, and social justice in engineering education. By establishing detailed cases of systemic injustice over generations and in particular lives, we can deepen our conceptualizations of injustice and what justice would demand of us. We can better understand the root causes of the systemic injustices that exist in engineering education and begin to design remedies that address those, facing the –isms and brutal practices of slavery, colonialism, and genocide that are fundamental to the establishment of the United States.

A popular Internet meme designed to teach the difference between equality and equity has led to some engaged conversation and re-visioning of justice and liberation in contrast to these concepts (Figure 1). Thinking through how these principles might be actualized in engineering education settings is well worth our time.
Figure 1: Equality, Equity, Justice, and Liberation. Internet memes compiled from:
In conceptualizing justice and injustice in engineering education, we need to think not only in large historical ways as Secules argues, but also in small everyday ways, as microaggressions, unconscious and implicit bias, and stereotype threat operate in cumulatively deleterious fashion and produce real and lasting harm.

The concept of intersectionality\textsuperscript{36} is also very relevant to fairness and justice arguments; not only does injustice exist, but it exists in different and specific ways for individuals who embody multiple kinds of difference; impacts are not merely additive and one must consider the particular experiences of individuals to truly characterize injustice. An intersectional approach is especially important as diversity encompasses more categories of difference; it prevents an “oppression Olympics” in which categories compete for focus and attention by recognizing multiple valences of privilege and disadvantage that operate simultaneously. It can also allow us to consider important differences within populations, so that members of large heterogeneous groups such as Latinos or Asians are not painted with one broad brush of assumed experiences.

\textit{Virtues and Values}

Some arguments we have not used frequently in engineering education (if ever) can be found in the area of virtue ethics, where common values help define aims and goals for diversity and inclusion work. The vast majority of academic institutions will articulate in some form a commitment to diversity, inclusion, and social justice, and some principles for being together as a community. Where these are strong, they can form an excellent basis for discussions of diversity, inclusion, and social justice in engineering and across campus.

For those of us at land grant institutions, the Morrill Act provides some guidance that education was being established not for elites but for all: “… in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.”\textsuperscript{37} Slaton\textsuperscript{25} provides an excellent and in-depth discussion of how racial segregation played out at land grant institutions. The second Morrill Act was passed in order to ensure that those states that were implementing segregated education systems did not exclusively funnel federal resources to white institutions. Even so, resource inequities persisted, radically shaping the whiteness of the engineering profession. This history of race in engineering education matters, and reminds us of exactly what is required to truly implement the mission of education for all students.

It is important to note that this land grant mission was dual in nature: to promote both liberal and practical education, for both professional and “several pursuits” of life. That is to say, the mission of the land grant university is not to be narrowly construed as solely for credentialing or professional training; rather it is there to shape the whole person as a citizen as well as an engineer, to fulfill their potential contributions to society for the common good.

In keeping with the ideal of education for all, Alice Pawley has recently argued in the \textit{Journal of Engineering Education}\textsuperscript{38} that we ought to view the diversity of proportionate representation as the norm – that is, engineering classrooms should reflect the demographics of society, and when it does not, we need to speak up and ask why not. Diversity should be the normative state of existence, she argues, and we should not accept anything less. Another value that can be salient in establishing the justification for diversity and inclusion efforts (and that likely informed both
the Jeffersonian ideal of public education and the Morrill Act) is the dignity and worth of all human beings, and human rights for all.

Sarah Song\(^{39}\) presents an important argument for multiculturalism that could be an effective part of the diversity and inclusion case. Rather than an individual rights-based approach, in which we would expect individual equal respect, she explains that philosopher Charles Taylor argued for ontological holism, which establishes recognition as a collective social good that is more than the sum of the individual parts. Identities develop, Taylor argues, through relationships with others. When those others fail to recognize us or mis-recognize us, it causes harm, especially if what is reflected is negative or limiting. People require a mutual recognition, grounded in collective concepts of the common good, which incorporates an intrinsic valuing of cultures and identities.

Another justification for multiculturalism articulated by Song\(^{39}\) is the idea of freedom from domination. This could also be viewed as a type of conceptualization of justice, and it may also be (or become) a commonly held value for campuses. In this line of argument, we might find justification for the incorporation of critical race theories, feminist theories, crip and disability theories, decolonizing theories, and queer theories, among other critical theories, in helping us think through what it might mean to develop a culturally responsive engineering – a decolonizing engineering, queer engineering, feminist engineering, crip engineering, and so on. These theories ultimately point to a need to expand fundamentally how we know what we know – what philosophers call our epistemology. This is an invitation to explore deeply what might constitute epistemic justice\(^{40}\) for engineering and its disciplines of knowledge.

**Weaving Arguments Together**

In practice, multiple types of arguments would be offered in making a case for diversity, inclusion, and social justice. An excellent example of how this might look is the public argument for diversity in college admissions made by Princeton and Harvard presidents Bill Bowen and Derek Bok in their book, *The Shape of the River*.\(^{41}\) The book presents a mass of data that speaks to the positive consequences of considering race in admissions, uses arguments around fairness and justice to explain the failures of a “color blind” perspective relative to a racial justice perspective, and appeals to both legal requirements and commonly held values or virtues.

As engineers, we often find ourselves convinced by data. However, it is important to remember that data is perhaps necessary but will usually not be sufficient in constructing compelling arguments in this area. As an example, consider the persistence of the roundly-debunked racist arguments presented in *The Bell Curve*.\(^{42}\) Even by the mid-nineties, when the book was first published, the arguments presented in that book had long since fallen out of scientific favor. A group of scientists got together and went through the book systematically and thoroughly refuted its arguments, again.\(^{43}\) Twenty years after this debunking, one of the authors appeared on the university lecture circuit again, and many scholars wondered how, after such a thorough takedown, these arguments could continue to persist. Eric Siegel\(^{44}\) offers the explanation that it is because the authors’ endorsement of prejudice was never thoroughly exposed. Logic and data cannot ultimately refute animus, though it may expose it; rather, meaningful relationships work on an affective level to mitigate hate.\(^{45}\)
A longer conversation in the future is warranted to discuss the ins and outs of the various arguments presented here, and the relative merits of different incarnations of each. For now, let it suffice to lay them out in general terms with the goal of reminding us that we need to bring the full range of these arguments to bear on the situation at hand. Different arguments will resonate differently for different individuals in different contexts. Recently we have gone fairly far down a road related to arguments about talent development and workforce preparation. It’s not that these arguments aren’t compelling; in fact, it is their effectiveness that renders them so popular in the present moment. At the same time, we can’t lose sight of other compelling arguments. We also must anticipate counterarguments and be prepared with responses to those.

**Engineering Education for Diversity, Inclusion, and Social Justice**

We must begin immediately to incorporate STEM diversity education into engineering curricula. One obvious justification is simply that our accreditation board now requires it, but the larger principles of establishing education for all embedded in the establishment of land grant institutions and other public universities, or the broader business case, or a broad justice-based argument that members of all communities ought to be able to have a role in designing and controlling the built environment and sociotechnical systems that are so central a part of all of our lives.

It needs to be said, first off, that we *are already* teaching diversity in engineering; we are teaching with our silence that it has no place for discussion in our classes. Students are quick to pick up on the disconnect between a sincere aspirational rhetoric of inclusion, and the reality of courses, in which we can’t even talk about who is missing and why. It comes as no surprise that some students walk away internalizing the lesson of this null curriculum, that maybe engineering isn’t for everyone after all. What we think of as “doing nothing” or “remaining neutral” is actually already quite damaging.

Another important reason for undertaking this effort now are the persistent student-to-student microaggressions and more overt acts of hate that occur on campuses where many students enter with little or no diversity education in their backgrounds. Despite the erosion of affirmative action policies, we continue to observe incidents where students of color and white female students are told they were only admitted because of their underrepresented status, and that they are taking up a spot of a more qualified white male. Many of our students arrive at universities having absorbed and internalized intellectually lazy positions that reinforce positions of privilege without pausing to apply basic critical thinking or investigate any facts. Taking no action to correct these presuppositions, even though we might think we are remaining neutral, or apolitical, in actuality serves the political agenda of the alt-right.

The educational outcomes related to STEM diversity could be based on the single learning outcome required by ABET, or it could be enhanced using some of the learning standards developed for curricula around difference, power, and privilege, such as the teaching tolerance learning standards. These include specific learning outcomes across four anchors: identity, diversity, justice, and action.
As with all education, all students may not achieve learning objectives in one lesson plan, one course, or one degree program. Our goal is to facilitate student learning as much and as best as we can. Some students will resist learning about STEM diversity. This presents its own learning opportunity for students as well as faculty.48

One key question related to content is how much to include the arguments of those who oppose STEM diversity. One of our own ethical obligations as educators is not to present discredited material – at least not in a way that would imply such material has merit. There is potential for real and significant harm to come to students from inappropriately presenting such material. We must not, for example, present discredited material as falsely equivalent, or offer all views equal time when they do not merit such consideration. Teaching about difference, power, and privilege may raise traumatic memories from previous incidents of bias and harassment for some students. In my experience, I have had both those who have experienced bias and those who have perpetrated it come to me in office hours for further conversation. It is essential that instructors are properly trained and prepared, and able to refer students to those with more extensive training as needed.

As few engineering faculty members have had sufficient education in difference, power, and privilege ourselves, it is immediately necessary for us to attend what trainings we can and work with colleagues from other disciplines who have expertise they can share. We have honed “train the trainer” strategies and the development of communities of practice around many topics, including the recent Safe Zone efforts led by ASEE and Stephane Farrell at Rowan University. Expanding such an effort, or creating a parallel effort in this area, is welcome and needed.

It would be naïve to suppose that this education will occur without significant protest from the alt-right. Part of the work of the community of practice may include working with networks of deans and department chairs to prepare them on how best to support faculty undertaking this work. It is critical that we do not allow the alt-right to sideline or marginalize the mainstream values of inclusion that are central to our profession and to our educational institutions. It is a professional obligation of engineers to have competencies in the area of STEM diversity, and it is therefore a professional obligation of engineering instructors to deliver this education.

Developing a diverse STEM workforce has been a national priority for decades; engineers would fail in our obligations to society if we do not do our level best to develop this workforce. If and when alt-right attacks occur, it is important that we support those scholars who are engaged in diversity work.49

Effective Pedagogies and Curricula for STEM diversity Education

Fortunately for us, there are mountains of resources available to teach STEM diversity, and there is significant research evaluating the effectiveness of different teaching strategies and curricula. For example, Kulik and Roberson\textsuperscript{50} found in a review of research since 1970 that there are “golden opportunities” for effective diversity education in both academic and business organizations. They note a record of success in improving both diversity knowledge and overall attitudes toward diversity. They argue that more work is needed in the evaluation space to answer further and more specific questions, more work is needed on skill and behavioral aspects
of diversity education, and more work is needed to measure long term effects of diversity education. More recently, a meta-analysis of 40 years of diversity education research by Katerina Bezrukova and colleagues showed strong and lasting cognitive learning outcomes for diversity education, with attitudinal or behavioral shifts being significant at first and then declining over time.\(^5\) Their posited explanation is that prior attitudes may be reinforced by individual’s home and community environments, while the cognitive gains for diversity may be more likely to be reinforced in occupational or educational settings. Bezukova et al. also found that integrated approaches to learning and longer, more intensive or immersive learning experiences were more effective than one-shot, superficial trainings.

Pettigrew and Tropp\(^5\) found in a meta-analysis of intergroup contact studies that encounters with minority groups can lessen prejudice and that it does so via three separate mechanisms: by increasing knowledge about the group, by reducing anxiety, and by increasing empathy. While they found all three to be important actors in reducing prejudice, the last two, affective aspects, were more important. It is important that whatever pedagogy and curriculum we develop, we consider and tend to students’ hearts as well as their minds.

**Placement in Curriculum**

The task before us is to identify where to place diversity education in the engineering curriculum. The research suggests that sustained experiences that are integrated with the wider curriculum are more effective. Incorporating significant diversity education into first year is an obvious immediately achievable goal, with many programs already incorporating some elements at present. Another obvious place to include a deep dive in diversity would be in courses on ethics and professionalism, or in co-op and capstone experiences. Here lessons about diversity can be readily applied in workplace contexts, and future employers can readily build on educational outcomes in industry training settings. Finally, we must seriously consider how to build diversity education into the engineering core courses. One easily implementable way to do this would be to identify and highlight achievers in the field who are members of diverse groups. Students could do this as an assignment initially, and profiles compiled over time for future students to explore. Applications of specific topics in a variety of cultural contexts (see for example the work of Ron Eglash), and applications that have not been inclusive and might be avoided in the future would be straightforward to include.\(^5\)

A more complex set of ideas might be presented in any of these courses using content from science and technology studies on the relationships between technology and society, and how relations of power across race, gender, ability, class, and other categories both influence and are influenced by sociotechnical systems. A stand-alone course on diversity in engineering or STEM would also be appropriate and could be offered as an advanced elective in any engineering degree program. Some models for such a course already exist; engaged learning in which students carry their broader education in difference, power, and privilege to peers in engineering and across campus would be particularly meaningful.
Ultimately a sequenced, four-year undergraduate thread on difference, power, and privilege in engineering could be developed in which students deepen their knowledge, skills and attitudes in this area over time.

**Critical and Culturally Responsive Pedagogies**

The review of effective practices in support of diversity, inclusion, and social justice, and everything we know about active learning, points to the importance of using engaged pedagogies – both in the sense of cognitive engagement and in the sense of social engagement. A set of pedagogies that may be less familiar to the engineering education community has been developed over decades to help learners understand, resist, and dismantle power and privilege. *The Critical Pedagogy Reader*\(^5^4\) presents a fine introduction to the family of critical pedagogies developed by Paulo Freire\(^5^5\) in Latin America, reinterpreted for feminist and anti-racist education by scholars like bell hooks,\(^5^6\) and later reinterpreted to address multiple contexts of oppression and liberation including decolonizing pedagogies, queer pedagogies, pedagogies that address class, ableism, and more. Central to all critical pedagogies is a focus on power relations, with a focus on transforming relationships of power in classrooms and in society. Critical thinking and reflective action are primary outcomes that empower students to act positively for change in the world.

Culturally responsive or culturally relevant pedagogy is a radically student-centered approach that seeks to ground learning in students’ lives, ensuring relevance to individual students and providing opportunities to validate different cultural backgrounds in multicultural classrooms to support student success.\(^5^7\) White, Cooper, and Mackey propose combining the two types of pedagogies in a mutually supportive fashion.\(^5^8\) While each has a different focus, the two approaches are complementary.

**Curricular Resources**

The number of potential resources for learning in this area is vast. Education Scholars at the University of Massachusetts have produced a pair of books to support education for diversity, inclusion, and social justice.\(^5^9\) Existing trainings abound, from Implicit and Unconscious Bias Training (https://diversity.ucsf.edu/resources/unconscious-bias-resources), to Ally and Bystander Intervention,\(^6^0\) to Dismantling Racism\(^6^1\) to the Difference, Power, and Discrimination model at Oregon State.\(^6^2\) The Black Lives Matter Syllabus has numerous current resources for teaching contemporary issues related to race and racism.\(^6^3\) The Southern Poverty Law Center’s Teaching Tolerance curriculum\(^6^4\) could be adapted for college campuses, or their guide for students countering the alt-right on college campuses could be used in an engaged classroom setting.\(^6^5\)

Recalling the lessons learned from evaluation of education efforts around difference, power, and privilege, it is important that the combination of curriculum and pedagogy address knowledge, skills, and attitudes, and that it enable intergroup contact as a means of reducing prejudice through reducing anxiety and increasing empathy.
The Packed Curriculum, Getting Political, and Other Objections

We can of course anticipate pushback about the packed engineering curriculum and faculty time commitments. It is best to acknowledge up front that it takes time, yes. And it’s a priority we have ignored for too long. We need to make the time. We may need to de-prioritize some other aspects of the curriculum and allow students to learn more advanced or esoteric details on their own or in graduate school. We know this is a fundamental learning outcome that must be acquired at the undergraduate level. We need to have an honest reckoning with ourselves as engineers, whether we believe competency around difference, power, and privilege is more important to learn than the nth obscure engine cycle, or the weirdest and wildest heat transfer fin shape. Is diversity more important than fugacity? In the end, we need to make room in our curriculum for what matters. It is time for boldness.

As discussed above, we can anticipate we will be accused of getting political. But our silence on matters of diversity in engineering classrooms is already political, communicating that there is no room for diversity in the engineering classroom, in engineering curricula, in the field as we define it. The absence is not neutral; it is in fact quite telling.

In this lies our greatest challenge: to educate students who are empowered as critical thinkers and reflective actors, who will not be idle bystanders but who will face and meet the challenge to refute, refuse, and resist prejudice and injustice as a professional obligation of engineering.

Conclusion

Diversity, inclusion, and equity are central values for both the engineering profession and many of our institutions of higher education. The professional formation of engineers thus must include education around difference, power, and privilege as a critical professional competency. Diversity education needs to be integrated without delay in engineering curricula. Embarking upon this mission in today’s vitriolic climate poses significant challenges for students and faculty alike. Returning to first principles, making the case again for diversity, inclusion, and social justice, is the order of the day. Working closely together, supporting one another, and continuing to organize robust networks of committed actors will parry attacks and facilitate the incorporation of effective diversity education on a broad scale. Building on lessons learned and best practices for faculty development, diversity education curricula, and effective classroom practices can equip us well for the work ahead.

References


6 See, e.g., Thomas Jefferson, Notes on the State of Virginia, 1785, for views on public education and the importance of educating all genders and classes. Karl Smith deserves recognition for this idea of returning to first principles for public higher education, which he shared in personal conversation at the 2017 FIE conference in Indianapolis.


20 Not on Our Campus. Project of Not in Our Town. https://www.niot.org/project/notonourcampus


Performance Paper presented at 2013 ASEE Annual Conference & Exposition, Atlanta, Georgia. 


37 Act of July 2, 1862 (Morrill Act), Public Law 37-108, which established land grant colleges, 07/02/1862; Enrolled Acts and Resolutions of Congress, 1789-1996; Record Group 11; General Records of the United States Government; National Archives.


46 Thanks to Idalis Villanueva for introducing me to this term.