Engineers are not the first actors that come to mind when considering social justice issues, but they play an integral role in designing and operating the sociotechnical systems in which we work and live.

**FACTORS OF CONCERN**

Decisions of engineers and the social power imbalances that exist around them have significant societal impacts. The twin lacks of education about how engineering and social justice issues are intertwined and of diversity in the field have led to a long history of inequitable engineering decisions made without considering their effects on large groups of people heavily affected by them. Disproportionately high levels of environmental pollution in poor communities (Katz 2012), algorithmic bias in facial recognition technologies that lead to wrongful arrests of people of color (Najibi 2020), and the increased risk of female injury in automobile crashes because of their inadequate representation in crash testing protocols (Barry 2021) are just a few examples illustrating the critical need to integrate equity in engineering. These technology-based inequities demonstrate the urgent need to prepare engineers who understand the societal implications of their work and can design equitable sociotechnical systems. Such systems promote a healthy society and distribute benefits to the system’s users equitably, taking into consideration different stakeholders’ requirements of technology (e.g., based on age, physical and mental abilities, socioeconomic or cultural background).

Educators across the country have risen to the task with education interventions, community-building approaches, and design initiatives that incorporate social justice concepts. Even with these efforts, much progress is still needed to integrate these concepts into the mainstream understanding of engineering practitioners.

**HISTORICAL CONTEXT**

Merging social justice concepts into the profession is not new—discussions of injustice and industry date back to Adam Smith’s writings in the 1700s (e.g., *The Theory of Moral Sentiments*, 1774). During the Vietnam War, engineers who were conflicted by the field’s contribution to the design and production of military weapons formed the Committee for Social Responsibility in Engineering, which inspired engineers to use their skills with regard to social context instead of only profit. The resulting publication *SPARK* identified negative applications of engineering skills and opportunities to work toward liberatory ends (Wisnioski 2012).

Since then engineering education scholars have made essential contributions to incorporate social and
political-economic context in students’ understanding of engineering.

Progressive engineering education reform efforts—including educational and professional community-building interventions as well as scholarly contributions—have been categorized in terms of how they could work at different levels of reform to comprehensively integrate social justice into the field (Nieuisma 2013). And studies have examined how engineering could be changed if social justice were a core component of the profession (Baillie et al. 2012; Riley and Lambrinidou 2015).

Scholarship thus laid a critical foundation that engineering educators are using today as they harness students’ heighten ed interest in social justice to develop more “reflective practitioners” (Schön 2017). Yet despite student interest and sound conceptual frameworks, efforts to integrate social justice concepts remain largely in science, technology, and society departments and have not extended into engineering programs’ technical core.

**FACULTY AND STUDENT CONCERNS**

The bulk of engineering curriculum in most academic institutions gives little opportunity for students to think deeply about sociotechnical systems (Leydens and Lucena 2016). However, engineering curriculum can make a major difference in whether students feel engaged or disengaged from their professional responsibility to public welfare (Lucena and Leydens 2015). Many universities are trying to include courses and programs (McGlynn 2014) to bring attention to the critical role of engineering in big-picture solutions by focusing on connections between engineering design and impact on local and global communities.

While an increasing number of engineering researchers and educators are trying to integrate social justice into their work, challenges remain. Faculty have noted that one of the main challenges in changing engineering curriculum is accreditation (Lucena and Leydens 2015). Another concern is that adding content to engineering curriculum implies sacrificing other content. Engineering educators are working to address these concerns in a variety of ways, including, for example, the incorporation of social justice concepts in textbook problems in core engineering subjects such as thermodynamics (Riley 2011).

Another challenge in integrating social justice in engineering curriculum is student attitude. While some students welcome the explicit recognition of social justice concerns in the study and practice of engineering, others see the topic as an irrelevant addition to the curriculum or worry about missing technical content by taking courses with social justice topics (Lucena and Leydens 2015). One study found that engineering students’ interest in and understanding of public welfare concerns and overall social responsibility may actually decline over the course of their engineering education (Cech 2014).

It is worth noting that, while ABET’s accreditation focuses primarily on the technical content, its code of ethics states that engineers should put “the safety, health, and welfare of the public” first and foremost. The ABET code of ethics thus reflects the importance of engineering design in terms of its societal, economic, and environmental impacts (Shannon and Mina 2021). The code in effect calls for the inclusion and discussion of these issues in engineering education so that they translate to the engineering profession.

**ENGINEERING FOR SOCIAL GOOD**

The benefits of including and/or expanding the integration of social justice topics in engineering education go beyond the development of more socially aware and engaged engineers in the workforce to bringing in a more diverse group of engineering students. Engineers in the United States are disproportionately white and male: in 2019 only 14 percent were women and 13 percent were from underrepresented racial groups (Wilson 2019).

In any discipline and profession, diversity of thought and experiences enhances the work done, but particularly in a field such as engineering, where the work directly impacts society. As Riley and Lambrinidou (2015, p. 26.322.2) succinctly state, “Social justice is an aspirational value conceptualized in contrast to -injustice, and is best defined by those most closely experiencing that injustice.” It is not surprising that engineering has struggled and stumbled in areas of social justice when those most affected by the negative impacts are significantly underrepresented in the field.

By integrating social justice and community engagement in engineering education curricula, students can begin to see engineering as a driving force for social good, not just a career for people who like math and science and want to build machines and bridges. Women and those in racial groups underrepresented in engineering are generally more interested in a career in which they can have a positive impact and make a difference (NAE 2018). Courses that combine engineering with subjects like community development and social equity can be especially effective when the curriculum includes hands-on project work. As a student at the University of California, Berkeley, said of her Engineering, the Environment, and Society class (McGlynn 2014), “I didn’t even know about engineering until I got here…. This class puts it all together—it gives examples but also includes the science.” She went on to study civil engineering in graduate school.

**OUR ASPIRATIONAL LOOK FORWARD**

With the debt that many students accumulate in order to pursue an engineering degree (NAE 2019, p. 35), a career in a socially conscious or community-oriented area may not offer the salary
necessary to pay the bills. We are hopeful that as more engineering students are exposed to social justice as part of their engineering curriculum and then enter the workforce, societal and other shifts will occur and more career opportunities will allow engineers to both follow their heart and support themselves financially.

The preparation of engineering students with an equity-based approach to design before they enter the workforce will go a long way to ensure that the field moves in a positive direction. Accreditation criteria and faculty investment in these ideas beyond courses on technology and society will need to follow suit.

Fully integrating social justice concepts in engineering education is imperative for the field. We understand that aspects of what we’ve described here are aspirational, and that additional societal priorities and politics will need to shift before every engineer can be directed by their morals and conscience, but that is a topic for another day. In the meantime, engineering curricula with a foundation of social justice can lead to more diverse, engaged students and in turn more diverse, socially aware engineers, making it much more likely that the world created by engineering functions equitably for all.

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