Chapter 93
Who Engineering Includes Impacts How Engineers Work: Diversity Challenges and Design Thinking Solutions

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ABSTRACT

This chapter focuses on the persistent lack of diversity in the engineering profession along intersections of race, gender, and other key demographic categories (e.g., sexual orientation, socioeconomic status). After outlining specific circumstances that have influenced the lack of diversity in engineering, the chapter outlines particular challenges related to this lack of diversity and suggests a design thinking approach to resolving those challenges. Drawing on research from engineering education, design thinking, and workplace practice, the authors provide both familiar and novel strategies for addressing diversity in engineering as well as in other professions.

INTRODUCTION

Although many view engineering as a purely technical domain, it is fundamentally social, as it is always working with and in service of people (Bucciarelli, 1988; Hynes & Swenson, 2013). Every stakeholder connected to a project is a person: the client and organization, the design team, other consultants, impacted members of the public, government regulators, shareholders or other investors, and representa-

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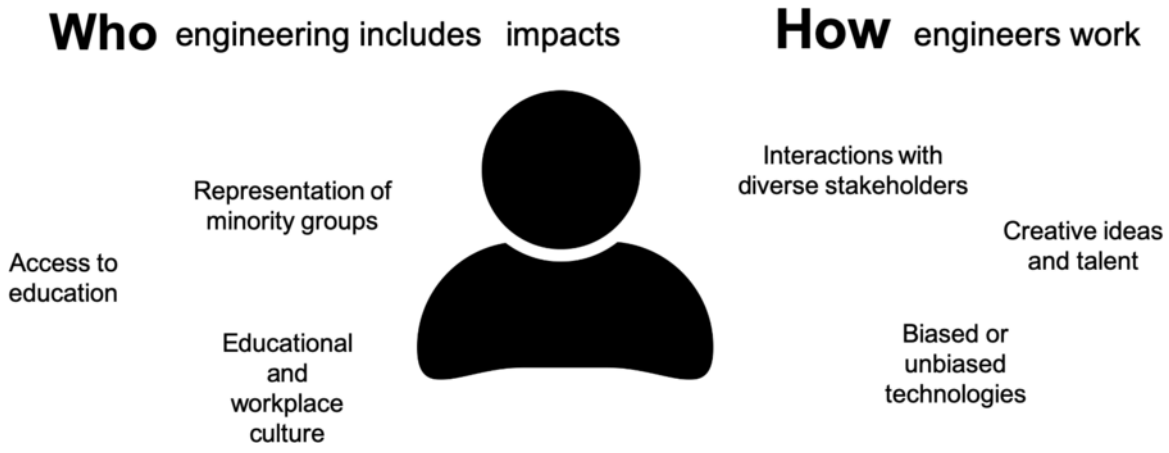
tives of other concerns such as the environment. In an increasingly global and interconnected society, the people with whom and for whom engineers must work have become increasingly more diverse and interconnected. To be an engineer is increasingly to communicate with, empathize with, and design for the problems of a wide variety of individuals spanning diverse demographics and perspectives.

Engineers have largely not increased their diversity parallel to the wider diversity of their stakeholders. Engineering has historically and persistently been a field that is dominated by certain demographic groups (Secules, 2017b). Since its formal organization in the 19th century, engineering has been predominantly white, male, straight, middle-class, and western-centric. This exclusion was formalized through educational pathways and professional societies through the 20th century. In the late 20th century, Civil Rights and Women's Rights movements paved the way for the moral imperative and progress for diversity in professions like engineering. Nevertheless in the 21st century, trends for demographic shifts in engineering have stalled in the United States.

This exclusion of other groups from engineering has meant that engineering solutions are often designed with a bias towards the same exclusive demographics as the engineers themselves. As progress on diversity stalls and the challenges engineers must respond to increase, we see and advocate a set of solutions grounded in design thinking (Brown, 2009) that 1) changes **who** engineers are by designing diversity into the profession, and 2) changes **how** engineers work within their existing and future professional settings (Figure 1).

Figure 1. Changing who engineering includes will impact how engineers work



Authors' Perspectives

The authors of this chapter come from an engineering education research perspective. Each of us have experience with educational and professional engineering contexts, and our perspective is informed by the knowledge that these are interconnected systems. In our current roles as engineering educators and researchers, we are cognizant of the ways that education is creating or reinventing the engineering profession of tomorrow, and the ways that our educational system can be bound up in the current and eventual realities of the engineering profession. By focusing our attention on the lack of diversity and