

Chapter 1

Engineering Justice

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ABSTRACT

This chapter addresses how the field of engineering has the potential of being a major force for social justice and how that may be accomplished. With their placement in a wide-range of occupations and job sites and with engineering professionals from many diverse countries, engineers are strategically located for societal impact. Engineers are naturally suited for problem solving and this propensity can be awakened to issues broader than those advanced by an employer or client. Educators can help engineers to think critically about how to think in socially just ways and how solutions will affect people. This chapter demonstrates how educational and training programs may be built around the understanding of the engineering profession and of the use of innovative instructional strategies that inspire and excite an engineer during the learning process. This chapter includes examples of instructional modules that may be used to accomplish these goals.

INTRODUCTION

Author, Joe Grimes, a university faculty member, who founded and administered a university faculty development center for ten years, is well-versed in teaching/learning and engineering publications, has published faculty development engineering material, presented at conferences, completed and designed education and faculty development courses and programs, and taught in a high school. He believes that implementation of a course should focus on learning over teaching. He has taught computer science/computer engineering

courses for forty years and served as an engineering consultant for government agencies and industry and has served as an expert witness in civil litigation lawsuits. He also headed the computer engineering program and campus computing for a 20,000-student campus. Much of this chapter is the formulation of his ideas that are a reflection of all of these experiences, the belief that innovation will lead to *Engineering Social Justice*, and the advice of co-author, Mark Grimes.

A universal definition of *social justice* can be difficult since different people will bring their experience and perspectives to their understand-

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ing. For example, in an author led grant program with faculty of five other disciplines, all participants were found to have different definitions of social justice. This chapter defines social justice as an action-oriented goal of making the world's resources more equally accessible and distributed to all individuals and keeping production and use of resources sustainable. It is action-oriented because while equality and social justice are sometimes realized at a local level, global social justice is never fully achieved, as there will always be inequalities. Thus, social justice is the action-oriented pursuit of accessibility and sustainability. However, it is our belief that through the good faith efforts of individuals, the world can approach social justice and become more equitable. It is through the innovative and inventive realization that more can always be done and that progress can be made, that the social justice efforts of individuals are motivated. We also believe this effort can be accelerated through good engineering education, as explored later in this chapter.

Engineering Social Justice is a term used here to describe social justice through the efforts of engineers. *Engineering Social Justice* efforts typically center on product design, specifically designs for *accessibility* and *sustainability*. Accessibility can be broken up into two parts: 1) the ability to functionally use a product and 2) the ability to acquire a product. The ability to functionally use a product means that a person has the knowledge and physical requirements necessary for implementing product use. For example, not all people can functionally use stairs. Another example has to do with the interface of personal computers; graphical user interfaces made personal computers functionally usable to a wider population. The ability to acquire a product mainly concerns monetary and geographical factors that encourage or prevent products from reaching individuals. One might not have enough money needed to afford a product, or the product might not be available to a certain region of the world. Engineering solutions that are completely

socially just will provide access to everyone now and in the future.

Sustainability has a few more layers than accessibility. When looking at issues of sustainability, one can look at *production sustainability* and *consumption sustainability*. Both production and consumption sustainability are concerned with the depletion of resources and harm of the environment. These are essential issues of social justice because they have a direct impact on the human condition. Depletion of resources makes them scarce and thus less available to the greater population. Harm to the environment not only hurts nature, it harms humanity's future. In addition to the depletion of resources, *Engineering Social Justice* considers how production and consumption can harm individuals such as workers and consumers resulting in a social injustice both now and in the future.

Table 1 helps provide a foundation for the identification of issues to be addressed by *Engineering Social Justice*. Working with Table 1, engineers can develop an inner-voice that would help self-regulate and identify the possibility of issues related to social justice. This inner-voice could use question prompts to help discover these issues. For example, some self-aimed questions could be:

- Is there something about the design of the product that excludes populations?
- Is there something about the design that can increase the number of people who would have access to the product?
- Have markets made it difficult to reach populations?
- Is there something about the production or use of the product that negatively affects people or the environment?
- Is there a way to produce this product that would use fewer resources?

Understanding issues related to *Engineering Social Justice* is only one component in the

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