

# Mentoring in Engineering

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*ABSTRACT: This article takes a practical look at the challenges and rewards of experienced engineers and educators becoming mentors for students or young practicing engineers. The author recommends an approach to mentoring that is deep in self-evaluation, one that considers the intellectual, social, and professional development needs of students and young professionals, and the need for taking little steps—one person at a time—that make big differences. Such an approach to mentoring, the author states, will help encourage more underrepresented groups, such as women and minorities, to pursue careers in engineering.*

**S**tart where you are. Use what you have. Do what you can. These three statements from tennis great Arthur Ashe form the cornerstone in becoming a mentor in engineering. While Mr. Ashe may have used these statements as a modest description of his prowess in tennis, we can derive further meaning from them for the field of engineering.

For it is through a serious commitment to mentoring that engineers can improve diversity throughout the profession. There is no question that our profession needs more underrepresented individuals—namely women and minorities—to choose engineering as a career. Mentoring, and its time-honored approach of one-on-one advice and consultation, can broaden the reach, effectiveness, and appeal of engineering.

As a profession, we need to do something. The engineering profession does not accurately reflect the rich mix of cultures and traditions that define America today. The fact is that engineering is known as a white, male, middle-class profession.

The changes in the makeup of American society have been remarkable in the last fifteen years, and engineering has not reflected this change. According to the U.S. Census Bureau, in 1990 Caucasians accounted for 75.6 percent of the U.S. population. At the same time, African Americans accounted for 11.8 percent and Hispanics 9 percent. By 2010, Caucasians will stand at 67.7 percent, African Americans 12.6 percent, and Hispanics 13.5 percent. While we acknowledge that America has changed in recent decades, what has the profession of engineering done to reflect these widespread demo-

graphic changes in American society? The answer is little, if anything.

Recent figures indicate that women and minorities make up just 10 percent of engineering faculty. More alarming, engineering enrollments continue to drop or remain unchanged in underrepresented groups. For example, since the early 1990s, enrollment in engineering programs by African Americans has dropped 17 percent, and has remained relatively flat, at about 20 percent, for women. As a profession, we must do more, and we must do a better job of encouraging underrepresented groups to pursue careers in engineering. Our profession can succeed in this vital endeavor. It does not require sophisticated technology or ahead-of-the-art advances in engineering theory or materials development. Instead, it requires something as acknowledged as the concept of work itself: helping prepare the next generation through mentoring.

## START WHERE YOU ARE

Mentoring is not a new concept. Many of us have benefited from a trusted mentor. Perhaps you called them a friend, family, or another whose opinions and experiences you trusted. They created an intangible bond with you through their experiences, opinions, and the time they took to give you advice and counsel. As a professional engineer, you have the same opportunity—a mandate, really—to get involved in two aspects that are vitally important to the engineering profession. The first is to make an incredibly positive impact on the life of a young, aspiring professional or student. The

second is to help solidify the role of engineering in a fast-paced, diverse American landscape.

How best to start? Begin by assessing what you have to offer as a mentor. As a mentor your role is to stimulate students or young professionals to think in new and creative ways. One of the biggest values you bring to mentoring is a broad perspective—and how that perspective can be of value to students.

From my experiences, a key issue in “starting where you are” relates to our own preconceived notions about students and their abilities to evolve into the field of engineering. It’s all too easy to consider general educational trends that indicate a woeful lack of most students’ preparation in math and science. The logical extension of such thinking is: they don’t have what it takes to succeed in engineering.

For example, numerous international studies indicate that, compared to peers in other countries, U.S. students underachieve in math and science. The French-based Organization for Economic Cooperation and Development (OECD), comprised of more than thirty member countries, conducted an international comparison in 2003 of mathematics, reading, and science skills among fifteen-year-olds (OECD 2003). More than 250,000 students in forty-one countries participated in the assessment. On the mathematics scale, the United States ranked twenty-fifth; on the science scale, the United States ranked twentieth; and on the reading performance scale, the United States ranked twelfth.

Other educational indicators are equally alarming. Nearly half of all high school students in some of the nation’s largest cities drop out before receiving their diplomas (Balfanz and Legters 2001). In some parts of the country, about a third of all high school students fail to graduate (Barnett and Greenough 2001), and among those who do receive their high school diploma, many find that they are not prepared for the rigors of college academics. Equally alarming, more than a third of first-year college students received or planned on getting remedial help in math (“This year’s freshmen” 2001). And finally, even though males and females take similar math classes and achieve similar scores in the K-12 environment, the participation rate of males in math is far greater than that of females after high school (National Science Board 1998).

In light of these findings, do we wave the white flag and simply give up? Or do we wave a red flag to rally our resources to do better? There is only one real option.

Yet, how do we meet students where they are in their educational preparation, and how do we help them develop their core competencies so they could one day become engineers?

As a group of professionals, we must remember that not all students coming into the college or university environment will be developmentally ready for the academic challenges they face. Our role is to help students develop their

potential and capabilities so they can earn an engineering degree.

How do we develop them? The best way, in my opinion, is to approach one’s development from intellectual, social, and professional vantage points. In my role as a faculty member, I work to develop the intellectual capability of my students. But the other elements—social and professional development and maturation—are equally important. All of these attributes carry equal weight because they come together in the same package. In increasing fashion, we must develop students not only intellectually, but in the other dimensions as well so they can lead, compete, and participate in, or contribute to, a complex and increasingly diverse workplace.

It is not just the students who stand to benefit from an effective mentor. Engineers new to the profession need mentoring, often until the point of professional licensure and beyond.

Effective mentoring of young engineering professionals is a two-way street. A young professional’s energy, new ideas, thirst for information, and willingness to learn give any organization spirit and momentum. In mentoring a young professional, it’s important to provide opportunities for the mentee to take part in team building, brainstorming and planning sessions, and to build relationships throughout the organization. Such processes and experiences are of significant benefit to the mentor as well. Mentoring is perhaps the best way to ensure that one’s intellectual and experiential legacy can be tapped, improved upon, and be of continual benefit to the organization.

Engineering is a profession in which learning occurs continuously. It begins with formal education and continues through various developmental experiences, including a positive, long-lasting mentoring relationship.

I noted above that mentoring provides organizations with spirit and momentum. That is true. In addition, however, it is the personal nature of these relationships that give organizations their strength.

Mentoring, however, is one part of the picture. Life experiences are another. We must continue to push for new ways to expose students to diverse experiences. That is how they will grow. It is one thing to watch and listen, and another entirely to be in the middle of a real-world situation experiencing it. Students gain from activities that include profession-related travel abroad, cooperative experiences, and community involvement projects that put them in contact with a wealth of opinions, new ideas, and alternate ways to approach an issue.

How do we accomplish our lofty objectives? We start where we are and help the next generation through mentoring.

## USE WHAT YOU HAVE

The finest mentors share similar attributes. What they have are the abilities to listen, question, challenge, and offer feedback and support. These are the qualities central to our roles as mentors.

What mentors also have are young people who stand before them with a variety of backgrounds, educational preparations, and aspirations. Our job is to raise their capabilities and help them develop in a holistic fashion intellectually, socially, and professionally. Each student or young professional is a collection of his or her individual backgrounds and traditions. They also each represent an opportunity—an opportunity for us as mentors to use our resource bases and reservoirs of experiences in helping them prepare for an engineering career to last a lifetime.

A call to mentorship should not be an unusual thing to read. As educators and professionals, we have an obligation to help those who need to be nudged along the way. Mentoring a young professional or student is part of the package of professional responsibility.

We do not need another study to make this happen. Just look at each student individually, on a case-by-case basis. That's the secret. We just have to move beyond what engineering has historically been good at—systematic problem solving—and apply our special skills to solve a problem that could one day undermine the profession: a paucity of ideas and creative solutions that could only come from the mindset of those who are currently unheard throughout the profession.

### What qualities make for a good engineering mentor?

Someone who:

- Is approachable and welcoming
- Shares information and experience openly
- Has good communication and listening skills
- Understands the field of engineering
- Has a network of contacts within the industry
- Is motivating, encouraging, positive and empowering
- Is willing to set aside/commit time to mentor someone
- Is committed to making a difference, one individual at a time
- Does not wait to be asked

## DO WHAT YOU CAN

It's amazing the differences a personal commitment can make to the life of another. We cannot expect to change the professional makeup of engineering overnight, and perhaps not even in a decade. But, with individual commitments, we can take positive steps one person at a time.

Mentoring is intensely personal, interactive, and rewarding. Mentoring can be achieved through a variety of methods. Here's how to "do what you can":

- Identify three to four students or young professionals who could benefit from your insights and experiences. Ask them if they have questions about the scope of engineering and how they might fit in.
- Help your students evaluate employment opportunities that they might not otherwise consider. Encourage them to think about many facets within the profession, and help them secure rewarding summer experiences.
- Encourage students to become involved with local, regional, and national professional associations. Membership and involvement in such organizations provides students with priceless leadership opportunities and helps students develop a variety of valuable workplace skills.
- Remember that a student or young engineer may have a different or even a better idea in solving a problem. The young engineer may well bring a perspective that is much more than fresh—it may well be of the "why didn't we think of that" variety.
- Seek out students where they exist. Get involved with local high schools and help them establish an engineering club. Seek involvement with community organizations such as Big Brothers and Big Sisters or Habitat for Humanity.

There is little if any magic in all of this. And, we won't be successful with every student we mentor. But our efforts will be 100 percent worthwhile as we strive to help make our profession more robust and vibrant for these complex and challenging times.

## FEW CHOICES MAKE SUCH A DIFFERENCE IN LIFE

Mentoring gives you the chance to make a significant difference in someone's life. For the mentor, the benefits of helping someone realize his or her professional goals and aspirations are lifelong, too.

Through mentoring, we help students discover themselves and their potential, show them how to apply their skills and special aptitudes, and guide them in defining and pursuing their own career goals. In turn, mentoring helps us discover new things about ourselves.

As a mentor, you will learn just how valuable your experiences and expertise are to another. You will discover new levels of patience and commitment not before experienced. And you will marvel at the energy, sincerity, and fresh perspectives of the next generation of professional engineers.

When a student reaches out to you, take their hand and guide them. They are saying that they trust your wisdom, your experience, and your leadership.

Mentoring makes a difference in your life, too. It's an equal-opportunity relationship that is voluntary and mutu-

ally beneficial. Because the fact is, the best way to increase the levels of underrepresented individuals in engineering is to lead them into the profession through thoughtful, purposeful mentoring. We accomplish this one person at a time. There is no better way. There is no greater satisfaction.

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