Universities do an outstanding job of teaching the technical skills necessary to produce great engineers, but today’s successful graduates also need good written and oral communications, teamwork, critical thinking, innovation, and entrepreneurial skills. How can a student obtain these additional skills while coping with a demanding course of study? One way is to intern at a company, but not everyone can take advantage of that opportunity. Another way is for students to have contact with professional engineers during their work on school projects.

After several years of personal involvement with student projects, it became apparent that projects involving guidance from an experienced professional had higher completion rates and possessed the qualities of a more finished or polished product by the end of the semester. Students that experienced this guidance were excited about what they accomplished, and it was apparent that they learned a great deal. This observation led to the concept of the IEEE Engineer in Residence (EiR) program, an innovative new endeavor that provides a window into the real world of engineering by bringing experienced professionals into labs to work alongside students.

Last fall, the Electrical and Computer Engineering (ECE) Department at Colorado State University (CSU) teamed up with the IEEE to launch EiR. Designed to help students develop professional skills and learn firsthand how those skills relate to the workplace, the program is attracting seasoned engineers from a range of companies and areas of technical expertise. With a dedicated space of their own inside the ECE projects lab, EiR volunteers devote many hours each week to helping students overcome technical challenges, navigate their careers, and gain insights into life after CSU.

An emphasis was placed on finding engineers that could easily relate to students and who had a wide range of technical expertise while featuring diversity in gender and ethnicity. During our first semester, 15 engineers were recruited, and by the second semester, the group had grown to 23. Predominately electrical engineers, the group also included mechanical engineers, optics designers, physicists, and one patent examiner. Many of the volunteers were worried that they did not have the up-to-date technical knowledge they thought the students would demand. But the vast majority of questions from students have been about the practical aspects of engineering, life experiences, and what it is like working for a company. When
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a question could not be answered by the EiR volunteers, we quickly polled the IEEE membership. From the more than 900 Members in northern Colorado, we always found someone who was willing to help.

The starting line
Our first semester started out slowly—some volunteers had intermittent contact with students throughout the time. We did a quick survey of over 300 students and found out that the visibility of our program was very low, but students that had contact with EiR engineers were really enthusiastic about the interaction. So we quickly performed presentations to classes and designed a set of humorous posters that were displayed in the engineering building hallways.

We also statistically analyzed the door openings of the electronic access to the ECE projects lab. The EiR office is within the ECE projects lab. Door openings were used as a proxy to better understand when students were in the lab area. We found out that no students used the lab before 11 a.m., even on the days we were not present and traffic to the lab was still heavy at 4 p.m. It gave us an unbiased quantitative measure of student availability. With this data, we adjusted the schedules of our volunteers. The reaction was immediate, with student contact increasing from 21% to in excess of 60%. Since that time, student contact continues to grow and their reactions to our EiR volunteers remain outstanding.

“While our education gives us the tools we need to figure out engineering problems, we appreciate the perspectives and advice of the EiR volunteers,” says Erin Karasz, senior electrical engineering student, in CSU’s Source publication. “They have gained more experience and wisdom than we could possibly have, and they help us see the big picture.”

Karasz is one of five students working on a snowflake-sensing system with the goal of creating more accurate winter weather predictions. Karasz and her team reached out to EiR volunteers for general project advice and feedback on current technologies used in the industry.

Electrical engineering students Andrew Sullivan and Darrin Minnard have also capitalized on the EiR program. Sullivan and Minnard contacted EiR volunteers Sam Babb, a retired engineer from Hewlett-Packard, and Scot Heath, director of engineering for Enabled Energy, for advice about the high-voltage electric system in their mini, Indy-style electric car project.
“The EiR volunteers are an absolute wealth of knowledge,” Sullivan says, “and they know about all kinds of systems—not just electrical but also mechanical.” Minnard added, “Sam and Scot saved us untold time by showing us how our problem is addressed in industry, which allowed us to simplify our design. As a bonus, they are hilarious and fun to be around.”

Gaining ground
At this time, we are beyond the pilot phase, as we have quickly become a more integral and recognized part of the ECE Department. In addition to preparing students for the challenges of professional life, the program allows industry partners to give back to the community, recruit promising graduates, and experience the excitement of being on campus. EiR volunteers go back to their everyday jobs refreshed and enthusiastic about what they have accomplished with the students. You could not ask for a better break from the daily grind.

The program also presents the IEEE in a very favorable light. The IEEE is not just an organization that provides funding for engineering contests, conferences, and standards, but it adds value to the education of the next generation of technologists. Our Section’s membership of students is at an all-time high, and we are hoping that we can convert those students to regular members after they graduate.

To help this recruitment, our Section also sponsors a “Grip and Greet” event at the end of the semester’s final week. We purchase beer (for those of legal drinking age) and snacks for students and faculty and take the opportunity to remind everyone why they should continue as IEEE Members. It is also because of the enthusiastic support and encouragement from the CSU ECE Department. It has promoted the program and supported it with lunches and a “thank you” cocktail hour for all the volunteers.

Our fourth semester is well underway but we are already working on improvements for next year. At the welcome luncheon, which we hold a few weeks before the start of the semester, we are planning a more thorough orientation for the EiR volunteers. From feedback we have received, it is apparent that a little knowledge of the structure of the CSU ECE Department would be beneficial, and it would make the volunteer feel more a part of the department rather than a visitor.

We also want to communicate the goals of the ECE Department so that it can best support the efforts to improve engineering education. Two EiR volunteers, Charles Potter and Eli Scott, have developed a program to review all senior projects early in the academic year. From our experience, helping students plan their projects greatly reduces unnecessary work and frustration. This change will start in the fall of 2017.

Finally, we would like other IEEE Sections to pick up the program, as diversity of experiences would only help improve and shape EiR to be more effective and successful.

As the founding volunteer, I call the EiR program a “grand experiment,” as it was not clear at the start that it would be successful. Today, I couldn’t be more pleased with the results of our efforts. I want the program to continue to evolve and serve as a source of pride for the volunteers, the ECE Department, and the IEEE. Most of all, I hope that contact with accomplished engineers will improve the retention of students during their last two years and during their initial years of employment.

About the author
Richard F. Toftness (rtoftness@gmail.com) is an IEEE Life Member who lives in Loveland, Colorado. After working for Hewlett-Packard (for 27 years), Motorola, Control Data, and several startups, he formed his own consulting firm, Tasterra LLC. Along with managing Tasterra, he and his wife enjoy the Rocky Mountain region and keep busy as volunteers at several organizations.