Bringing Real-World Experience into the Classroom

By Mark Kanonik, P.E., F.ASCE

In 2019, the American Society of Civil Engineers (ASCE) published the *Civil Engineering Body of Knowledge* (CEBOK, 3rd ed.), which "defines the set of knowledge, skills, and attitudes necessary for entry into the practice of civil engineering at the professional level." ASCE acknowledges that the "fulfillment of the CEBOK must include both formal education and mentored experience." Indeed, the CEBOK lists 21 desired outcomes, although 14 cannot be achieved without mentored experience after or separate from formal classroom experience. In 2019, ASCE also hosted the *Education Summit: Mapping the Future of Civil Engineering Education*. In the proceedings published in August 2020, the Summit listed four objectives of future engineering education; Objective 2 is to "Elevate professional skills to a truly equal footing with technical skills."

Employers expect graduates to correctly perform the calculations necessary to design beams and columns, and footings. Still, many employers feel that recent graduates lack the ability to apply these calculations to real-world problems where the general solution is not obvious. Today's economic reality is that employers expect recent graduates to be immediately billable and productive workers who can effectively apply the theoretical knowledge gained in the classroom to the projects on their desks.

The author recently conducted an unscientific review of 96 open faculty positions posted on the ASCE website and noted that only two required licensure for appointment. However, eight stated that licensure was "preferred." Another recent and unscientific review of the first 10 civil engineering programs in New York State listed by Google showed that only 10 of 212 faculty are licensed, as reported on their respective college's website. It is disappointing that more faculty are known by the author to be licensed even though their respective college websites do not acknowledge this. Why does the "engineering education system" place such little value in the licensure of its faculty when students are so strongly encouraged to become licensed after graduation?

The author acknowledges that requiring *all* faculty to be licensed or even to have experience outside of academia is unrealistic. Perhaps a reasonable middle-ground is to employ adjuncts in the classroom. Most students study structural engineering because they want to improve the built environment. They long to see how the abstract concepts learned in the classroom can be applied to actual projects with all of their unexpected complications. Often, it is the adjunct who is most apt to bring that project experience into the classroom. Many

"It has been said that a picture is worth a thousand words, but a visit to a construction site is worth a thousand pictures in a PowerPoint presentation.

adjuncts have years of meaningful experience, and they view teaching as one way to "give back" to the profession. They bring the experience that students want but that many faculty cannot provide. Adjuncts cannot and should not replace full-time faculty, but adjuncts can and do complement full-time faculty by bridging the gap between academics and experience.

Most structural engineering classwork is very matter-of-fact. Often homework problems are structured to guide students to a particular answer, such as the lightest-weight beam to support a given load. But structural engineers design *buildings* (and other complex structures, too), which are more than just a collection of individual elements. And there is rarely, if ever, one and only one correct answer to any real-world engineering problem. Computer programs are incredibly sophisticated, allowing structural engineers to design buildings that could not have been conceived a generation earlier. But these same computer programs cannot conceptualize. They cannot locate the columns in a building, and they cannot determine if the building should be framed in steel or concrete or some other material. Such conceptual thinking is typically gained through years of experience. Still, conceptual thinking can also be taught, most effectively by an adjunct who interacts with the architects who design buildings and the contractors who build them. Nearly all civil engineering programs culminate in a design-intensive capstone project, in which the students work on projects meant to simulate professional practice. What better opportunity to engage an adjunct who can demonstrate what actual professional practice entails?

Structural engineers spend much of their time producing construction documents, yet little if any coursework is devoted to this. This seems counter-intuitive since construction documents are part of a legally binding agreement with significant potential risks. Rarely do buildings collapse because of a gross error, but many construction projects have become legal battlegrounds over inadequate drawings and specifications. Yet adjuncts, with their years of experience, know full well the importance of proper construction documents and can explain the subtle nuances that make a successful set of documents. Since calculations are not usually included with the construction documents, students must understand how abstract calculations become a physical building based on construction documents that they will ultimately develop.

Adjuncts are also likely to have close contacts within the industry outside of the classroom. Students spend considerable time calculating the potential failure mechanisms of a bolted connection. However, nothing explains the actual working of that connection like going to a steel fabrication shop and seeing it in person. Learning the difference between mortar and grout is much easier when the students build a masonry wall with a trowel in hand. It has been said that a picture is worth a thousand words, but a visit to a construction site is worth a thousand pictures in a PowerPoint presentation.

Certainly, a thorough understanding of the subject matter is necessary to teach at the college level, but one does not need to be a world-renowned expert to be an effective adjunct. The primary requirement for being an adjunct is simply a willingness to teach. There is an investment in time and energy, particularly the first year, but the benefits far outweigh the costs. The author's sincere wish is that many readers become actively involved in educating the next generation of structural engineers. No less than the future of the profession of structural engineering is at stake.▪

Mark Kanonik is the National Technical Director of Structural Engineering at EYP Architecture & Engineering, PC, in Albany, NY. He is also an Adjunct Faculty at Rensselaer Polytechnic Institute in Troy, NY. (mkanonik@eypae.com)