TO LICENSE OR NOT TO LICENSE

It has come into question whether it is ethical for university engineering faculty to teach technical subject matter to engineering students without obtaining a professional engineer license (P.E.). The answer is yes, it is ethical. There are several practical reasons and guidelines to support that a university engineering professor's qualifications to teach technical subject matter should be independent of professional licensure as an engineer. Asking whether it is ethical focuses on the wrong question; the question should be whether the professor is qualified to achieve the job goals as an engineering professor of all engineering courses in his/her field, not just technical design courses. To answer the true question will require defining what the job description of university professors should be.

THE EDUCATOR'S ROLE – THE REAL JOB

In "Teaching and Learning: The Critical Balance in Effective Education", Vorster (2011) recounted discarding his prepared presentation about his job and instead expressing a different view of his role as a professor at Virginia Tech. He changed the job description from teaching to causing his students to learn because he viewed his responsibility for his students' learning to continue beyond the lesson (Vorster, 2011, p. 917). In fact, Vorster stated that he must do everything possible because learning is not an automatic and inevitable outcome of teaching (Vorster, 2011, p. 921). Having the technical knowledge that can be demonstrated through obtaining licensure as a professional engineer is not sufficient nor related to *causing students to learn*. While Vorster does have experience in construction education, it is the view that his job responsibility does not end when he has spoken that will have the most positive impact on student learning. Vorster advocates that education should produce self-motivated, independent lifelong learners, so it is understandable that Vorster shifted his job description view from the action of teaching to the result of students learning (Vorster, 2011).

CHANGING THE TRADITIONAL ROLE OF AN EDUCATOR

The position that teaching methods should focus on students being more active in their education is taking root in other geographic areas. In "Introduction of Innovations into the Traditional Teaching of

Construction and Building Materials", Reyes and Gálvez (2011) explain that in Spain traditional teaching methods for civil engineers are under revision to address ensuring students learn the new knowledge and skills their labor market expects. "The European Higher Education Area is requesting that students be given a greater say in their learning" so the Civil Engineering School of Universidad Politécnica de Madrid has introduced cooperative learning and other teaching innovations (Reyes and Gálvez, 2011, p. 28). The program understands the importance of the faculty's knowledge, teaching style, and willingness to adapt to and implement a student centered style that supports "autonomous as well as cooperative learning in students" (Reyes and Gálvez, 2011, p. 29). Supplementing traditional teaching methodologies with open-ended group work, continual assessment, student presentations, and new technologies has had the following positive effects: An increase of 29% in student passing rate; higher rate of in-class attendance; greater interest in the subject matter; student ability to self-direct his/her learning; student ability to make group decisions; and improvement in the students' communication skills (Reyes and Gálvez, 2011, pp. 33-34). While both faculty and students surveyed found the teaching innovations to be positive, the faculty did acknowledge the increased teaching work load required to implement the changes (Reyes and Gálvez, 2011, p. 36). Being a licensed professional engineer would not have been sufficient to result in the same improvements in student learning as the increased training and time commitment demonstrated by the faculty.

SUPPORTING THE NEW ROLE OF AN EDUCATOR

In addition to dedicating time to effectively engage students in learning, faculty need to dedicate time meeting their many other commitments to their university, research, and professional development. With "University Education Dilemma: Challenge of Incorporating Alternate Views of Scholarship and Teaching", Mau and Ford (2015) suggest that universities should resist the trend of becoming research focused institutions and utilize Boyer's model of Scholarship to allow each university to stay true to its own mission and identity. Following Boyer's Scholarships of Discovery, Integration, Teaching, and Application can help universities improve teaching, benefit the local community, and provide alternate views of

accomplishments for tenure and promotion review. By reducing pressure to publish research, faculty have more time to stay current in their field, improve courses, craft policy, provide expert services to their community, bring real world projects to students, and connect across disciplines (Mau and Ford, 2015). Allowing faculty to focus on their existing duties would benefit future engineers more than requiring faculty to prove their qualifications to teach technical courses by obtaining and maintaining professional engineer licensure.

WHAT ENGINEERING SCHOOLS THINK: UNDERSTANDING EXPECTATIONS AND REALITIES

In "Professional Registration of Engineering Faculty", Madhavan and Malasri (2003) show that many engineering schools did not support requiring licensure for professors who teach technical engineering courses. Deans of engineering schools from thirty-seven states responded to a survey relating to licensure of engineering faculty. Two-thirds of respondents opposed requiring all faculty member to be licensed (Madhavan and Malasri, 2003, p. 22). Twelve percent more deans opposed requiring licensure of engineering faculty who teach design related courses than those who supported the position, with the remaining twenty-four percent taking a neutral position. Some deans provided additional comments such as that licensure does not guarantee current knowledge and that requiring licensure would make it difficult to hire the best. Interestingly, sixty percent of deans who responded were themselves a licensed P.E. So the respondents were knowledgeable about what licensure means, and most deans still did not believe all university engineering faculty needed be licensed to teach technical engineering courses.

THE MANY WAYS TO DEMONSTRATE ENGINEERING TEACHING EXCELLENCE

Engineering faculty have alternate means of illustrating and advancing their competency in their field of engineering other than obtaining and maintaining a P.E. license. Engineering faculty have at least above average knowledge of engineering in the courses they teach which would allow them to pass those sections of the licensing exam. Faculty enhance their knowledge of their subject matter through continued teaching, community outreach, and research, which are essential components of careers in academia. The faculty can lead advances in their field, benefitting the students, university, and entire engineering

profession. University faculty can design and teach continuing education courses that benefit licensed engineers for license renewal, providing additional evidence of the faculty's engineering competence. As the engineering faculty are qualified to teach engineering courses to professional engineers, it should not be necessary for them to obtain a P.E. license to prove they are qualified to teach students.

WHAT IT COSTS EDUCATORS TO BE A P.E.

If engineering faculty were required to obtain a P.E. license, the time and financial costs of licensing would continue as long as they wished to maintain an active license. While the financial cost would be unwelcome, the more difficult cost to pay would be the time commitment. Faculty already have many duties in addition to teaching that compete for their time, including the considerable time needed to keep abreast of developments in their specialty. It is redundant to require faculty to earn professional development credits for licensure renewal when faculty already stay current in their field as part of their normal duties.

WHAT ENGINEERING ORGANIZATIONS HAVE TO SAY

The faculty demonstrate their competence and qualifications to teach engineering in many ways, and the American Society of Civil Engineers' (ASCE) Code of Ethics canons support knowledgeable faculty being allowed to teach engineering students in all engineering courses. Two canons are relevant to the issue of faculty licensure: Canon 2 and Canon 7. Canon 2 addresses engineers (or faculty) performing services only in their area of competence. A faculty with advanced structural engineering knowledge would not feel qualified teaching a course on water quality but would be very well qualified to teach within their area of competence, i.e. structural engineering. Canon 7 covers engineers continuing their professional development throughout their careers and providing opportunities for professional development of those (future) engineers under their supervision. Faculty not only need to know their courses thoroughly, they also need to know the advances being made within their specialty. In the course of doing their own research and experiments, faculty must also study the work others are doing elsewhere to see if it is applicable to their own work. Keeping current with the state of engineering within the faculty's specialty is a built in

aspect of a university career. Additionally, faculty are ideally situated to provide opportunities for future engineers under their supervision through classes, internships, and letters of recommendation. There is nothing in the ASCE canons that would require qualified faculty to be licensed to teach any university engineering course.

In addition to the practical reasons for saying it is ethical for university engineering faculty to teach technical subject matter to engineering students without obtaining a professional engineer license, there are guidelines that allow faculty who choose to not pursue licensure to nonetheless teach any engineering course. The ABET (Accreditation Board for Engineering and Technology) lists many criteria that can be used to judge competence to teach engineering courses, even technical engineering courses. General Criterion 6: Faculty states:

> The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching effectiveness and experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and licensure as Professional Engineers. (ABET, 2016).

While the ABET list does include licensure as a professional engineer, it does not *require* all faculty teaching technical subject matter courses to be licensed. Notably, the list includes diversity of backgrounds which allows for non-licensed faculty to be considered. If all the factors listed were required to become university engineering faculty, a number of universities would have difficulty in hiring sufficient qualified professors to be accredited. The list also includes teaching effectiveness and ability to communicate, which supports the redefined job description this essay previously presented.

The ASCE's "Commentary on the ABET Program Criteria for Civil and Similarly Named Programs" agrees with the latitude allowed as qualifications for teaching design based curriculum, stating that "…faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience." (ASCE, 2016, p. 27). The ASCE understands that "appropriate qualifications to teach design in a civil engineering program may not

be solely defined by professional licensure … Licensure as a professional geologist along with appropriate design experience may be sufficient to satisfy the overall requirement to teach certain design courses, even if not sufficient to satisfy the licensure requirement." (ASCE, 2016, p. 27- 28). The ASCE acknowledges that a faculty who has chosen to not pursue licensure might have sufficient experience to be eligible for licensure; furthermore, the ASCE grants that there are many ways to document design experience (ASCE, 2016, p. 28). Given the leeway allowed by the ASCE's commentary, licensure as a professional engineer is not a requirement for engineering faculty to teach design courses.

WHAT IS BEST FOR THE PROFESSION

The original question regarding the ethics of non-licensed but qualified faculty teaching technical engineering courses is a non-issue. Most engineering deans polled feel engineering faculty should be allowed to teach technical courses regardless of their licensure status. Both the ABET and the ASCE allow for non-licensed qualified faculty to teach technical courses. The modified question of whether the professor is qualified to achieve the job goals as an engineering professor is more vital for student learning. A diverse faculty body which is qualified and capable of encouraging students to become lifelong independent learners is essential to the civil engineering profession, regardless of the faculty's P.E. license status. When all faculty are free to teach and support the education of an increasingly diverse engineering student body, both the students and the profession benefit. The broad range of strong engineering graduates will be ready to move the profession into the future.

References

1. ABET. (2016). "Criteria for accrediting engineering programs, 2016-2017." http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2016-2017/#faculty (November 4, 2016).

2. ASCE. (2006). "Code of ethics." http://www.asce.org/code-of-ethics/ (November 17, 2016).

3. ASCE. (2015). *Commentary on the ABET program criteria for civil and similarly named programs effective for 2016-2017 accreditation cycle*, Reston, Virginia.

4. Madhavan, K., and Malasri, S. (2003). "Professional registration of engineering faculty." *J. Prof. Issues Eng. Educ. Pract*., 129(3), 122-124.

5. Mau, R.R., and Ford, G. (2015). "University education dilemma: Challenge of incorporating alternate views of scholarship and teaching." *J. Prof. Issues Eng. Educ. Pract*., 141(1), 02514001.

6. Reyes, E., and Gálvez, J. C. (2011). "Introduction of innovations into the traditional teaching of construction and building materials." *J. Prof. Issues Eng. Educ. Pract*., 137(1), 28-36.

7. Vorster, M. C. (2011). "Teaching and learning: The critical balance in effective education." *J. Constr. Eng. Manage.,* 137(10), 916-922.