

## Professional Practice: Teaching the Value of Licensure

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### Abstract

ABET accredited engineering programs require a substantial amount of math, science, engineering science, and engineering course and lab rigor. Come senior year, students are focused on finishing their course work, writing their resume, networking for job opportunities, and/or applying to graduate schools. Often, taking the fundamentals of engineering (FE) exam or studying for the exam does not get the needed time and attention it deserves. Teaching the value of licensure to engineering students is important, and to do so impacts the civil engineering curriculum. Faculty have a significant role and responsibility to teach this to their students. This paper examines parts of the curriculum that focus on licensure and the impact on students. While successes have occurred, there are still many challenges including FE and PE awareness and passing rates.

### Keywords

Professional practice, licensure, fundamentals of engineering exam, and engineering education.

### Introduction

During the final year of earning a baccalaureate degree in engineering, seniors are faced with many potentially time consuming challenges to complete as they prepare for life after their undergraduate studies. Some of these challenges include: completing all of their undergraduate course and lab work; preparing their resume; networking for job opportunities; preparing and taking the fundamentals of engineering (FE) exam; and potentially applying to graduate schools. In addition, many students can feel a certain amount of anxiety and stress as they near the end of their undergraduate education<sup>1</sup>. Completing all the necessary tasks takes a significant amount of time and energy, and many engineering students are left prioritizing some of these activities over others.<sup>2</sup> Completing all course work is of primary importance.

All ABET accredited engineering programs require a substantial amount of math, science and engineering course and lab work rigor<sup>3</sup>. The average engineering student completes their undergraduate course work in approximately 5.2 years. Completing all the required ABET courses and labs especially the culminating design experience, senior project, can be daunting. Many times, this entire experience leaves the students exhausted and wanting to postpone taking the FE exam.<sup>4</sup> However, students know that listing on their resume that they have passed the FE exam will boost their chances of securing a job after graduation. Like studying for their courses, adequately preparing and filling out the FE application also takes time. In addition, making a quality resume takes time as well. And while making a resume can be part of a course that students take, there are many different formats and styles to choose from.

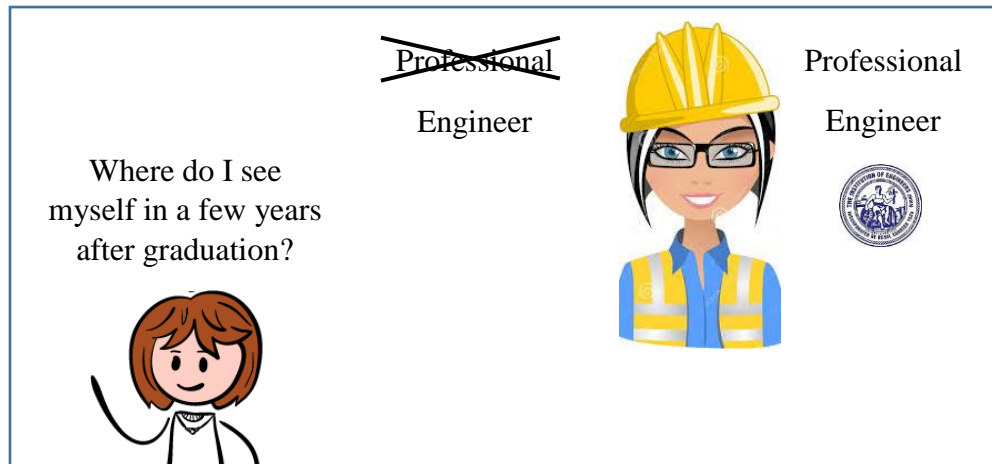


Figure 1. Future engineer pondering “Is licensure really necessary or important?”

Students at this point have little free time to ponder as to value of licensure and how this may impact their career ahead. See Figure 1. However, this is important. As seniors look to life after their undergraduate studies, students spend a significant amount of time looking for job opportunities and/or applying to graduate schools.<sup>5</sup> All of these activities can lead to stress and anxiety, and I believe it is the responsibility of the faculty to assist and help motivate students in achieving their future goals.

### Faculty Responsibility

At Western Kentucky University prior to being granted tenure and/or promotion from assistant to associate professor, engineering faculty are required to obtain their professional engineering license and to keep it in good standing. According to Kentucky Regulatory Statue (KRS) 322.010, faculty must possess a professional engineering license to teach engineering design courses in the commonwealth. All engineering tenured faculty at Western Kentucky University are licensed professional engineers. In addition, the mission of the Department of Engineering at WKU states that the scholarship of the faculty will be the practice of engineering. This requirement has created an environment where faculty are continually engaged in the practice of engineering. Collaboration between engineering faculty and students with local engineering companies as well as public organizations is commonplace. This gives faculty practical engineering experience that they can draw from when teaching courses and labs and helps to reinforce the importance of professional licensure to the students.

Faculty serve an important role in guiding students to becoming successful engineers and hopefully professional engineers. This goes far beyond teaching the academics of engineering education and advising students of courses and labs that they need to take. Student mentoring by faculty as they proceed through the curriculum is invaluable. This becomes even more important as students become seniors and need to eventually figure out their plan after graduation. Approximately 21% of students at Western Kentucky University are the first children in their families to have completed a bachelor’s degree, which can complicate things since they have no immediate family role models that are college graduates<sup>6</sup>. For these students in particular, faculty can help serve as role models bridging the gap from engineering academia to practice.

Faculty can inform and teach the value of licensure to students in several different ways. Through student advising, faculty can on a one-on-one basis can address the importance of licensure in the context of the student’s future career plans. In the classroom, faculty can discuss the value of licensure and answer student questions.

**Curriculum Responsibility**

According to ABET, the program criteria for civil engineering, the curriculum must prepare graduates to “explain the importance of professional licensure.”<sup>3</sup> At WKU, topics regarding engineering licensure are included in the curriculum during the freshman and sophomore years with faculty discussing licensure during the junior year. During senior year, licensure is examined and discussed in detail, and students are required to complete many homework assignments which focusing on ABET’s criteria that students be able to explain the importance of professional licensure.

In the freshmen year, most civil engineering students take CE 176 Civil Engineering Freshman Design in the spring semester. This course introduces civil engineering to the students and requires a small design project. All of the branches of civil engineering are discussed so students see the broad view of which civil engineering encompasses. As part of this course, an introduction to engineering licensure is briefly provided so students begin to learn about what it means to be a practicing “licensed,” professional engineer. During the sophomore year, students typically take CE 303/304 Construction Management and Lab. In this course, students see multiple sets of engineering construction plans that are signed and sealed by licensed engineers and architects. Students learn why plans are signed and stamped by licensed professionals in terms of responsibility and liability. Seeing signed and dated stamps on actual construction plans helps make these discussions real and tangible to the students. During the junior year, students take CE 382 Structural Analysis. In this course, students see and review a set of structural plans, where the need and value of licensure is further reinforced. Beginning senior year, students take CE 400 Senior Seminar as part of their senior project experience. Engineering licensure is discussed in detail in this course, many homework assignments are required to complete. Topics discussed in this course include: the history of engineering licensure; engineering licensure today; the future of engineering licensure, case studies in licensure; the process of being a licensed engineer; the FE application process and how best to prepare for this exam.

Academic Year	Semester	
	Fall	Spring
Freshman		
Sophomore		
Junior		
Senior		

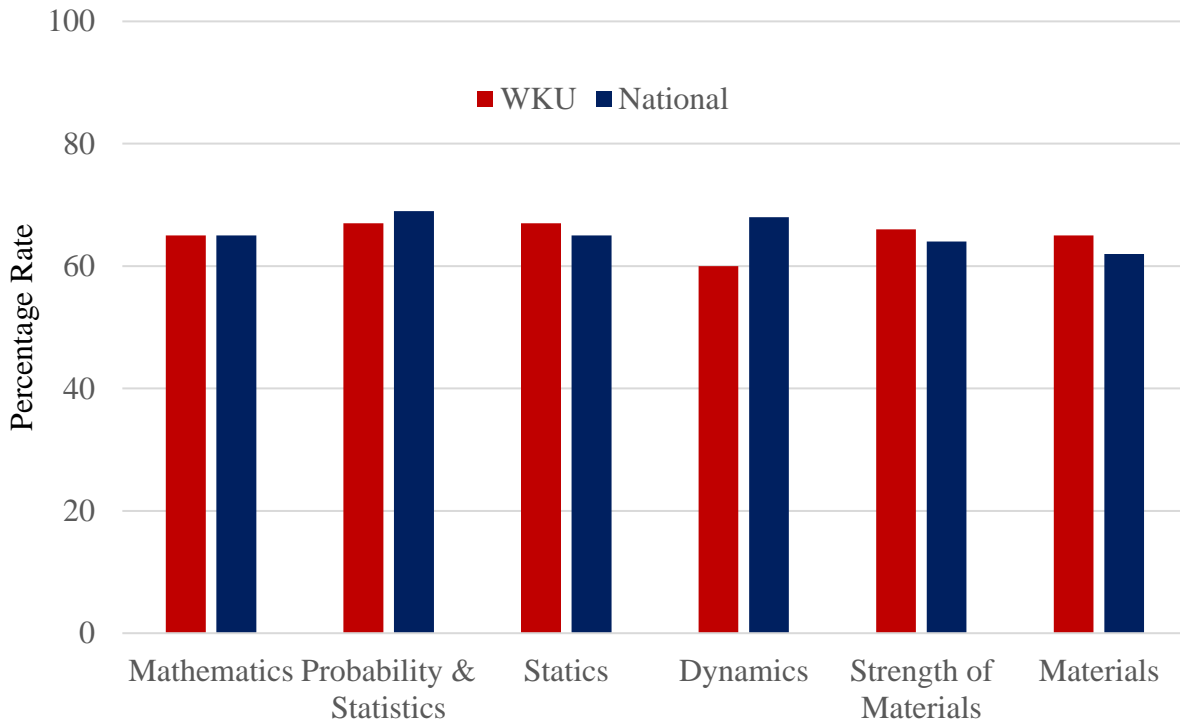
Licensure Curriculum Content	
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Table 1. Licensure curricular content

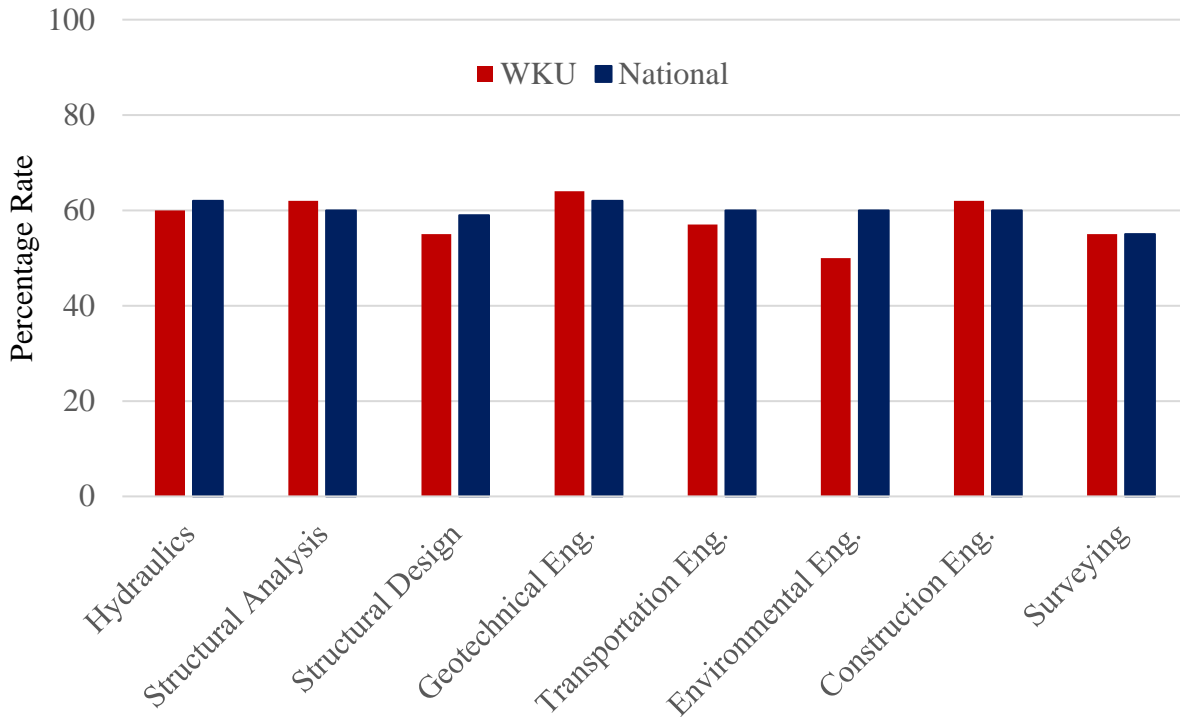
## Successes of Students Pursuing Licensure

Only 25 percent of all practicing engineers become licensed. In civil engineering, this increases to 50 percent which shows the importance for undergraduate students in this field of engineering to pursue licensure. This importance of civil engineering students to pursue licensure upon graduation is strongly emphasized and promoted by the civil engineering curriculum and program at WKU, and some successes have been achieved.

Civil engineering students at WKU are passing the FE exam at rates close to the national averages. Based on the emphasis throughout the curriculum, higher rates would be better and perhaps expected. However, one aspect of passing rates is the overall strength and caliber of students coming into the program. WKU is not an elite private institution, it is a comprehensive public University aimed at providing a quality education to all who pursue higher education. At WKU, any student who applies and is accepted to the institution may pursue engineering studies. There are no separate or additional entrance requirements for studying engineering at the department or college level. FE results for the past 4 years are shown in Graphs 1 and 2 where average overall percentage rates are given. As shown in Graph 1, some areas where WKU students consistently perform above the national average on math and engineering science topics include: statics, strength of materials, materials. As shown in Graph 2, some areas where WKU students consistently perform above the national average on civil engineering topics include: structural analysis, geotechnical engineering, and construction engineering.



Graph 1. Math and engineering science FE results



Graph 2. Civil engineering FE results

### Faculty and Student Challenges

While there have been successes in terms of teaching the value of licensure to civil engineering students at WKU, there have also been challenges. As coordinator of the civil engineering program at WKU, I believe one of the most important challenges is to create and maintain a student culture of awareness regarding the FE exam as well as the importance of engineering licensure. For faculty teaching freshman and sophomores, the challenge is getting the initial message and process across to the students who are typically studying hard in other courses such as calculus and physics. For them, licensure is far away so getting the message to these students requires effort and attention by the faculty. However, upper classmen can help bridge this gap encouraging student awareness of licensure. For junior and seniors, they feel the pressure of all of their engineering courses, labs, and projects. Getting this group of students motivated about applying, preparing and taking the FE exam is the challenge of the faculty.

For students, there are many challenges to consider and balance. These challenges which are interconnected include: cost, time, and effort. All of which are in limited supply forcing the students to make difficult decisions. As shown in Graph 1, some areas where WKU students consistently perform below the national average on math and engineering science topics include: probability and statistics, and dynamics. At WKU, civil engineering students are not required to take dynamics but they may choose to take this course as an elective. As shown in Graph 2, some areas where WKU students consistently perform above the national average on civil engineering topics include: hydraulics, structural design, transportation engineering, and environmental engineering. At WKU, structural steel design which is part of structural design on

the FE exam is not a required course but is offered as an elective. Over the past four years, the average national pass rate for 1<sup>st</sup> time takers was approximately 74%. For 1<sup>st</sup> time WKU students taking the FE exam, the passing rate was approximately 68%.

## Summary and Conclusions

Teaching the value of licensure to engineering students is important, and to do so impacts the civil engineering curriculum. Faculty play a significant role in this, and have a responsibility to teach this to their students. Students face many time consuming challenges as discussed herein come there senior year when they are typically trying to prepare for the FE exam. For 1<sup>st</sup> time WKU students taking the FE exam over the last four years, the pass rate is fairly close to the national passing rate.

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