From Classroom to Licensure — Exploring Diverse Student and Faculty Perspectives on the FE Exam Requirement

Samuel Sola Akosile, Morgan State University

Samuel Akosile is a Ph.D. student in Sustainable Infrastructure and Resilience Engineering at Morgan State University, within the Department of Civil Engineering. He currently works as a Research Assistant, contributing to innovative studies in the field of civil infrastructure. His primary research area focuses on sustainable design for pavement systems, aiming to develop environmentally responsible, durable, and cost-effective solutions for modern transportation networks. Samuel's work explores the integration of green materials, lifecycle assessment, and resilient engineering practices in pavement design. Through his research, he seeks to address key challenges in infrastructure sustainability while promoting long-term resilience in the face of climate change and increasing urban demands

John Olawale Akosile, Morgan State University
Dr. Oludare Adegbola Owolabi P.E., Morgan State University

Dr. Oludare Owolabi, a professional engineer in Maryland, joined the Morgan State University faculty in 2010. He is the director of the Sustainable Infrastructure Development, Smart Innovation and Resilient Engineering Research Lab, Department of Civil Engineering at Morgan State University

Grace Yemisi Balogun-Ifesanmi, Morgan State University

Grace Yemisi Balogun-Ifesanmi is a Ph.D. student in Bio-Environmental Sciences at Morgan State University. She received her Bachelor's and Master's degrees in Plant Biology from the University of Ilorin, Nigeria, with specializations in food safety and environmental biology. With a professional background in environmental, health & safety (EHS) consultancy and ISO 14001:2015 auditing, she blends research with impact. Her passion lies in ESG strategy, nanoparticle applications to mitigate environmental challenges, as well as microplastic studies. She continues to explore the intersection of science and policy for a global sustainable future.

Grace's research on the use of nanoceria as a foliar application offers promising strategies to reduce toxic stress and promote sustainable agriculture. https://orcid.org/my-orcid?orcid=0009-0005-7248-5013

Jeremiah Olaoluwa Akinlade

Jeremiah Olaoluwa Akinlade is a Doctoral student in Civil Engineering at Morgan State University, with strong interests in structural and transportation engineering, data-driven analysis, and engineering education. His academic and research pursuits align closely with ASEE's mission of advancing excellence, innovation, and inclusivity in engineering education, with a focus on translating research into impactful teaching, workforce development, and real-world engineering practice.

1.0 Introduction

The Fundamentals of Engineering (FE) exam was developed as part of a national effort to promote consistency in engineering licensure and to safeguard public health, safety, and welfare. Coordinated by the National Council of Examiners for Engineering and Surveying (NCEES), which was founded in 1920, the FE exam evolved from earlier state-level Engineer-in-Training examinations that emerged in the mid-20th century. These examinations were introduced as states sought a uniform method for assessing foundational engineering knowledge prior to professional practice. Over time, the FE exam became established as the first step in the two-stage licensure process leading to the Professional Engineer credential [1].

The transition from engineering education to professional practice involves more than the completion of academic coursework. For many engineering graduates in the United States, this transition formally begins with the FE exam, which serves as the first step toward professional licensure. Administered by the NCEES, the FE exam is designed to assess whether graduating engineers have acquired the foundational knowledge necessary for entry into professional practice [1].

Engineering programs often view student performance on the FE exam as an external indicator of curricular effectiveness and alignment with professional standards. This perspective is reinforced by accreditation expectations from the Accreditation Board for Engineering and Technology (ABET), which emphasize student outcomes related to problem solving, ethical responsibility, and preparation for professional practice [2]. As a result, the FE exam occupies a unique position at the intersection of classroom learning, institutional accountability, and professional identity development.

Research in engineering education has shown that students' professional planning, including decisions related to licensure pathways, is strongly influenced by faculty messaging, departmental culture, and advising practices [3]. In addition, institutional context and access to academic and professional guidance have been shown to shape how students engage with long-term professional goals in engineering [4].

These perceptions may be further shaped by students' cultural and educational backgrounds. Research has documented that first-generation college students and students from underrepresented groups often encounter differences in access to professional guidance and institutional knowledge about licensure pathways [5], [6].

To support student engagement with the FE exam and readiness for professional practice in civil engineering, many civil and environmental engineering (CEE) departments employ a variety of institutional approaches. These commonly include graduation requirements related to the FE exam, the involvement of licensed professional engineers among the faculty, and the offering of structured FE review courses as optional or required elements of the curriculum [7]. FE review courses have been widely implemented and are frequently identified as effective in increasing student participation in exam [8], [9], [10].

Despite this attention, comparatively little empirical work has focused on how students themselves understand and navigate the FE exam as a transitional experience, especially in HBCU settings. This study addresses this gap by examining student perceptions of the FE exam and how institutional support and background characteristics relate to their licensure planning.

Research Questions

This study investigates the following research questions:

1. What do engineering students understand about the purpose, timing, and relevance of the FE exam?
2. How confident and motivated are engineering students to take the FE exam?
3. How do students perceive the availability and usefulness of advising and institutional support related to FE exam preparation?
4. How do student background characteristics relate to differences in FE exam awareness, confidence, and preparation planning?
5. What challenges and barriers do students report in preparing for or deciding when to take the FE exam?

2.0 Theoretical Framework

Schlossberg's Transition Theory defines transitions as events or non-events that disrupt individuals' roles, routines, or assumptions and emphasizes that such transitions are experienced differently depending on personal and contextual factors [11], [12]. In this study, the FE exam is conceptualized as a transition within engineering education, as it marks an increased awareness of licensure expectations and professional responsibility for many students.

The theory's Four S framework situation, self, support, and strategies is used as an interpretive lens to examine how students describe academic preparation, advising practices, personal background, and coping approaches related to FE exam readiness. The situation component reflects contextual factors such as exam timing and perceived expectations. The self-component captures individual characteristics including confidence and academic identity. The support dimension includes advising, peer networks, and institutional resources, while strategies represent how students plan and prepare for the exam.

This framework supports interpretation of varied student experiences without assuming uniform outcomes.

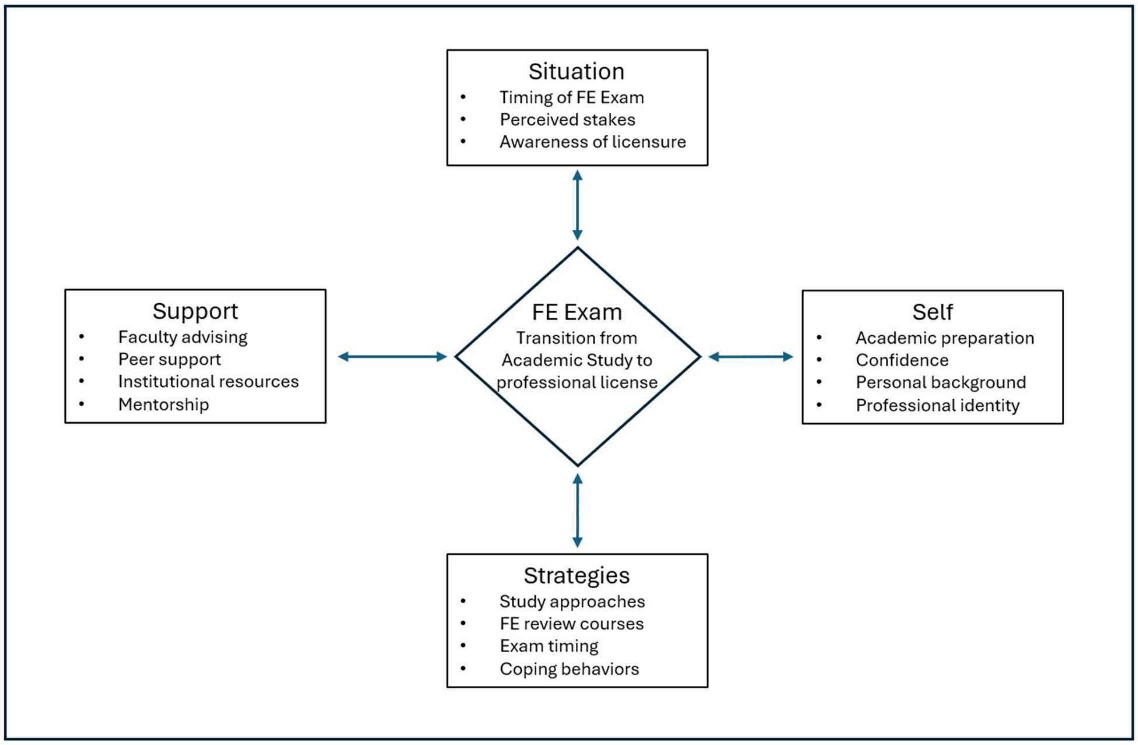


Figure 1: Schlossberg's Four S Transition Framework

Figure 1 presents a schematic that applies Schlossberg's Four S Transition Framework to the Fundamentals of Engineering (FE) exam by positioning the exam as a central transitional experience in students' academic and professional pathways. In this representation, the FE exam sits at the core, emphasizing its role as a focal point in the shift from undergraduate study toward professional licensure. Surrounding this core are four interacting layers that reflect how the transition is experienced. The self-layer captures individual characteristics such as academic confidence, background, and emerging professional identity. The situation layer reflects contextual conditions, including the timing of the exam, perceived stakes, and awareness of licensure expectations. The support layer represents the advising, peer networks, and institutional resources available to students during this transition. The outermost strategies layer highlights the actions students take to cope with and manage the transition, such as study planning, participation in review courses, or decisions about exam timing. Consistent with Schlossberg's theory, the diagram illustrates that these layers interact to shape how students perceive and navigate the FE exam, without assuming uniform experiences or predicting outcomes.

3.0 Methodology

3.1 Research Design

This study adopted a mixed-methods research design to examine engineering students' perceptions of the Fundamentals of Engineering (FE) exam as part of their transition from academic study to professional licensure. A mixed-methods approach was selected to allow quantitative analysis of trends in student awareness, confidence, advising experiences, and preparation planning, alongside qualitative analysis of open-ended responses that provided contextual insight into these perceptions. The research design and analytic approach were intentionally aligned with the study's conceptual framework, which views the FE exam as a transitional experience influenced by contextual, personal, and support-related factors. Integrating quantitative and qualitative data strengthened the study by enabling numerical patterns to be interpreted alongside students' own explanations and experiences [13], [14].

3.2 Participants

A total of 36 engineering students in an HBCU school, including both undergraduate and graduate students, participated in the study by completing the survey. Participants represented diverse backgrounds and academic levels within engineering programs. Participation was voluntary, and responses were collected anonymously to encourage candid reporting of experiences and perceptions related to the FE exam.

3.3 Instrumentation

Data were collected using a structured questionnaire consisting of Likert-scale items and open-ended questions. The Likert items measured awareness, advising practices, confidence, motivation, and preparation planning using a five-point scale. Open-ended questions captured students' perspectives on challenges and support needs.

3.4 Data Collection

The questionnaire was distributed electronically, and participants were informed of the study purpose and their right to withdraw. Responses were handled confidentially.

3.5 Data Analysis

Quantitative data from the 5-point Likert scale were coded and processed through descriptive statistics, with weighted means serving as the primary measure for identifying participant patterns. To make sense of these averages, the study used a specific interpretation framework to map numerical values onto qualitative sentiments. Mean scores between 1.00 and 1.80 were categorized as Strongly Disagree, followed by 1.81 to 2.60 as Disagree, 2.61 to 3.40 as Neutral, 3.41 to 4.20 as Agree, and 4.21 to 5.00 as Strongly Agree.

Before conducting inferential analysis, key assumptions for parametric testing were examined. Normality was assessed using the Shapiro–Wilk test, and all variables (awareness, advising practices, and confidence/motivation/perceived value) showed no significant departure from a normal distribution ($p > 0.05$). Homogeneity of variance was evaluated using Levene's test, which was not significant ($p > 0.05$), indicating that the assumption of equal variances was met. Based on these results, independent-samples t-tests were conducted to examine differences based on gender, legal status and first-generation college status. Statistical significance was evaluated at $\alpha = 0.05$, and Cohen's d was used to assess effect size.

Qualitative responses were analyzed using thematic analysis through iterative coding and theme development.

4. Results and Discussion

4.1 Socio-demographic Characteristics

Figure 2 shows that the sample was predominantly composed of civil engineering students (31, 86.1%), reflecting the strong emphasis on licensure within the discipline [8], [9]. Most participants were graduate students (22, 61.1%), indicating that many were at advanced stages of their academic programs where exposure to licensure pathways is more likely.

The gender distribution was mostly male (25, 69.4%), consistent with broader trends in engineering education [5]. The sample also included a relatively balanced mix of domestic (17, 47.2%) and international students (19, 52.8%), which provides a balanced perspective across different educational and professional backgrounds. In terms of first-generation status, a majority were continuing-generation students (23, 63.9%), while 13 (36.1%) identified as first-

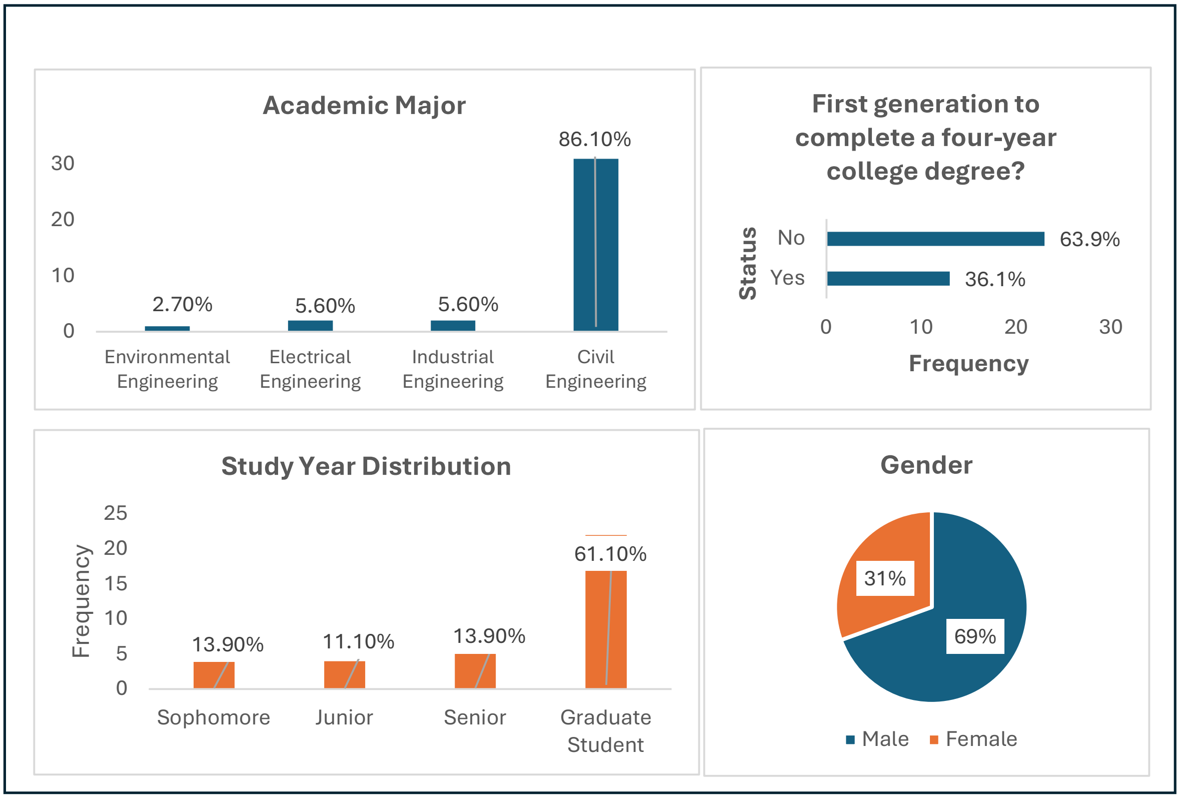


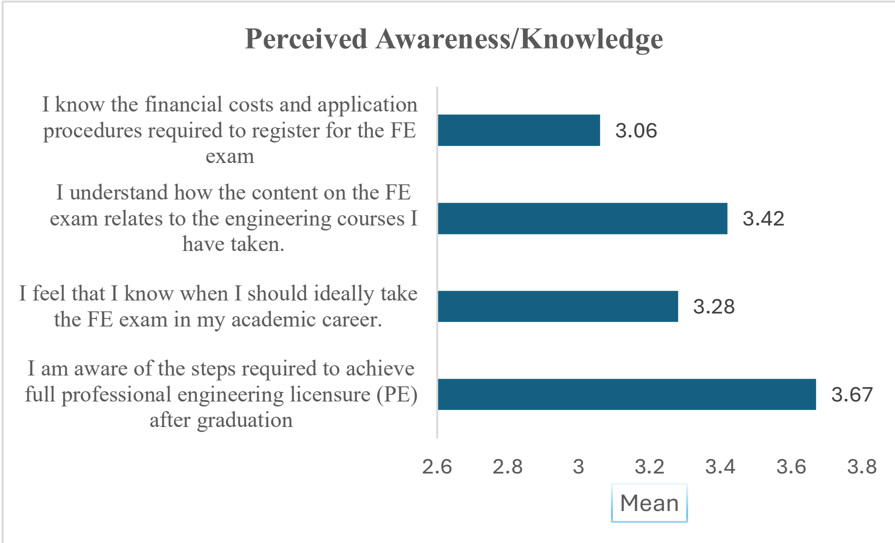
Figure 2: Participants' Demographic Characteristics (N = 36)

generation. Prior research suggests that first-generation students may have less access to informal academic and professional guidance, which can influence their understanding of licensure pathways and preparation strategies [6].

4.2 Awareness and Advising

Figure 3 shows that students had a general awareness of the FE exam, particularly regarding licensure steps (mean = 3.67), but this did not extend to practical aspects such as exam timing and registration procedures, which remained less clear (means = 3.28 and 3.06, respectively).

In contrast, perceptions of advising and institutional support were consistently lower. Access to preparation resources (mean = 2.97), equity in support (mean = 2.72), and timeliness of advising (mean = 2.94) all fell below the midpoint threshold, indicating gaps in structured guidance.



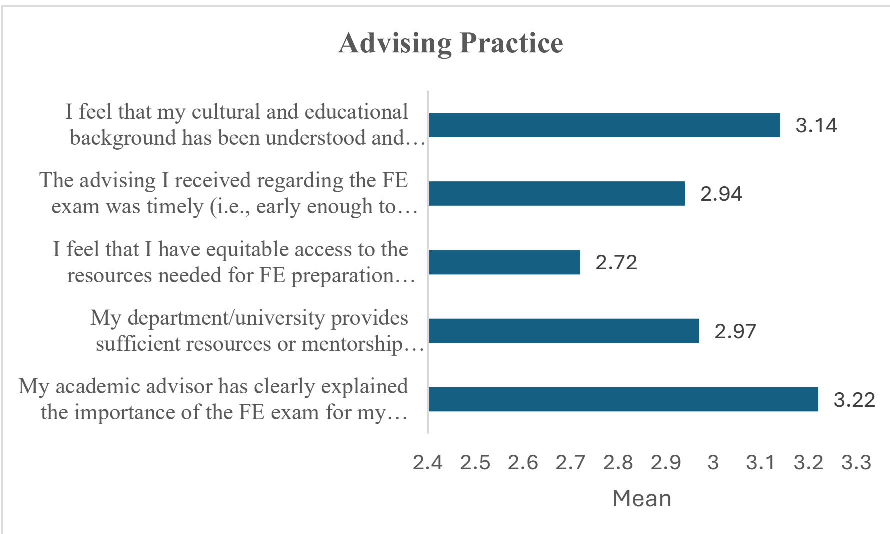


Figure 3: FE Exam Awareness and Advising Practice among Participants

These results point to a clear imbalance: students are aware of the importance of the FE exam but lack the support needed to prepare effectively. This aligns with prior research showing that advising and institutional context play a critical role in shaping students' engagement with licensure pathways [3], [4].

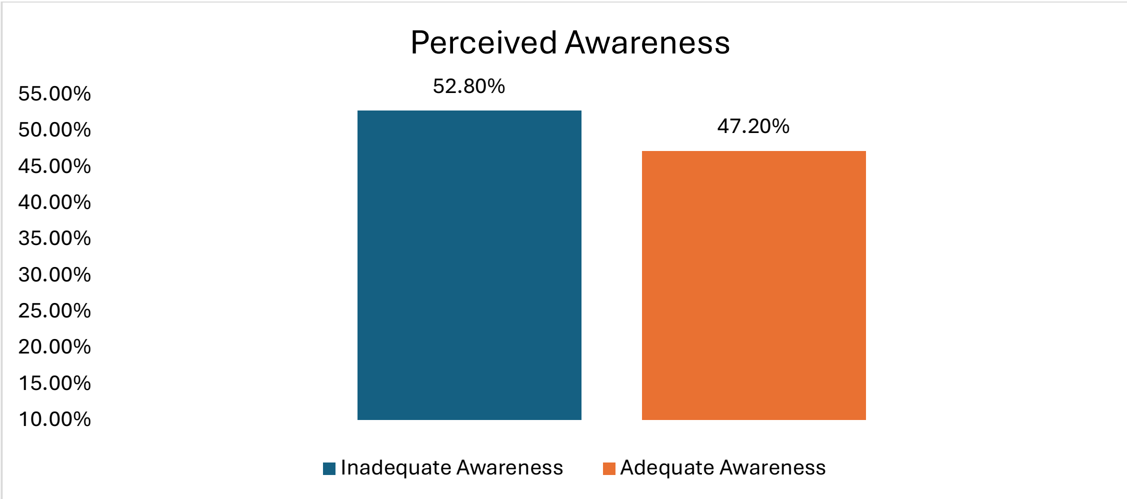


Figure 4: Overall Perceived Level of Awareness

Figure 4 shows that a slightly higher proportion of students demonstrated inadequate awareness (19, 52.8%) compared to those with adequate awareness (17, 47.2%).

This near-even distribution indicates that while many students are familiar with the FE exam, a larger share still lacks sufficient understanding of key aspects of the licensure process.

This pattern reinforces the findings from Table 2, where general awareness was evident, but gaps remained in practical knowledge, such as exam timing and procedures. The results suggest that awareness alone may not be sufficient to support effective preparation, particularly in the absence of consistent advising and structured guidance [3], [4]

4.3 Confidence, Motivation, and Perceived Value

Figure 5 shows that students placed a high value on the FE exam but reported lower confidence and only moderate motivation. Most students viewed the FE exam as a necessary measure of engineering competence (mean = 3.86) and essential for their career goals (mean = 3.92). However, confidence in passing the exam on the first attempt was low (mean = 2.83), and perceptions of preparedness through coursework were moderate (mean = 3.17), with a large proportion of neutral responses.

Motivation to prepare for the exam was also moderate (mean = 3.22), indicating that recognition of its importance does not fully translate into readiness or action. These findings highlight a gap between perceived value and confidence, suggesting that students may understand the importance of licensure but feel insufficiently prepared, particularly in the absence of structured academic and advising support [3], [4].

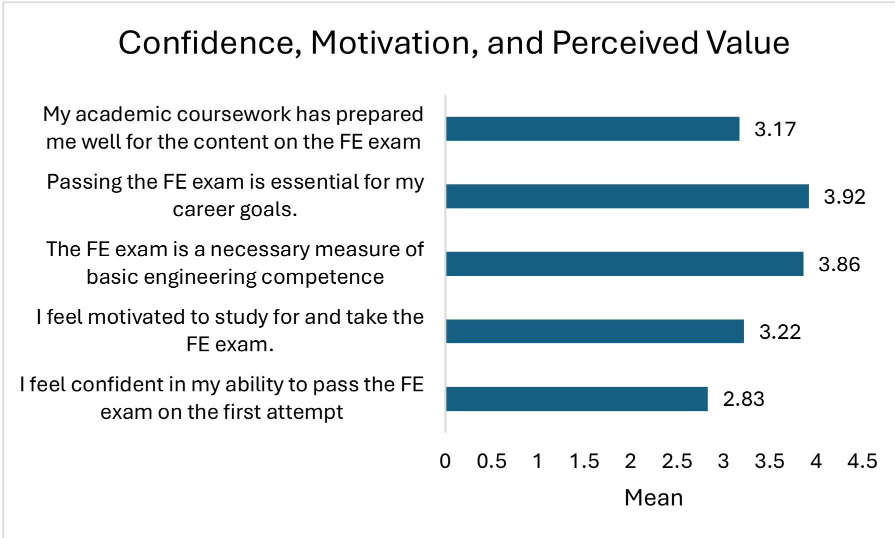


Figure 5: Confidence, Motivation, and Perceived Value

4.4 Differences in FE exam awareness, confidence, and advising perceptions across Students' Background

Table 1 shows that gender differences were most pronounced in advising experiences. Male students reported significantly higher advising satisfaction than female students ($p = .024$, $d = 0.86$), indicating a large effect. Differences in awareness ($p = .091$, $d = 0.63$) and confidence ($p = .066$, $d = 0.69$) were not statistically significant, although moderate effect sizes suggest meaningful variation.

Table 1: Independent Samples t-test Results Comparing Outcomes by Gender and First-Generation Status

Characteristic × Outcome	Group comparison (n)	Mean diff.	t(df)	p	d
Gender (male vs. female) → Advising practice	Male (n = 25), Female (n = 11)	0.79	2.37(34)	0.024	0.86
Gender (male vs. female) → Awareness of FE exam	Male (n = 25), Female (n = 11)	0.51	1.74(34)	0.091	0.63
Gender (male vs. female) → Perceived confidence	Male (n = 25), Female (n = 11)	0.50	1.90(34)	0.066	0.69
First-generation (no vs. yes) → Awareness of FE exam	No (n = 23), Yes (n = 13)	-0.11	-0.37(34)	0.715	-0.13
First-generation (no vs. yes) → Advising practice	No (n = 23), Yes (n = 13)	0.39	1.14(34)	0.261	0.40
First-generation (no vs. yes) → Perceived confidence	No (n = 23), Yes (n = 13)	-0.12	-0.46(34)	0.651	-0.16

No statistically significant differences were observed based on first-generation status across awareness (p = .715), advising (p = .261), or confidence (p = .651). However, a small to moderate effect was observed for advising (d = 0.40), with continuing-generation students reporting slightly higher perceived support.

In summary, the results indicate that advising experiences vary more clearly by gender than by first-generation status. These patterns suggest that access to guidance and support may differ across student groups, which can influence how students engage with licensure preparation [5], [6].

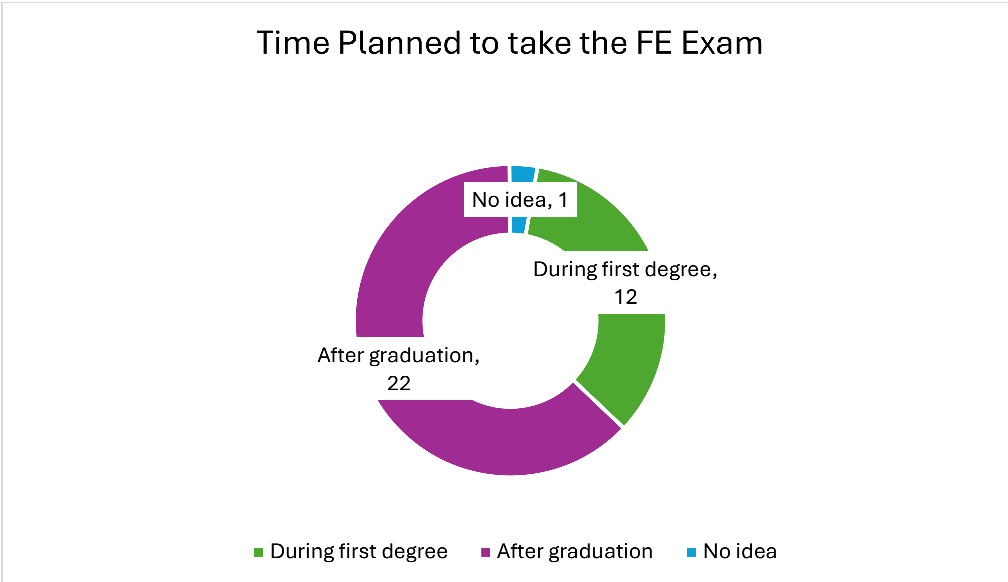


Figure 6: Time Planned to take the FE Exam among Participants

Figure 6 shows the chart of how students plan to take the FE exam. Most students (62.9%) indicated that they plan to take the exam after graduation, while 34.3% plan to take it during their first degree. Only 2.9% of respondents reported having no clear plan regarding when to take the FE exam, suggesting that most students have at least some intentions regarding exam timing, even if it is delayed.

4.5 Qualitative Findings

Thematic analysis identified several recurring challenges:

i. Uncertainty about how coursework aligns with FE exam content
ii. Limited time due to academic and professional commitments
iii. Financial and procedural barriers
iv. Low confidence and perceived difficulty of the exam
v. Need for earlier and clearer institutional guidance

Students consistently emphasized the importance of structured and proactive support.

5 Conclusion and Recommendations

Students recognize the importance of the FE exam but often do not feel adequately prepared to pursue it. Moderate awareness, low confidence, and inconsistent advising highlight gaps in the transition from academic study to professional licensure.

Gender-based differences in advising suggest uneven access to support, while patterns observed for first-generation students indicate potential variation in perceived guidance. These findings underscore the need for consistent and equitable advising practices.

Improving licensure preparation requires clearer communication, earlier engagement, and integration of FE-related content into engineering curricula.

5.1 Implications to Practice

Programs can strengthen student preparation by introducing structured advising checkpoints, integrating FE-related content into coursework, and providing accessible review resources. Targeted support for underrepresented groups may improve equity in preparation. Engagement with licensed engineers can also help clarify the role of licensure in professional practice.

5.2 Future Work

Future studies should include larger and more diverse samples across multiple institutions. Longitudinal research may provide insight into how preparation evolves over time. Evaluating targeted advising interventions can further inform effective strategies for supporting licensure readiness.

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