WIP: Engineering Mentorship Program: A Scalable Model for Developing Future Leaders

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Work in Progress: Developing a Structured Engineering Mentorship Program Through Dual-Perspective Needs Assessment

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Abstract

While engineering programs emphasize technical skill development, intentional training in mentorship and leadership remains underrepresented in many curricula. Preliminary conversations with graduate teaching assistants in the Civil and Environmental Engineering (CEE) department revealed gaps in their preparation for mentoring undergraduates, highlighting the broader need for structured mentorship training that extends beyond technical advising relationships.

This work-in-progress paper documents our process of using systematic data collection to inform the development of a formal Engineering Mentorship Program. The initiative aims to prepare undergraduate students to serve as peer mentors for fellow undergraduates through a structured curriculum grounded in mentorship theory and adult learning principles. Proposed core components include a one-unit mentorship and leadership course integrating research-backed competencies, faculty-led workshops, and guided mentoring experiences.

Our pedagogical approach emphasizes experiential learning through hands-on practice and reflective feedback, with student mentors engaging in mentorship theory while developing competencies such as communication skills, trust-building, goal-setting, and inclusive engagement practices. The initiative is designed to align with Accreditation Board for Engineering and Technology (ABET) Student Outcome #4 (ethical and professional responsibility) and institutional strategic priorities in experiential education and leadership development.

During our planning phase, we are conducting needs assessment surveys of faculty and undergraduate students within the CEE department to systematically evaluate current mentorship practices, gauge student interest in peer mentoring, identify what faculty currently provide in mentoring relationships, and determine where structured mentorship training would be most beneficial. This data will directly inform decisions regarding course structure, content emphasis, credit options, and implementation strategies.

Assessment methods under development include reflective assignments and feedback tools designed to measure mentoring effectiveness and student learning outcomes. We anticipate evaluation metrics will include mentor confidence levels, mentee satisfaction and learning gains, and leadership skill development measured through pre- and post-program surveys and reflective journals.

This paper will share our needs assessment design and methodology, the theoretical framework informing program structure, and our planned approach for using survey data to guide pilot implementation.

Introduction

Mentorship serves a vital function in engineering education, contributing to student retention, professional development, and long-term career success [1]. However, while technical advising relationships between faculty and students are well-established, intentional training that prepares students to mentor their peers is

often lacking. Preliminary conversations with faculty and graduate teaching assistants in the CEE department revealed notable gaps in their preparation for mentoring undergraduates, suggesting a broader need for structured mentorship training. This paper describes our approach to developing an Engineering Mentorship Program. Rather than designing the program based on assumptions, we conducted parallel needs assessments with both faculty and students to gather comprehensive input. This paper presents our methodology, preliminary findings from both surveys, and a framework for translating results into program design.

Background

According to American Society for Engineering Education (ASEE) data, approximately 40-50% of engineering students either drop out or switch to another major before completing their degree [2]. Research has linked this attrition to feelings of isolation, perceived lack of belonging, and difficulty connecting coursework to real-world applications [3]. Peer mentoring addresses these concerns by connecting students at different stages of their academic journey.

A systematic review [4] found that peer mentoring programs contribute to retention by providing emotional support, increasing motivation, and reducing stress during the critical first year. Students who participate in peer mentoring acquire practical skills, including time management, communication, teamwork, and goal setting. Recent studies in engineering education have demonstrated measurable impacts: Herzog et al. [5] reported that first-year retention improved by over 10% after implementing a peer mentor program, while research at Texas A&M University-Kingsville showed positive outcomes for both mentors and mentees [6].

Several engineering programs have implemented structured mentorship initiatives that inform our approach. MIT's MechE ENGAGE program supports new graduate students through weekly "mentorship pod" meetings combining faculty and peer mentors [7]. Stanford's Center for STEMM (Science, Technology, Engineering, Mathematics, and Medicine) Mentorship takes a team-based approach, offering workshops designed to enhance dynamics within entire lab groups and foster collaborative environments [8]. UC Berkeley's Getting into Graduate School (GiGS) program matches undergraduates with graduate student mentors who guide them through application preparation, prioritizing first-generation and underrepresented students [9]. These models demonstrate the range of successful approaches, from peer-to-peer support to alumni networking, that we draw upon in designing our program.

Methodology

This study employed parallel surveys targeting two key stakeholder groups: faculty members who observe student mentoring needs and students who experience mentorship directly. This dual-perspective approach allows for the comparison of perceived and expressed needs.

Faculty Survey: A 22-question instrument was distributed to all CEE faculty in Fall 2025. Questions assessed current mentorship practices, perceived student needs, challenges in mentoring, and program design preferences. After removing duplicate submissions, 15 unique faculty members completed the survey. Respondents included Full Professors (n=7), Clinical Professors (n=2), Associate Professors (n=2), Teaching Professors (n=2), Lecturers (n=1), and others (n=1). The majority (53%) had more than 20 years in academia.

Student Survey: A 22-question instrument was distributed to CEE undergraduate students in early 2026. The survey assessed students' mentorship experiences, expressed needs, interest in participation, and format preferences. A total of 131 students completed the survey, representing all academic levels: Juniors (n=67), Sophomores (n=25), Seniors (n=20), and Freshmen (n=19). Students represented various CEE focus areas, including Structural Engineering (n=39), Construction Management (n=28), Undecided/General CEE (n=23), Transportation Engineering (n=20), and Environmental Engineering (n=10).

Results

This section presents findings from the faculty and student surveys, followed by a comparative analysis of both perspectives and an examination of barriers and program preferences.

Survey Results: Faculty Perspectives (n=15**):** Faculty demonstrated strong support for providing formal mentorship training to students. When asked whether they would support such training, 47% strongly agreed and 33% agreed, for a total of 80% in favor. The remaining 20% were neutral, and no respondents disagreed. Regarding their own background, 53% reported receiving formal mentorship training, while 20% had no training but expressed interest.

Faculty identified the following student needs: career planning guidance, academic success strategies, and communication skills (n=7 each), followed by time management (n=5) and technical skills (n=4), as shown in Figure 1. They identified gaps, including limited structured opportunities (n=7), lack of continuity across academic stages (n=6), and insufficient training for student mentors (n=6). When asked about challenges, time constraints were the most frequently cited (60%), followed by balancing mentoring with other responsibilities (53%) and managing diverse mentoring styles (47%).

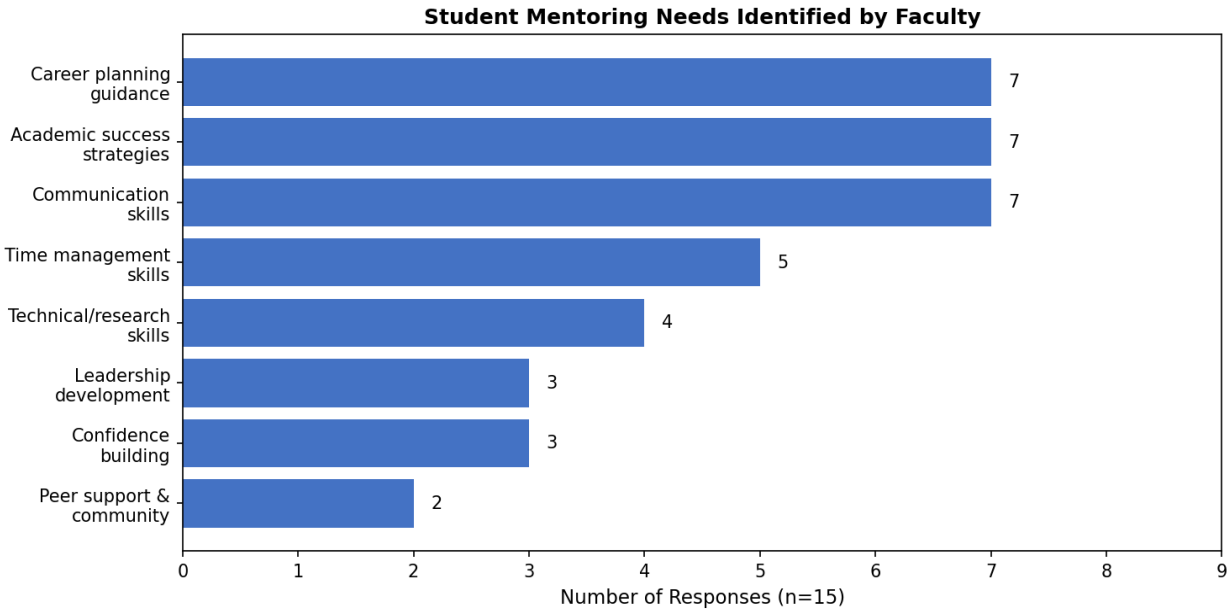

Figure 1. Student Mentoring Needs Identified by Faculty (n=15)

Survey Results: Student Perspectives (n=131): Students reported varied mentorship experiences. The most common source of mentorship (multi-select) was upper-class undergraduates (45%), followed by faculty (17%) and graduate students (13%), while 47% reported having received no mentorship at the University

of Illinois Urbana-Champaign (UIUC). Regarding their own mentoring experience, 35% had served as mentors (14% formally, 21% informally), while 38% expressed interest in becoming mentors.

When asked about their interest in participating as mentees, 64% expressed interest (18% very interested, 47% somewhat interested). Interest in serving as mentors was also notable at 49% (14% very interested, 35% somewhat interested). Notably, 93% of students indicated they would be open to being matched with a senior undergraduate or graduate student mentor rather than a faculty member, with 67% specifically preferring mentors with experience in their area of interest.

As shown in Figure 2, students identified their top needs from mentoring as: career planning and professional development (69%), networking opportunities (61%), understanding industry careers (60%), and academic success strategies (46%). These priorities closely align with faculty perceptions, with career guidance emerging as the top priority for both groups. Students identified key gaps: not knowing how to ask for mentorship (54%), not knowing what to expect (46%), difficulty finding mentors (38%), and lack of peer mentoring opportunities (27%).

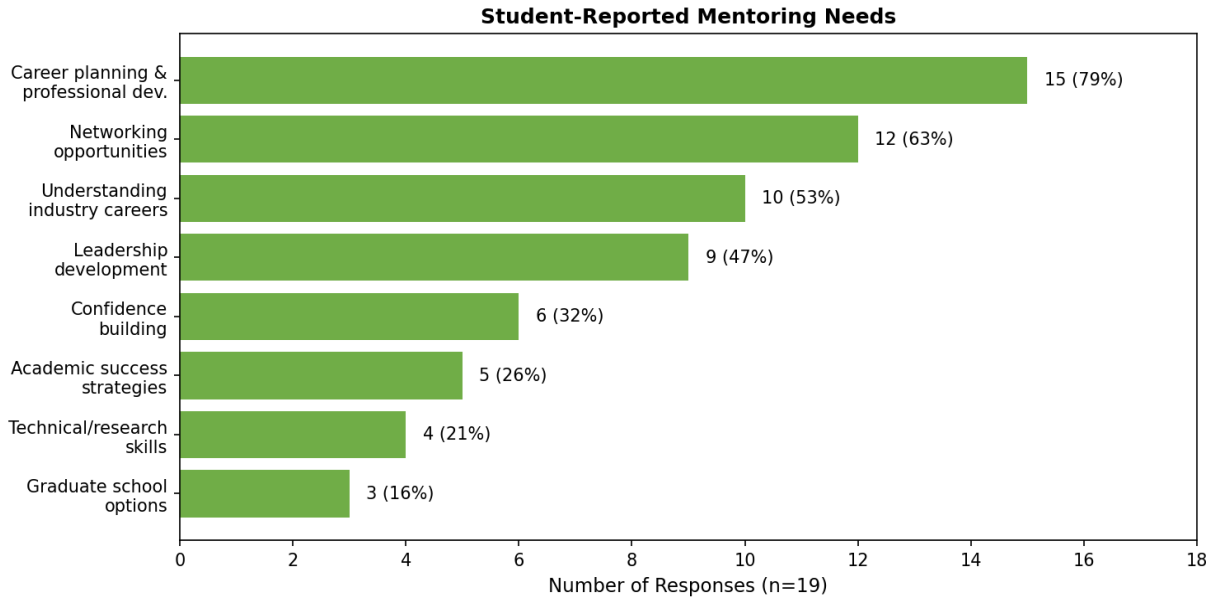

Figure 2. Mentoring Needs Reported by Students (n=131)

Comparing Faculty and Student Perspectives**:** Several points emerged consistently across both surveys. Time constraints were identified as the primary barrier by both faculty (100%) and students (66%). Career planning emerged as the top priority from both perspectives. Both groups identified communication skills and professional development as key training needs. These convergent findings strengthen confidence in program priorities.

However, some differences emerged. Students placed greater emphasis on networking opportunities (61%) and understanding industry careers (60%) than faculty anticipated. Students also identified a gap that faculty may not fully recognize: 54% of students reported not knowing how to ask for mentorship, and 46% did not know what to expect from mentoring relationships, as shown in Table 1. This suggests the program should include explicit guidance on initiating and navigating mentoring relationships, not just skills for providing mentorship. These findings align with and extend previous research. For example, the strong

emphasis on career planning by both faculty and students is consistent with the competencies targeted by programs such as MIT's MechE ENGAGE [7], which combines faculty and peer mentors to support professional development. The team-based approach used by Stanford's Center for STEMM Mentorship [8] also informs our design, as our survey data supports incorporating group-based formats alongside individual mentoring.

Table 1. Comparison of Faculty and Student Survey Findings

Dimension	**Faculty (n=15)**	**Students (n=131)**
Top Need Identified	Academic success, career planning, communication skills (47% each)	Career planning (69%)
Primary Barrier	Time constraints (100%)	Time commitment (66%)
Support for Participation	80% support mentor training	49% interested as mentor
Interest in Course	N/A	45% interested
Key Gap Identified	Limited structured opportunities (47%)	Don't know how to ask (54%)
Preferred Format	One-on-one mentoring (53%)	One-unit course (42%)

Barriers and Program Preferences**:** Faculty barriers to participation included time constraints (100%), lack of student interest (60%), and lack of institutional recognition (40%). Student hesitations included time commitment (66%), uncertainty about expectations (44%), and not feeling prepared to mentor (31%). These findings suggest the program must clearly communicate expectations and provide structured training to build confidence.

For program format, students preferred one-unit courses (42%), monthly peer group meetings (39%), and workshop series (36%). When asked about meeting frequency, students preferred as-needed/flexible (33%) or bi-weekly (32%) meetings. The most desired faculty incentives were recognition in promotion/tenure (73%) and consideration of teaching load (60%). Student incentives emphasized networking (60%), personal growth (51%), and career resources (49%).

Regarding the proposed one-unit course, 45% of students expressed interest (10% very interested, 35% somewhat interested), with 37% neutral and 16% not interested. The most valued training topics identified by students were career guidance (53%), leadership skills (49%), communication and active listening (45%), and time management and boundaries (42%).

Challenges

Several challenges emerged during the development and data collection phases of this study. First, achieving adequate survey response rates proved difficult, with limited participation despite multiple follow-up reminders. As a result, the modest sample sizes drawn from a single department limit the generalizability of the findings. Second, differences in perspective between faculty and students posed challenges for the mentorship program's design. For instance, faculty tended to favor one-on-one mentoring, whereas students preferred group-based formats, necessitating the accommodation of multiple mentoring modalities. Finally, baseline data on departmental mentorship outcomes were unavailable, making it difficult to establish pre-program benchmarks against which future program effectiveness can be evaluated.

Conclusion

This work-in-progress presents a systematic, dual-perspective approach to developing an Engineering Mentorship Program. Results from faculty (n=15) and student (n=131) surveys reveal strong support from both groups: 80% of faculty support formal training, and 64% of students are interested in participating as mentees. Career planning emerged as the top priority across both populations. Time constraints were cited as the primary barrier by both groups, informing the need for efficient, high-impact program design.

A key finding is that students want guidance not just on how to mentor, but on how to seek and navigate mentoring relationships. Over half of the students (54%) reported not knowing how to ask for mentorship. This insight, which might not have emerged from faculty surveys alone, demonstrates the value of gathering input from both perspectives.

Limitations include the modest sample sizes from a single department at one institution. Future work includes finalizing curriculum development incorporating both faculty expertise and student-expressed needs, submitting a proposal to the Strategic Instructional Innovations Program (SIIP) for implementation funding, and launching a pilot program in Fall 2026. By grounding program development in comprehensive input from faculty members and students, we aim to create an evidence-based mentorship initiative that addresses the actual needs of our student population.

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