Amplify: A mentoring program for second year engineering students

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Work-in-Progress: ECE Amplify - A near-peer mentoring program for 2nd year engineering students

Abstract:
This work-in-progress paper describes the motivation and implementation of a near-peer mentorship program, ECE Amplify, for second-year undergraduate engineering students in the University of Texas at Austin. The primary objectives of ECE Amplify are to build a supportive community among second-year ECE (Electrical and Computer Engineering) students, offer guidance on navigating rigorous discipline-specific second-year coursework, and foster professional development by providing insights into technical areas and internship opportunities.

The transition from the first to the second year of an undergraduate engineering program often presents significant challenges for students. The coursework becomes significantly more rigorous, built on foundational concepts learned in the first year but requiring deeper understanding and application. Additionally, there tends to be less structured academic support, leaving students to navigate difficult subjects with greater independence. Many students also struggle with time management as they balance increased academic demands with extracurricular activities, internships, or job searches. Moreover, the pressure to choose a specific technical area or specialization can create stress as students consider their long-term career paths.

The program utilizes a group mentoring model, which is structured to maximize interaction and support among participants. Each mentoring pod consists of approximately five second-year mentees, who are paired with one undergraduate peer mentor. These peer mentors are typically third or fourth-year students who have successfully navigated the challenges of the second year and can provide valuable insights and guidance. Additionally, engineering faculty and alumni are integrated into the program, participating in pod meetings once per semester to offer their expertise and professional perspectives. A graduate teaching assistant oversees all the pods, ensuring consistency and providing additional support where needed.

In this work-in-progress paper, we will discuss the overall program structure, the recruitment process, the types of activities implemented to support both academic and professional development, and data from surveys administered to learn more about the experiences of our engineering student mentees and mentors.

Background and Motivation:
Mentorship programs play a critical role in shaping the academic and professional development of engineering students. These programs provide a structured opportunity for students to gain insight from experienced professionals, such as faculty, industry experts or alumni, and peers. They serve to bridge the gap between theoretical learning and real-world application. The guidance these programs provide has the potential to not only enhance students' technical

proficiency but also their confidence and belongingness. They also give the participants the opportunity to develop their soft skills, such as communication, leadership, and teamwork.

A literature search of currently implemented mentoring programs for engineering students all point to the significant impact these programs can have on the educational experiences of engineering students. Cummings et al. describe a mentorship program featuring a layered peer mentorship model, where upper-level undergraduate students mentor lower-level students, creating a chain of support and knowledge transfer throughout the engineering program [1], [2]. The study explores how students make meaning through this mentorship experience, focusing on three key aspects: academic support, professional development, and personal growth. The authors present specific examples of how the program impacts students in each of these areas, highlighting the mutual benefits for both mentors and mentees. Other studies explore various aspects of mentorship programs in higher education, including its effects on students' success and retention, career readiness, and sense of belonging in the engineering field [3], [4], [5], [6]. Erdil et al. discuss the implementation and outcomes of a mentoring program implemented for their engineering students, which consists of two components: a peer mentorship program for incoming first-year and transfer students, and a career mentorship program for juniors and seniors. The peer mentorship program pairs first-year students with current sophomores or juniors, while the career mentorship program connects upperclassmen with alumni or industry professionals. Initial results from the mentoring program for first-year students suggested higher retention rates for participants, particularly among students from underrepresented populations [7]. Studies also reveal that mentorship programs can contribute to the development of social communities among engineering students [8], [9]. These studies have identified several important social community outcomes, including increased connectedness, resilience, and overall satisfaction. Design of mentorship programs have also been a focus of research revealing that the most effective mentorship techniques for retaining first-year engineering students include establishing clear goals for the mentorship program, aligning them with student needs and expectations, and creating a supportive environment that encourages open communication and fosters trust between mentors and mentees [10].

Mentoring programs for first-year engineering students are widely recognized and implemented due to the transitional challenges that students face when entering college. Many universities have invested significant resources into these programs, recognizing their value in improving retention rates and fostering student success. However, there is a noticeable gap in mentoring programs targeted to second-year engineering students despite this being a pivotal year due to more advanced coursework, discipline-specific classes, pursuing engineering internships, and selecting a specialization area. These unique challenges faced by second-year engineering students contribute to the well-documented phenomenon of sophomore slump, a decline in student motivation and engagement, ultimately impacting student retention [11], [12]. The retention rates for second-year ECE students, specifically, in our university are 6-10% lower than

the first-year retention rate. Much more alarming is the retention rates of second-year students from under-represented populations. For this population, our retention rates show more than a 16% decline compared to the retention rate of first-year students, presented in an internal ECE department report to all faculty in Fall 2023.

Research Questions:
The purpose of this research is to explore the following research questions:
1. How does near-peer mentoring influence the educational experiences of second-year ECE student mentees?
2. What specific aspects of the mentor-mentee relationship contribute most to the success of near-peer mentoring in enhancing the educational experiences of second-year ECE student mentees?

Methodology and Implementation:
To better understand the experiences of our second-year ECE students before implementing our mentoring program, we conducted a focus group consisting of second-year ECE students. The invitation was sent to all our second-year ECE students, about 380 students in all, although due to conflicts at that time of the semester, only 20 students accepted the invitation to join the focus group. The focus group was facilitated by a learning consultant from our university Learning Center, who was one of the collaborators on this project.

The three main takeaways from the focus group discussion were, (i) the importance of personal and peer advising that felt more like friendly advice rather than professional advice, (ii) the need for social hours or informal gatherings with teaching assistants and upper class students to discuss topics such as internships, course advice, and personal experiences, and (iii) the necessity for additional academic support, review sessions for courses, and mentorship programs to help students succeed in their courses. This feedback gathered from the focus group inspired us to design a peer mentoring program tailored specifically for our second-year ECE students. In the following sections we will describe our methodology and findings.

ECE Amplify, the student mentoring program, was intentionally designed to be an opt-in initiative to support and guide second-year ECE students through their academic and professional journeys. The program coordinators consisted of one ECE faculty member, three ECE staff advisors, and one ECE graduate student.

In the fall semester of 2024, all second-year ECE students were invited to participate in the mentoring program. Approximately 200 students (out of ~380 students) opted in, demonstrating a strong interest in peer support and professional development. These students were also requested to share their technical interests, and this information was used to create 20 pods (in Fall 2024) of around five members each, based on their specific areas of technical interest. This

structure will be replicated in the Spring of 2025, with another 100 students forming similar pods.

All our third and fourth-year ECE students, who have selected their technical areas of specialization and are registered for elective courses in those areas, were simultaneously invited to apply to serve as mentors in this program. Besides their resume, they were asked to write about why they were interested in this position and their thoughts about what made them a good candidate for this position. We received more than 35 applications for 20 positions. Priority was given to the 4th year ECE students who had served as mentors, peer advisors, tutors or assistants in the department. In this paper we refer to these mentors as **_near-peer_** mentors, since these students were further along in the ECE curriculum, and not in the same year of our ECE curriculum as the mentees.

These mentors were required to complete a mentor training session coordinated by some of the creators of this program. The training session was designed to prepare these students for their roles as mentors. It included an overview of the structure of the program, the program goals, and mentor responsibilities and expectations. The session included some role-playing exercises that simulated common situations, such as helping a mentee find tutoring resources for specific courses, assisting a mentee with internship searches and interview preparation, and advising a mentee on which courses to register for and other specific challenges such as effective time management strategies.

The program included a variety of structured activities such as:

1. Monthly Pod Meetings: Regular group meetings to discuss progress, challenges, and upcoming events. The following were some suggested topics for meetings: (i) tips for coursework success, (ii) ways to engage in the department, (iii) participation in student organizations, and (iv) maintaining mental wellness.
2. One-on-One Meetings with mentees to provide personalized guidance and support. Mentors were encouraged to follow up with all mentees, even those who seemed disengaged, and to keep reminding them of the program's benefits.
3. Faculty Mentor Meeting: Each pod met with a faculty mentor once per semester to gain additional academic insights and professional advice.
4. Career Expo and Tech Core Night: Pods attended these events to explore career opportunities and learn about the latest technological advancements.
5. Panel Discussions: Participation in ECE Graduate Student and Alumni panel discussions to gain perspective on advanced studies and career paths.
6. Site visits to some local engineering companies to gain a better understanding of the different careers after graduation and the skills required in specific positions.

7. Meeting with the ECE graduate student coordinator of this program to gain unique insights into topics such as graduate school preparation, research opportunities, or career pathways in engineering.
8. Regular communication between pods using the Discord platform. This virtual platform was used for discussions, sharing resources, and circulating announcements about events and activities relevant to second-year ECE students.

As per university policy, an IRB approval form was filled out with the specifics of the data collection, procedure, and usage (minimal/no risk associated, no identifiable information collected, results to be strictly internal and for program improvement purposes only). The IRB office assigned the program a "Non-Human Research" determination for non-generalizable program evaluation.

Findings:
To address the first research question - how near-peer mentoring influences the educational experiences of the second-year student mentees - we surveyed the ECE Amplify program participants at the end of the semester. Survey responses to Likert scale questions provided valuable insights into student experiences within the mentoring program. Table 1 are results from the mentee survey, and Table 2 are from the mentor survey.

Students were asked to rate statements on a Likert scale from 1(low) to 5(high). The responses revealed that a significant majority of the mentees reported that this mentoring program positively impacted their academic journey. The only survey question that received a lower score was about the impact this program had on the mentees' overall academic experience. One reason why this question scored lower than the others may be because there were other factors that contributed to the mentees' academic experiences such as challenging coursework and exam grades. Therefore, the mentees could have received valuable academic support from their mentors without feeling that their overall academic experience was significantly transformed.

Survey Question	Mean Score out of 5
How satisfied are you with the ECE Amplify mentoring program overall?	4.24
How helpful has your mentor been in providing academic support?	4.12
How helpful has your mentor been in giving career advice?	4.18
Has this program impacted your overall academic experience this semester?	3.65

Table 1: ECE Amplify Mentee survey responses

To address the second research question - what specific aspects of the mentor-mentee relationship contribute most to the success of near-peer mentoring in enhancing the educational experiences of second-year ECE student mentees - we analyzed the comments and feedback we received from the mentees. Overall, the mentees appreciated this pilot offering of the program as is evident from the following comment – *"I think it was good, especially as a first-time endeavor! I feel like it will gain traction as it becomes more popular."* Some of the comments, *"Having (my mentor) to talk to within the Electrical and Computer engineering major was incredibly helpful. It is rare for me to meet people who genuinely become my friends and are willing to listen to any challenges I am facing or help me learn something I am interested in. She always responded to my messages, and when I was struggling whether with coursework, personal challenges, or feeling like I wasn't contributing enough to my lab partner it meant so much to have someone there who understood. Her support showed me I wasn't alone in my struggles, and that made the experience all the more valuable."* highlighted the impact that the mentor had on the mentee's experiences, especially the challenges associated with coursework. This speaks to the level of trust in the mentor-mentee relationship, and how that was instrumental in the mentee's overall success.

The mentor survey results revealed that they experienced lower levels of satisfaction than their mentee counterparts. Also, the mentors' perceptions of the impact that this mentoring program had on their mentees was lower than the perceived impact of the mentees. The qualitative findings from the student survey's comments may explain the reasons behind this disparity. For instance, one mentor commented *"Need a better system for attendance. Maybe a 0-credit hour course to put it on mentees' schedules. Also, the application should more clearly mention that the mentees are expected to participate."* Another source of frustration for the mentors was the lack of structure as was evidenced by the following comment – *"I wish the program were more structured to provide both mentees and mentors guidelines to navigate expectations. The mentees should be held accountable if they don't maintain communication standards or fail to show up for events. Similarly, mentors should be made aware of weekly expectations. It felt a little too open ended at times, leading to uncertainty in the program."* Overall, it seemed like some of the mentors were frustrated about the lack of engagement of a few of their assigned mentees, and difficulties scheduling pod meetings.

Survey Question	Mean Score out of 5
How satisfied are you with the ECE Amplify mentoring program overall?	3.55
Do you think this mentoring program has impacted your mentees' overall academic experience this semester?	3

Table 2: ECE Amplify Mentor survey responses

Future Work:

Based on student experience and survey results, the following are some areas of improvement that we will work to implement in future semesters:

1. Provide guidelines for structured mentoring sessions with clearly defined goals and topics. This could take the form of a semester-long mentoring curriculum with suggested discussion themes such as time management strategies, exam preparation, and navigating internship applications.

2. Organize more community events or multi-pod gatherings to encourage engagement among mentees and mentors across pods. This will help to provide networking opportunities for all participants in this program. Arranging workshops or panel discussions featuring industry professionals and faculty could supplement the mentoring experience giving mentees a broader range of expertise and access.

3. Create a structure of incentives and recognition for both mentees and mentors such as certificates of completion, awards for active engagement, or sharing success stories. This may especially help to encourage mentee participation.

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