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Work In Progress: Mentorship Matters—Shaping the Professional Pathways of Biological Engineering Students

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Work in Progress: Mentorship Matters—Shaping the Professional Pathways of Biological Engineering Students

Abstract

This work-in-progress paper explores the success of a professional mentoring program for undergraduate Biological Engineering (BENG) students. One of the key goals of the Biological Engineering program at the University of Arkansas is to graduate skilled engineers capable of addressing sustainable solutions for water, food, energy, and related systems. Post graduation placement rates have ranged from 66.7%-100% from December 2020-December 2023 and the department is committed to further improving student success. By enhancing career guidance and strengthening connections with industries and alumni, the program aimed to assist in bridging the gap between academic learning and successful job placement and career satisfaction.

The BENG Mentor Program was established as a mutually beneficial connection between industry mentors and current biological engineering students. The program was designed to promote professional development by connecting students with experienced engineers in fields related to food, water, and energy. Through this connection, students gained valuable networking opportunities and access to industry professionals, enabling discussions on career pathways, job expectations, and strategies for success in the field.

Piloted in Fall 2024, the program was open to all undergraduate students. It followed a mentor circle format, with groups of two to four students paired with two industry mentors. These groups met monthly for 1 to 1.5 hours, either in person or remotely, based on the preferences of each circle. Mentor circle assignments were made based on availability, facilitated by BENG faculty and representatives from the Arkansas Academy of Biological and Agricultural Engineering.

Participant demographics, program engagement, mentor-mentee relationship quality, and program logistics were preliminarily assessed through mentor and mentee surveys. These surveys gathered both quantitative data, such as participation rates and frequency of communication, and qualitative insights on the quality of interactions, the relevance of advice, and satisfaction with the mentoring experience. This assessment identified strengths and areas for improvement, providing feedback for refining the program structure, enhancing the mentor matching process, and ensuring that the program continues to meet the evolving needs of both students and industry mentors. The results will also inform future program expansions and guide efforts to maximize its impact on student career readiness and professional development.

Introduction

Mentorship is a foundation of both professional and academic growth, offering students the guidance, support, and opportunities they need to succeed. Mentoring helps students discover their potential and explore how to apply their unique skills and strengths; it also provides guidance as they define and work toward their career goals [1]. Mentorship is not new to higher

education, but interest in creating programs that support student-to-work transitions and its potential to facilitate a range of career development outcomes is growing [2].

Industry mentors can provide valuable guidance in areas such as time management, financial planning, self-discipline, character development, and leadership. Their experiences may be more readily received by students as both practical and inspirational. Existing alumni and industry mentorship programs have demonstrated positive outcomes, with students reporting significant personal and professional growth, greater career clarity, and reduced stress due to a better understanding of potential career paths [3-5].

The benefits of industry mentorship programs extend beyond just the students. A significant gap often exists between academia and industry, where academic curricula may not fully align with industry needs, resulting in graduates who lack essential skills required by employers. As Malhotra suggests, mentorship programs that connect students with industry professionals offer a solution to this challenge. These programs promote collaboration between academia and industry, supporting technological advancements, driving innovative research, and ensuring that academic programs remain aligned with industry demands [6].

The field of biological engineering has the potential to make a significant global impact, yet it remains less widely recognized compared to more traditional engineering disciplines. Its relevance is steadily increasing as it addresses pressing global challenges related to renewable energy which is driving innovation and economic growth [7]. Students who have a balance of technical skills as well as professional skills (e.g., problem solving, strong communication, teamwork and interpersonal skills) are often better equipped to navigate the competitive job landscape and find fulfilling roles after graduation [8].

One of the key goals of the Biological Engineering program at the University of Arkansas is to graduate skilled engineers capable of addressing sustainable solutions for water, food, energy, and related systems. Post graduation placement rates have ranged from 66.7%-100% from December 2020-December 2023 and the department is committed to further improving student success. The BENG Mentor Program was created to foster collaboration between industry professionals and students. The program aims to bridge the gap between academic learning and workforce readiness by creating an environment where mentors could share their expertise while helping students build professional skills and confidence as they prepare for careers in biological engineering. These mentoring relationships give students opportunities to expand their professional networks, engage in meaningful conversations about career paths, and learn practical strategies for navigating workplace expectations and achieving their goals.

This program is a collaborative effort between the Department of Biological and Agricultural Engineering and the Arkansas Academy of Biological and Agricultural Engineers, and is open to biological engineering sophomores, juniors, seniors, and graduate students. Participation is voluntary, and the program is designed to accommodate students and mentors from a variety of backgrounds and locations. Flexibility is a key component, with mentorship occurring either in person or virtually to ensure accessibility for all participants.

Methodology

The Biological Engineering (BENG) Mentor Program was piloted in Fall 2024. The program was designed based on successful mentorship models from the University of Arkansas Chemical Engineering [9, 10] and Industrial Engineering [11] Departments, both of which have been established for over three years. To ensure an effective launch, the BENG Mentor Program committee consulted representatives from these programs to gather advice, best practices, and lessons learned.

One of the key recommendations from these consultations was to adopt a mentor circle format and focus the program primarily on the fall semester. The mentor circle structure was favored over one-on-one meetings because it encouraged richer discussions and more diverse perspectives. Additionally, the established programs noted a decline in attendance during the spring semester, emphasizing the importance of concentrating efforts in the fall.

Recruitment for mentors and mentees was conducted through the Arkansas Academy of Biological and Agricultural Engineers Annual Meeting, targeted email campaigns, and classroom announcements. Mentors completed an online application providing personal details, professional experience, interests, and availability. Successful mentors were expected to demonstrate qualities such as active listening, honesty and confidentiality, and to focus on career and professional development. Their roles included acting as listeners, advocates, coaches, and guides, serving as positive role models and facilitators of self-confidence, and providing job references when appropriate. Mentors were encouraged to support mentees by fostering career skills, helping them access resources, encouraging interactions with diverse groups, and promoting competency development [12]. While mentors were given a handbook for guidance, no specific topics were mandated for discussion, allowing flexibility to tailor conversations to the group's needs.

Mentees applied through an online form that captured their personal information, interests, current employment (if any), expectations, and availability. Selected mentees committed to attending monthly meetings and program events, adhering to program guidelines. Mentees were encouraged to interact with mentors in a respectful, honest, and professional manner, leveraging their mentors' expertise to achieve educational and career goals. Common discussion topics included workplace culture and dynamics, industry insights, and career planning and strategies for success.

Mentor circles were developed based on scheduling compatibility. Once the mentor circles were established, the program's committee handed over communication responsibilities to the assigned mentors for each group. Circles were expected to meet monthly from September through December. Meetings were structured around discussions that aligned with the participants' shared interests, but mentors and mentees had the flexibility to adjust topics as needed, and no specific topics were assigned to any given meeting.

To assess the program's effectiveness and gather feedback for future iterations, a voluntary survey was distributed to all participants in early December. It aimed to identify the program's strengths, areas for improvement, and overall participant satisfaction. Comprising 16 questions,

the survey required approximately 5-6 minutes to complete. A mix of question types was included to collect both quantitative and qualitative feedback. The majority of questions (n=11) utilized a single-choice format with Likert-scale responses to assess participants' perceptions of program effectiveness, communication, and overall satisfaction. These questions allowed respondents to rate various aspects of the program on a structured scale, such as clarity of objectives, meeting effectiveness, and quality of interactions. Additionally, five open-ended questions were included to capture qualitative insights, allowing participants to elaborate on valuable topics, suggest improvements, and provide general feedback. This mix of structured and open-ended responses ensured a comprehensive evaluation of the program's strengths and areas for growth without being too time consuming to complete.

Results and Discussion

During Fall 2024, 10 mentors and 17 students participated in the pilot BENG Mentor Program. Due to the small number of participants, mentor circles were formed based on logistical considerations, including preferences for in-person or virtual meetings and availability (i.e., daytime vs evening by weekday). Five mentor circles were formed as described in Table 1. Groups 1-4 met once a month as intended; Group 5 was not able to find a meeting time that worked and did not meet. One group chose to visit two different industry facilities—a wastewater treatment plant and a manufacturing plant—rather than having a traditional sit-down discussion during two of their monthly meetings. At the conclusion of the program, 50% of mentors and 29% of mentees completed the post-program survey.

Table 1. Meeting logistics of the established mentoring circles for the Pilot BENG Mentor Program during Fall 2024

Group	Virtual Mentor(s)	In-Person Mentor(s)	Virtual Student(s)	In-Person Student(s)
1	1	1	1	3
2	0	2	0	3
3	0	2	0	4
4	2	0	4	0
5	2	0	2	0

The mentors were members of the Arkansas Academy of Biological and Agricultural Engineering, a distinguished group of program graduates recognized for their integrity and commitment to the highest ethical and professional standards. Mentors had at least 10 years of professional experience in the field of biological engineering with expertise spanning consulting, design, drinking water utilities, water treatment, pharmaceutical research, and industrial food processing. The educational background of the mentors varied, with 40% holding a Ph.D., 30% holding an M.S., 10% holding an MBA, and 20% holding a B.S. degree. All mentors had at least one degree in Biological and Agricultural Engineering. Regarding demographics, 90% of the mentors identified as white, while 10% identified as Asian. Additionally, 60% of the mentors identified as male, and 40% identified as female.

The participating students included two sophomores, eleven juniors, and four seniors, with cumulative GPAs ranging from 2.22 to 4.00 and an average GPA of 3.28. Six of the students

were members of the Honors College. Four participants identified as first-generation college students. 76% of participants identified as White, while two identified as Hispanic, and two identified as mixed race (Hispanic and Black, and Hispanic and American Indian). The group was 65% female and 35% male, with interests spanning the food, water, and energy industries, with a particular focus on renewable energy. Students joined the program to seek guidance on a variety of topics, including career advice, strategies for success, job opportunities, interview preparation, transitioning from college to the workplace, and networking.

Participant Feedback- Mentor Perspective. Overall, the mentors who responded to the survey (n=5) had a positive experience with the BENG Mentor Program. All mentors agreed that the program was beneficial and recommended its continuation with suggested improvements. Mentors found the program's objectives to be somewhat clear, noted good interaction between mentors and mentees, and indicated they would likely recommend this program to other BENG students (Figure 1). They appreciated the program's flexibility, which allowed both in-person and virtual participation, enabling non-local mentors to be involved. However, some mentors expressed challenges with the lack of a structured agenda for meetings. Without predefined topics, conversations occasionally became one-sided or stalled. To address this, mentors suggested that students come prepared with a list of questions to discuss or that each meeting include a set agenda with suggested topics. Additionally, they recommended implementing measures to ensure accountability for student attendance.

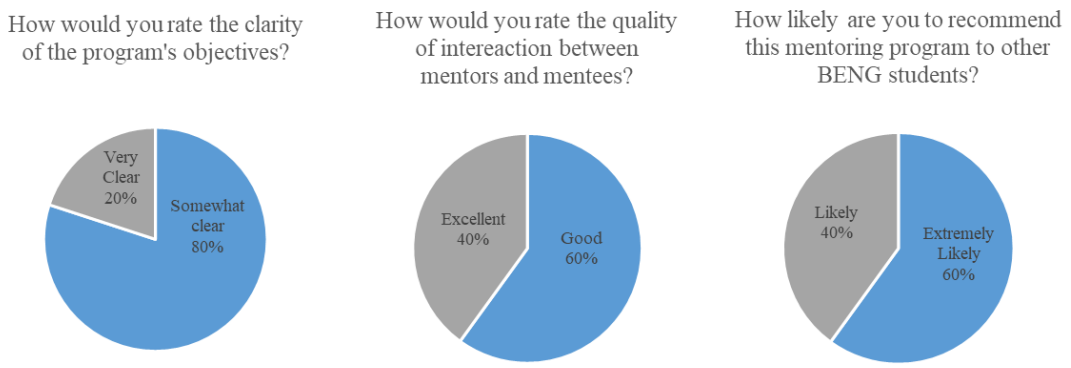

Figure 1. Feedback from mentors in the Fall 2024 BENG Mentoring Program

Participant Feedback- Student Perspective. Only 29% of students (n=5) completed the end of program survey, likely due to the heavy workload at the end of the semester when the survey was conducted. Students who consistently met with their mentor circle reported positive experiences, while one respondent from Group 5 (which did not meet) expressed understandable disappointment.

Among the students who met with their mentor circle, respondents agreed that the program's objectives were somewhat clear, interactions with their mentors were positive, and they would likely recommend the program to other BENG students (Figure 1). They also noted that the topics discussed during the mentor meetings aligned with their expectations and needs, and they felt comfortable asking questions and sharing their thoughts. These students expressed at least

some level of satisfaction with their group meetings, which helped boost their confidence in pursuing their academic and career goals. When asked about the topics that they found most valuable students shared the following feedback:

“I think our discussion about internships and what to expect in the workforce were the most valuable.”

“I found it valuable to hear about our mentor’s experiences in getting their first jobs and then proceeding in industry. It was helpful for me to hear their tips on going in for interview and talking about salary to employers.”

“Mentors talking to each other about their jobs so I could understand professional language”.

While students generally had positive experiences, they also expressed a need for more structure during meetings. They suggested having specific topics or agendas to reduce the burden on students to drive the conversation. Additional suggestions included incorporating a free or low-cost group activity to allow participants to interact across mentor groups. Another student recommended allowing participants to choose their groups instead of being assigned, as this might improve accountability and engagement.

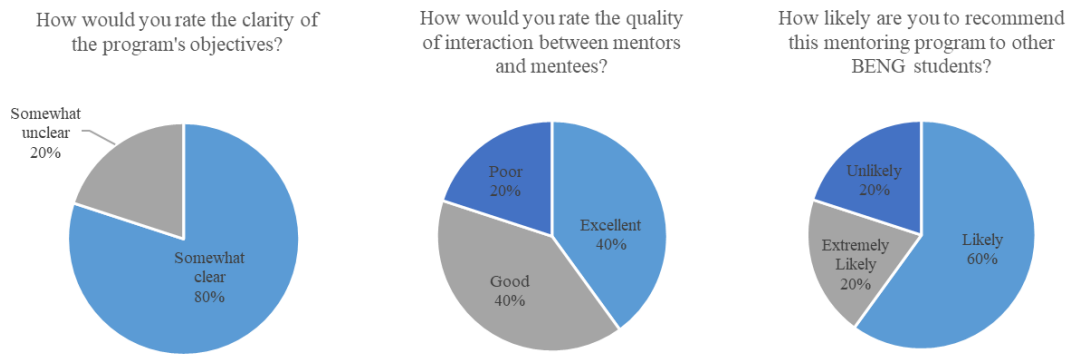

Figure 2. Feedback from students in the Fall 2024 BENG Mentoring Program

Challenges and Lessons Learned. The program has potential for improvement through increased participation. With more students involved, mentor groups could be larger, offering additional meeting times and enhancing the overall experience. Larger groups would likely reduce the pressure on both mentors and mentees to sustain conversations while creating greater networking opportunities and potentially increasing accountability for participation. An ideal mentor circle would consist of 6–8 students and 2–3 mentors representing varying career stages (early, mid, and late career) to bring diverse insights to the group.

Moving forward, lead mentors will establish meeting times and formats (in-person or virtual) before students sign up. This change will allow students to commit to specific meetings that align with their schedules, rather than a generalized time frame (e.g., "Tuesday afternoons"). With a larger pool of participants, mentor groups could also be matched based on shared interests in specific BENG fields, rather than purely logistical considerations.

To recruit more students, program information will be shared earlier in the semester through multiple channels, including email, class announcements, and the BENG student club. Periodic accountability check-ins conducted by the program committee with both mentors and mentees could help ensure consistent participation and active engagement.

Additional enhancements could also improve the program. Providing mentors and mentees with structured agendas or suggested topics for each meeting could guide discussions and reduce any awkwardness or lack of direction. Hosting an initial orientation or kick-off event would help clarify program objectives, set expectations, and share best practices for mentor-mentee interactions. Additionally, establishing a mid-semester feedback loop could identify and address potential issues while the program is still in progress. Cross-group networking events, such as social gatherings or professional development activities, could further enhance peer learning and establish connections among all participants. Finally, allowing students to have some input in selecting their mentor circles based on shared interests or preferred meeting formats may improve engagement and overall satisfaction.

Future Work. As the program evolves and expands, we will continue to collect data on the participants to evaluate the benefits of the program in terms of student satisfaction with the program and whether the program had the intended benefits of helping bridge the gap from higher education to the job placement and satisfaction.

Conclusions

The pilot implementation of the BENG Mentor Program successfully connected undergraduate biological engineering students with industry professionals, promoting networking, career exploration, and professional development. The program demonstrated the value of matching students with experienced mentors to link classroom education to practical, professional experience, particularly in fields related to sustainable solutions for food, water, and energy systems.

Survey feedback highlighted key strengths, including the relevance of advice provided by mentors and the positive mentor-mentee relationships that formed during the program. Students who participated reported increased confidence in pursuing their academic and career goals, while mentors valued the opportunity to give back to the profession by sharing their experiences and guidance. The flexible format, allowing for both in-person and remote meetings, was particularly effective in accommodating diverse mentor and mentee needs.

However, the program also revealed opportunities for improvement. Implementing structured agendas, creating an initial orientation session, and enhancing accountability measures to ensure active participation would strengthen the program. Expanding the program's reach, increasing participant numbers, and improving the mentor-matching process based on shared career interests were also identified as priorities for future iterations of the program. Finally, organizing cross-group networking events could further enhance the program’s impact by broadening students' professional connections.

As the program evolves, the insights gained from the piloted version of this program will guide efforts to refine its structure and logistics to better meet the needs of the students and industry mentors. By addressing these areas for improvement, the BENG Mentor Program has the potential to enhance student career readiness, strengthen alumni and industry relationships with students, and serve as a model for mentoring initiatives.

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