

Building Better Beginnings: Using Qualitative Feedback to Improve First-Generation Engineering Bootcamps

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Nyna, born and raised in Durham, North Carolina, obtained her Bachelor's degree in General Engineering with a concentration in Biomedical Engineering in 2022 from Wake Forest University. Following her undergraduate degree, she received her Master's degree in Biomedical Engineering with a focus in Immunoengineering from Johns Hopkins University. Nyna has a strong interest in increasing diversity in biomedical engineering spaces and she intends to research this by focusing on inclusive classroom spaces and diversifying research models.

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Dr. Morelock is an Assistant Professor of Practice with an emphasis on engineering education research, and the Associate Director of Educational Innovation and Impact for UGA's Engineering Education Transformations Institute (EETI). In addition to coordinating EETI's faculty development programming, Dr. Morelock conducts research on institutional change via faculty development, with an emphasis on innovative ways to cultivate and evaluate supportive teaching and learning networks in engineering departments and colleges. He received his doctoral degree in Engineering Education at Virginia Tech, where he was a recipient of the NSF Graduate Research Fellowship. His dissertation studied the teaching practices of engineering instructors during game-based learning activities, and how these practices affected student motivation.

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As Assistant Dean for Advancement and Community Development, Dr. Sonia Garcia provides strategic leadership in advancing student success, institutional partnerships, and inclusive excellence initiatives within the College of Engineering. In this role, she works collaboratively with faculty, staff, and academic leadership to design, implement, and assess high-impact programs that strengthen academic pathways, expand access to educational and professional opportunities, and support the holistic development of students across the College.

Dr. Garcia leads efforts to secure and steward external funding, including competitive grants and philanthropic investments, to create sustainable scholarship opportunities, mentoring programs, and experiential learning initiatives. She partners closely with faculty and staff to align these resources with curricular and co-curricular priorities, ensuring that programs are pedagogically sound, scalable, and responsive to student and departmental needs.

A core responsibility of her position involves working alongside faculty, advisors, and professional staff to develop initiatives that support students' successful transition to college life, persistence in engineering majors, and preparation for graduate study and professional careers—particularly for students historically underserved in STEM and engineering. Through cross-functional collaboration, she helps foster inclusive learning environments that promote retention, academic excellence, and student well-being.

Additionally, Dr. Garcia collaborates with faculty to integrate practitioner-informed and community-engaged components into academic programming, connecting industry, government, nonprofit, and research partners with classroom and experiential learning. Her work strengthens the bridge between theory and practice, enriching engineering education while advancing workforce readiness and civic responsibility.

Dr. Garcia also contributes to the College's scholarly and institutional mission by engaging in research, assessment, and dissemination of best practices related to student success, inclusive pedagogy, and organizational change in engineering education. She works with faculty and staff to analyze program outcomes, support accreditation and reporting efforts, and produce publications and presentations that inform institutional decision-making and national conversations.

Through sustained collaboration with students, faculty, staff, and external partners, the Assistant Dean for Advancement and Community Development plays a pivotal role in advancing the College of Engineering's mission, strengthening its academic community, and expanding its long-term impact.

Prior to her tenure at UGA, Garcia served as senior director of the Access and Inclusion Program in the Texas A&M University College of Engineering.

Garcia earned a Ph.D. in Higher Education / Higher Education Administration from Michigan State University. She received a master's degree in human development, Family Studies, and Related Services at the University of Rhode Island and a bachelor's degree in political science and government from the University of Massachusetts Boston. Dr. Garcia speaks Spanish, Italian, French.

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Background and Motivation

The identity of a first-generation college student possesses a unique set of challenges, as these students are the first in their families to pursue higher education. These challenges increase the probability that students will struggle with adjustment and make students more likely to drop out (Gibbons et al., 2016). McCarron and Inkelas suggest that this disparity of first-generation students not finishing their degree is due to not feeling supported in the college environment and not thoroughly understanding the demands and expectations of higher education (McCarron & Inkelas, 2006). This is especially true for students who plan to study engineering (Bettencourt et al., 2020; Lehto & Fang, 2023).

Summer bridge programs, often referred to as “bootcamps”, have been implemented at various institutions to address these challenges. These programs are used as support for students to get them acclimated to the university. This has been especially important for students pursuing STEM fields as it serves as an introduction to campus life and rigorous course material before the academic year begins, thus supporting retention (Barth et al., 2021; Bradford et al., 2021).

The Engineering Academic Bootcamp is a two-week-long immersive residential experience for incoming first-generation students at the University of [blinded]. Through this program, students are provided with the opportunity to become familiar with the College and University through attending lectures, completing assignments and projects, partaking in skills sessions, and learning effective study and time-management skills (Shamsi et al., Under Review). This program appeals to different areas of the undergraduate experience. Academically, students engage in courses that align with the engineering curriculum, such as physics, calculus, MATLAB, chemistry, transportation, engineering design, circuits/coding, engineering graphics, and manufacturing optimization. This line of coursework is more comprehensive than that of previous cohorts, therefore providing students with a clear concept of the first-year engineering experience (Shamsi et al., Under Review). These courses were chosen to expose students to the content and rigor of first-year engineering courses without being assessed for credit yet. Socially, students acclimate to the university environment by connecting with other boot campers through team-building activities, meeting with peer mentors from previous cohorts, and learning university life skills. Beyond the two-week residential experience, boot campers participate in programming throughout the academic year that includes meeting with their peer mentors, wellbeing workshops, and professional development sessions. The EABC is different than other bridge programs offered at peer and surrounding institutions because it is offered at no expense to the students. The EABC is sponsored by [blinded], [blinded], and [blinded] thus providing financial relief for first-generation families. First generation students are four times more likely to drop out after their first year in comparison to continuing generation students (Frogg  & Woods, 2018). The EABC has shown to be effective in retaining first generation students after their first year with a proven college-level retention record of 90-100% across the three cohorts. These percentages are comparable to the 95% first year retention rate of the University of [blinded].

This research seeks to understand student perspectives of the bootcamp and answer the research question, “*How can the themes that emerge from student feedback shape future iterations of the Engineering Academic Bootcamp?*” The motivation for this work stems from a quantitative analysis of the data provided by the previous and current cohorts.

Methods

Participants

The data for this study were collected as a partial fulfillment of a longitudinal study that examines the first-year experience of the 2025 cohort of EABC participants.

Instrument and Data Collection

The survey instrument was influenced by assessments administered to previous cohorts. Through consultation with the Principal Investigator (PI), the assessment was edited to include questions concerning more specific aspects of the student experience. Students were administered two assessments using the QuestionPro surveying platform; the first on the first day of the bootcamp and the second on their final day. The core of both assessments was developed using five-point Likert-scale questions that appealed to six areas describing facets of the first-generation student experience. These areas included (1) Perceptions of the College of Engineering and the University, (2) student experience, (3) community and communication, (4) leadership, (5) academic confidence, and (6) college preparation. In addition to this core element, the post-assessment included three open-ended response questions that sought to understand the impact of the bootcamp, experiences with peer-mentors, and ideas for future programming.

The focus of this paper is on the analysis of the open-ended response questions. This focus came after somewhat puzzling quantitative results compared to the previous year. Despite the program being run almost identically to the prior year, the two cohorts had almost no overlap in their statistically significant gains from the program. The 2024 cohort showed gains in college preparation and community/communication, while the 2025 cohort showed gains in leadership. We hoped that the qualitative responses would help shed light on these differences.

Qualitative Data Analysis

Open-ended responses were assessed using qualitative content analysis to identify patterns across student responses to the three open-ended questions on the post-assessment. Pursuant to the standards of the content analysis method, frequency counts were used as a measure of how often students alluded to key themes that were derived from the responses. We started by reading each response and using open-coding and code categorization to determine themes. Then, we tabulated the frequency count for each theme (Leedy & Ormrod, 2012). Frequency counts represent the number of students who included the theme in their response, not the number of times the theme was brought up. In other words, each student's response was assigned a binary value for each theme: 1 if the theme was present, and 0 if it was not. The values for each theme were then added up across students to determine frequency.

Results

Students in this study participated voluntarily without financial incentive, resulting in a completion rate of ~86% (n=12) for the pre-assessment and 100% (n=14) for the post-assessment. Table 1 shows our codebook of the themes found through content analysis of each open-response question.

Table 1. Open-ended response question themes and frequency counts (i.e., the number of respondents who included each theme, out of n=14).

Question	Theme	Definition	Frequency Count
If you were to explain the impact of this bootcamp to a future first-generation student considering engineering, what key takeaways would you emphasize?	Community/ Connection	Students feel that they have a sense of belonging, and there are people around them who can help	13
	Preparation	Students feel equipped to begin college	3
	Academic Advice & Practice	Students emphasized academic methods and skills that they found useful	3
	Anticipation of Difficulty	Students highlight the potential challenges of college or engineering	3
If you could design an additional module or experience for future bootcamp participants, what would it include, and why?	Social	Students expressed wanting more time to socialize with other participants	2
	Professional	Students wanted more professional development opportunities	2
	Hands-On Opportunities	Students wanted more experiences creating and using their hands	2
	Participant-Specific Interests	Students desire more experiences that cater to their specific interests	3
	Nothing to suggest	Students felt that the bootcamp did not require anything additional	1
How could your peer mentor have improved their support?	Praise (General)	Participants approved of peer mentors	7
	Praise (Support)	Participants feel nurtured throughout the bootcamp	3
	Praise (Hospitality)	Participants felt that peer mentors were friendly and welcoming	1
	Longing	Participants want to interact with their peer mentors more	1
	New content/coverage	Participants suggested something they wished their mentor had covered in more detail	1

Question 1: If you were to explain the impact of this bootcamp to a future first-generation student considering engineering, what key takeaways would you emphasize?

Question 1 sought to identify the most meaningful elements of the bootcamp. Participants' responses reflected that community/connection was the most impactful component of the bootcamp, often alluding to the relationships that help increase their sense of belonging while on campus. It was the only theme across all responses that had nearly a unanimous consensus (n=13). One student noted in their response:

The camp helps you build a sense of community. It really emphasizes that we all belong here, regardless of background!

The students recognized that by sharing this experience with those who also share the first-generation identity, they are not alone in the challenges that oftentimes come along with that status. Additionally, this points out that there is a community students have to look forward to once the academic year begins. This point was furthered by another participant when they stated,

Helped me get to know others in my same situation that I can rely on, as having others in the same boat as you helps. Getting to spend time with others helps.

This illustrates how the bootcamp was successful in creating an inclusive experience for students that they feel is transferable to their first-year experience.

The remaining themes for this question had the same frequency (n=3), but all indicated positive, impactful experiences. Students believed that the EABC influenced how prepared they felt going into the academic year. Specifically, one participant described this as an ideal opportunity to experience the academic culture, stating,

I would tell them that this is a great opportunity to get a first taste of life at [blinded] (classes, labs, etc.).

Student responses indicated that the opportunity allowed them to gain a better understanding of the expectations of the University, thus aligning with the goal of the EABC. This was supported by another student's response stating the bootcamp was, "...preparing you and setting you up for success at the college of engineering."

Along with understanding the academic culture, students believed that the academic advice and practice were a useful component of the bootcamp. One participant suggested, "*It is also a good way to test out different note taking methods and study methods.*" while another student stated, "*Time management is an important skill for everybody.*" Through these sentiments, students emphasized the need to take advantage of this opportunity to get familiar with the practices that align with academic success before beginning the academic term.

This sense of academic preparation was also observed in how students anticipated the difficulty of the coursework. One participant stated,

My main takeaway is engineering is going to be tough for everyone. All the problems you struggle with, everyone else is equally as confused as you.

Students were able to acknowledge the rigor in the curriculum, yet not express a sense of avoidance in the challenges they may face because they are to be expected. They were also able to recognize that other students are struggling as well because of the rigor, and that feeling is not equated to a personal failing. Students approached this with advice such as, *“Time waits for no one, so utilize it to the best of your ability,”* furthering the notion that barriers and challenges should be faced head-on and to be prepared for them.

Question 2: If you could design an additional module or experience for future bootcamp participants, what would it include, and why?

While students had impactful experiences, they also had recommendations for improvement. Question 2 resulted in five themes across student responses. Students wanted more social interactions by suggesting

I would include more free time into the days because it is a fun way for the campers to connect with each other.

Students desire more time to get to know other campers, indicating they understand the importance of having a community in the college. Additionally, student responses wanted more interactions that allowed them to work as a team, thus illustrating that they view this as a valuable skill to develop.

Students also wanted more opportunities to develop professionally, suggesting ideas such as

...include a how to network session and what to do to prepare for future opportunities and how to approach them

Recognizing the need for more opportunities for professional development, especially for first-generation students, is an insightful suggestion for advancing this demographic more holistically. While participants have opportunities to interact in professional environments and with EABC sponsors, students believe that more structured sessions on developing professional skills would be beneficial.

Participants also desired more hands-on and creative activities. One stated,

I would include more opportunities to create things like mini projects such as the [StickC-Plus] that we can bring home.

Students would like more tangible outcomes, which would involve more project-based learning approaches to the bootcamp curriculum and opportunities for them to express their creativity. Students see this as a time begin developing their engineering identity, and this is accomplished through their idea of what engineers “do”.

The most prominent theme from the responses to Question 2 involved participants requesting specific content they were interested in. One student provided the recommendation to *“Have a module speaking about every major and what they entail at the college of engineering.”* and another student stated, *“Maybe a hands-on prosthetic or biochemical lab.”*

Students viewed the EABC as an overarching view of the first-year engineering experience, when they wanted to know more about what they can look forward to when getting into their specific majors.

Lastly, one student stated, *“I believe this camp covered everything.”* alluding to the EABC being a comprehensive experience that adequately prepares incoming first-generation students to the college of engineering.

Question 3: How could your peer mentor have improved their support?

Responses to the final question resulted in five themes. Despite the question asking for points of improvement, the most common sentiment that students expressed about the peer mentors was praise. This praise came in the form of general, support, and hospitality. General sentiments were observed in responses that stated things such as, *“I loved them. Each one brought a different energy which was amazing.”* and *“all of them were absolutely amazing!!”*

This form of praise broadly showed appreciation for the peer mentors and was observed in half of the responses (n=7), thus indicating that students overwhelmingly had a positive experience with peer mentors.

Beyond general praise, students also praised how supportive peer mentors were. Sentiments such as *“They were all very informational”* and *“I feel like they supported us very well...”* illustrated that peer mentors were effective at advising students through the bootcamp and ensuring they knew what it took to be successful.

Praise was also given about their hospitality, stating, *“...made sure we were safe and comfortable during the entire camp.”* Ensuring students feel comfortable during the bootcamp is a key element, as it intends to make students feel that they belong on campus.

While peer mentors were commended for their work with bootcamp participants, there was also a longing to spend more time with them. One student stated,

I know she was busy with classes, so we didn't get the opportunity to see her as often as some of the other peer leaders.

Students understood that peer mentors also had to balance other responsibilities, but would have appreciated more interactions with them. This desire to spend more time with peer mentors showed how they had positive interactions with them and wanted more.

Lastly, there was a need for peer mentors to cover additional content. One student suggested,

They could have helped with the bus routes and given a small run though before classes.

Students hoped for peer mentors to share more knowledge, given that they were once in the same position as students. Bootcamp participants viewed peer mentor input as valuable and felt that it could be applied to other day-to-day campus activities, such as learning the transportation system and going to classes.

Discussion and Implications

This work explores the insights of students from the 2025 EABC cohort. The qualitative component of this research is new this year and has allowed us to shed light on the student experience. This has been accomplished by adjusting the end of bootcamp assessment, and subsequent assessments, so that we can capture students' thoughts through open response questions.

The data from open response question asking about key takeaways suggests that students generally viewed the boot camp as having a positive impact on them. This was most seen through the way students were able to build community and connect with others, thus characterizing the boot camp as a belonging-oriented program and not just academic. The prevalence of this theme suggests that the EABC is effective in building social capital amongst first-generation students at least by the end of the two weeks. Emphasizing community for first-generation students is especially important, as there is a correlation between social capital and retention. Lack of community increases feelings of not belonging and imposter syndrome, which are particularly prevalent in students studying STEM, as these course types tend to foster competition and favor students with prior exposure (Kamalumpundi et al., 2024; Sudbrock et al., 2024).

Although fewer students allude to the themes of preparation, academic preparedness, and advice, or anticipation of difficulty, those who did understood the academic rigor and what was necessary to be successful academically. This understanding illustrates how the EABC was successful in increasing the comprehension of the expectations of higher education settings. Specifically, anticipation of difficulty is viewed as a positive outcome because students are recognizing how engineering may be challenging, but no responses suggested that students viewed this difficulty as a personal failing. This allows students to take an adaptive approach to building their academic confidence instead of being overconfident. The prior aligns with the phenomenon that individuals treat their challenges like opportunities for growth instead of a threat to their sense of self or perceived intelligence (Yeager & Dweck, 2012).

Themes from question 2 revealed a desire to have more tailored content. Particularly, students wanted more hands-on and interest-specific experiences. This can be understood as students wanting to participate in activities that would be more reflective of their academic journey and provide them with the agency to begin shaping their experience. Data from the previous cohort reflects these themes as students perceived the usefulness of the content declined throughout the academic year. By relating these two data points, it can be suggested that students do not find the content as relatable, specifically as they evolve academically. Beyond the academic components of the bootcamp, students needed more social and professional experiences, therefore reinforcing the EABC as a holistic program.

Themes presented from question 3 showed overwhelmingly positive responses from students' interactions with peer mentors. Specifically, this was seen through general approval, emotional support, and hospitality and approachability. Peer mentors are being seen as key elements to the EABC experience by helping students build social and cultural capital. Peer mentors for first-generation students serve a dual purpose: guiding students through their first year by bonding over their shared identities and supporting students in building connections with other students and faculty (Thurman & Miranda Tapia, 2023). The positive experiences of students can be accredited to the implementation of suggestions provided by the previous cohorts. During peer mentor training for the current cohort, mentors were intentionally provided with areas of improvement from the years prior. The singular instances of "longing" or "new content/coverage" represent students' desire to deepen what they already feel is an effective support component of the EABC.

Future Directions

The data collected is being used to improve future programming and to help refine future assessments. Like previous years, this year's assessment sought to gain more insights from the participants; this came in the form of open-ended questions. Acknowledging the individual responses of each student serves as a starting point for program evolution so that it is more targeted to student experiences. Current plans for the 2026 EABC cohort include creating more hands-on experiences for students. Preliminary plans include participants working on a two-week long project that they present at the end of the bootcamp to their families, faculty, and EABC sponsors. This approach not only addresses student suggestions for a tangible product, but it also allows students to engage more in their specific interests.

The qualitative assessments have also urged us to ask in future assessments about the EABC programming throughout the academic year, how students are maintaining their relationships with their peer mentors, and if students are facing challenges with getting adjusted academically. These changes have been implemented for assessments distributed after their fall and spring semesters. The EABC will also expand their 2026 cohort to include transfer students. Including this demographic allows transfer participants to have a comparable transition period that promotes adjustment to university life and the academic rigor of the college. Lastly, student feedback has aroused curiosity about their experiences beyond their first year. This is being explored by determining if additional assessments or interviews are the best methods for data collection. Assessments would likely result in more data, while interviews would provide deeper insight into whether skills learned in the EABC are sustained.

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