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"The only difference is now it counts:" Exploring the Role of a Summer Bridge Program in Shaping Student Expectations of Engineering

Taylor Y. Johnson, Virginia Polytechnic Institute and State University

Taylor Y. Johnson is a graduate student at Virginia Polytechnic Institute and State University pursuing a Ph.D. in Engineering Education, where she serves as a graduate research assistant. Taylor earned her Bachelor's from The University of Texas at Austin in Biomedical Engineering. She was previously a member of the student support staff for the Virginia Tech Center for the Enhancement of Engineering Diversity where she served as an instructor for the first-year professional development seminar and as co-ordinator for the summer bridge program. Her research interests include equity in engineering education, middle-years of engineering, and engineering student support.

Ms. Malini Josiam, Virginia Tech

Malini Josiam is a Ph.D. student in Engineering Education at Virginia Tech. She is advised by Dr. Walter Lee.

Dr. Walter C. Lee, Virginia Polytechnic Institute and State University

Dr. Walter Lee is an associate professor in the Department of Engineering Education and the director of research in the Center for the Enhancement of Engineering Diversity (CEED), both at Virginia Tech. His research broadly focuses on inclusion, diversity, and educational equity—mainly related to students from historically marginalized or underrepresented groups in engineering. Lee received his Ph.D. in engineering education from Virginia Tech, his M.S. in industrial & systems engineering from Virginia Tech, and his B.S. in industrial engineering from Clemson University.

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Abstract

The College of Engineering at Virginia Tech hosts a five-week program for incoming students each summer, also known as a summer bridge program (SBP). As part of the program, first-time-in-college students become acclimated with the university setting and community prior to the start of their academic career. Students take non-credit courses in subjects that are historically challenging and required for first-year students, such as calculus, chemistry, and engineering fundamentals. Throughout the program, students also participate in informational seminars presented by various offices on campus to understand the range of opportunities and resources available to them. In light of participation occurring prior to the official start of the semester, the purpose of this paper is to explore the role of this program in shaping the expectations that participating students have of the undergraduate engineering program. To address this purpose, we analyzed a) written student responses from a workshop activity, b) data from semi-structured interviews that occurred after the workshop, and 3) responses to an exit survey administered at the conclusion of the five-week program. Combined, these data sources shed light on expectations students developed by the end of the program. We found that students emerged from the SBP with varying degrees of expectations regarding the alignment between the SBP experience and a college semester in engineering. We also found that students’ experiences and observations led them to recognize that marginalization exists in engineering while they also viewed engineering as a level playing field. We uncovered that when asked how they would respond to challenging situations, students relied on what they learned about during the SBP. Finally, we conclude with questions based on a transition theory in student development for practitioners to consider when developing or implementing a SBP.

Keywords: undergraduate, engineering, transition theory, first-year engineering

1. Introduction

The transition from high school to college is a notoriously difficult time for first-year students. Adjusting to a new environment, coursework, and/or university demands can present challenges for students in their first year of college [1], [2]. For engineering students, this transition can be particularly challenging due to the rigor of engineering coursework and the need to navigate social integration into the engineering discipline [3].

This critical transition has gained particular attention in engineering education as an effort to promote student success and retention in the discipline [4], [5]. Engineering student support centers offer engagement opportunities for students that range from mentorship programs and seminars courses to living learning communities, all of which typically begin during the first semester of the academic year [5]–[7]. An overarching goal for these programs is to get students involved early and help them create social and academic connections with peers, upperclassmen,

faculty, and staff at the university in an effort to improve retention and improve students' experience in engineering [8].

In an effort to assist in the transition, universities have started offering programs called engineering summer bridge programs (SBPs), held in the summer before students' first semester of college. SBPs are designed to assist in the transition by introducing incoming first-year students to coursework and resources on campus [4], [9]–[14]. Although there are a wide range of programs, SBPs are typically multi-week programs that incorporate academic coursework and support with mentorship, and personal and professional development. SBPs aim to prepare students for college, and hope to facilitate a smooth transition to college for students [12]. The introductory coursework and professional development opportunities offered by SBPs, along with the opportunity to interact with peers, staff, and faculty, can help students establish a support system within engineering [12].

However, because of the timing and structure of the programs, SBPs have the potential to play a critical role in setting student expectations for what they could encounter during their first year of engineering [1], [3], [15], [16]. Holmegaard et al. [3] states "Becoming an engineering student is, in other words, a process of negotiating expectations and experiences and of dealing with the way the environment reacts upon and interacts with the student" [3, p. 155]. Although there is research on the positive effects participating in SBPs, such as higher grades, retention, and higher graduation rates, there is a gap in the literature regarding the ways in which SBPs can influence student expectations for undergraduate engineering programs.

1.1. Purpose

The purpose of this paper is to investigate the role of a SBP in shaping the expectations that participating students have of the undergraduate engineering program. To address our purpose, we answer the following research question: *How does participating in a SBP shape students' expectations for the transition into college?* We analyzed a) written student responses from a workshop activity, b) data from semi-structured interviews that occurred after the workshop, and 3) responses to an exit survey administered at the conclusion of the five-week program. Combined, these data sources shed light on expectations students had developed by the end of the program.

2. Theoretical Foundation: Schlossberg's Transition Theory

To understand student development during the transition into engineering, we situated this study in Schlossberg's [17] Transition Theory. A transition is defined as "an event or non-event, resulting in changes in relationships, routines, assumptions, and roles" [18, p. 39]. The type of transition, the perspective, the context, and the impact of the transition all play a role in defining the transition for the individual [19].

Additionally, the individual can utilize resources throughout the transition, defined by Schlossberg [17] as the four S's: *situation, self, support,* and *strategies*. The *situation* can be defined by whether the transition is anticipated or not, when the transition takes place, and whether the individual has encountered a similar transition previously. *Self* is described as the

assets the individual has at the time of transition. This can refer to the individual's personal and/or demographic characteristics (i.e., ethnicity, age, gender, sexual orientation, and socioeconomic status) as well as psychological resources such as optimism and self-efficacy [18]. *Support* refers to the individuals' support systems at the time of the transition such as family, peers, and organizations. During the transition to college, engineering students could find *support* in the form of support programs staff, upperclassmen mentors, in addition to the groups previously listed. *Strategies* refers to how the individual responds to a transition. These responses can be classified as the individual trying to "control the *situation*", "control the meaning of the *situation*", or "control the stress" of the *situation* [18, p. 91]. An individual's ability to cope with the transition depends on their resources in the four areas.

For the context of this study, there are aspects of the transition that are universal for the participants, such as the type and timing of the *situation*. The transition is anticipated because the students are intentionally participating in a SBP focused on transitioning to college and the program is held during the summer prior to their first semester of college. The additional resources related to the *situation* (i.e., concurrent stress, attitude, etc.), *self, support*, and *strategies* that the students possess prior to and during the transition may vary greatly.

3. Program Context: Summer Bridge Program Overview

The Diversity in Engineering Program (DEP) in the College of Engineering at Virginia Tech hosts a five-week residential program for incoming students each summer. As part of the program, first-time-in-college students become acclimated with the university setting and community prior to the start of their academic career. Students reside in a residence hall on campus for the duration of the program and take non-credit courses in subjects that are historically challenging and required for first-year students, such as calculus, chemistry, and engineering fundamentals. Although the courses are designed to replicate courses offered in the semester (i.e., assign homework, group projects, and exams) the students do not receive credit for the courses. Thereby, the SBP provides the space and time for students to grapple with the difficulty of the academic subjects without penalty to their academic standing or grade point averages (GPAs).

Throughout the program, students also participate in informational seminars presented by various offices on campus to understand the range of opportunities and resources available to them. Offices such as counseling services, career and professional development, undergraduate research, and study abroad lead presentations and take time to answer student questions about service offerings and resources. Additionally, students attend weekly seminars led by faculty about their research and attend academic coaching sessions led by engineering graduate students each week about topics such as study skills, time management, and professional development.

The 2022 Virginia Tech SBP had 60 participants total, one of which departed the program in Week 3 due to a family emergency. The demographic data on gender was collected on the SBP application and self-reported by the students for housing purposes. The demographic data on the

participants' race and ethnicity was collected from their application information provided from the university. A summary of this information is provided in Table 1.

Table 1. Summary of Data Sources and Information

Gender Identity	# of students	Percentage (of 60 student)
Woman	18	30.0%
Non-Binary	1	1.7%
Man	41	68.3%
Race/Ethnicity	-	-
Asian	6	10.0%
Native American or Alaska Native	0	0.0%
White (other than Hispanic/Latino)	27	45.0%
Hispanic/Latino	8	13.3%
Black/African American	13	21.7%
Two or More Races or Ethnicities	3	5.0%
Not Reported	3	5.0%
First Generation		
Yes	53	88%
No	7	12%

4. Positionality

The research team is author's Johnson, Josiam, and Lee. As a research team, our individual positionalities impacted our interest in this research topic and how we view the SBP. Namely, for this study, we believe it is important to highlight our prior experiences with the context as suggested by works on positionality in engineering education research by Hampton et al. [20] and Secules et al. [21]. The research team for this study consists of individuals with a range of proximity to the SBP and students at the center of this study. Lee directed the SBP for many years during their time in graduate school and now serves as the Director of Research in the DEP that hosts the SBP. Johnson has worked with the University DEP as a graduate assistant as well, and directed the two most recent iterations of the SBP, including the 2022 program. All of the authors have bachelor's degrees in engineering, and have experienced the transition into an undergraduate engineering program. Lee participated in an SBP while Johnson and Josiam did not. These prior experiences with directing and/or participating in SBPs have influenced the

team's ideas and thoughts on the role of SBP in transitioning incoming first-year students into engineering programs.

Before starting this project, our initial hypothesis was that participating in the SBP would help students feel prepared for Virginia Tech engineering, while also establishing realistic expectations about what it takes to successfully navigate the demands and challenges associated with the first-year engineering program. However, after facilitating a workshop to the participants in the program, we determined that this hypothesis was worth exploring systematically.

5. Methodology

The purpose of this paper is to explore the role of a SBP in shaping the expectations that participating students have of their undergraduate engineering program. To address this purpose, we used an intrinsic case study, with our case defined as an SBP at Virginia Tech [22]. We relied on three data sources collected during the SBP: responses to a workshop during the SBP, interview data from program participants, and exit survey responses from program participants. Responses across the three data sources were analyzed collectively to inform the key insights. Table 2 presents a summary of the data sources.

Table 2. Summary of Data Sources and Information

Data Source	Time of Data Collection	Data	Purpose of Data Source
Workshop	Week 4	11 group responses	Uncover incoming students' familiarity with navigating the demands and challenges associated with engineering
Interviews	Weeks 4 and 5	7 interviews	Uncover students' expectations surrounding engineering and marginalization in the engineering environment
Exit Survey	Week 5	54 survey responses	Uncover how students anticipate the SBP experience will compare to a semester of engineering and what students think the SBP prepared them for

5.1. Data Collection

We hosted a workshop with students during their penultimate week in the summer bridge program to uncover incoming students' familiarity with navigating the demands and challenges associated with engineering. Majority of SBP attendees (n = 54) participated in the workshop. Students in each group wrote their collective responses to hypothetical scenarios on one sheet of paper per group. We thematically analyzed data from 11 groups totaling 50 students because one group's responses were misplaced. We provide further details about the workshop and workshop data in the next section.We also conducted semi-structured interviews with the purpose of uncovering students' expectations surrounding engineering and marginalization in the

engineering environment. Josiam interviewed seven SBP participants, who were selected using purposive sampling using a pre screening questionnaire [23]. Our last data source is the exit survey, which all SBP participants were asked to complete and a majority of the participants (n = 54) submitted a response. The purpose of the questions we analyzed from the exit survey was to uncover how students anticipate the SBP experience will compare to a school semester of engineering and students' interpretation of what the SBP prepared them for. As we created the exit survey after interviewing SBP participants, we were specifically interested in understanding more about how students thought the SBP prepared them, which are reflected in the questions we asked them, provided in the next section. We thematically analyzed the responses to the exit survey.

5.1.1. Workshops Response

We hosted a workshop with students during their penultimate week in the summer bridge program. The workshop consisted of two main activities: (1) an icebreaker and (2) scenario response. For this paper, we only analyzed responses from the second activity. In the second activity, we presented students with a subset of scenarios to respond to through individual written response, small group written response and discussion, and facilitated large group discussion. We prompted them to write down how they thought they would respond to the four scenarios they were given. The scenarios were one sentence scenarios (e.g. "Your first round of tests did not go well and your usual studying habits are not working") that fell into one of six categories: academic performance, faculty and staff interactions, extracurricular involvement, peer-group interactions, professional development, and special circumstances. The scenarios were aggregated from a variety of sources about the demands of college and engineering [24]–[28]. After students individually wrote down their responses to the scenarios they were given, students got in groups and wrote down a collective response to the scenarios they were given. These collective responses are what we analyzed in this paper.

5.1.2. Semi-structured Interviews

We conducted semi-structured interviews with students in the program. We used interviews to understand the lived experiences of students, the meaning making of those experiences, and the variation among students [29]–[31]. All SBP participants received an invitation to fill out a pre screening questionnaire to participate in our study. We invited everyone who chose at least one non White (e.g., European descent) race to interview (9 out of 17), as well as a few who selected White (e.g., European descent) based on their responses to other questions in the pre screening questionnaire. We sent out an email inviting 12 students to interview and 7 students participated in interviews, which we thematically analyzed. Demographic information about the interview participants is presented in Table 3.

Table 3. Overview of Interview Participants

Pseudonym	Gender	Race	First Generation
Jake	Man	White	No
Katherine	Woman	White	No
Thomas	Man	Latino/a/x, White	No
Melissa	Woman	Southeast Asian	Yes
Alex	Man	Black or African American, White	No
Abe	Man	American Indian or Alaska Native, White	No
Alia	Woman	East Asian	No

All of our interview participants were first-time-in-college students, joining college directly from a U.S. high school. Our sample was not representative of the SBP population given that a majority of the students that participated in the SBP were White (45%) and identified as men (68.3%). Additionally, our sample had one first generation student (14%), so first generation students were slightly overrepresented in our sample, compared to the SBP population (12%). We provide further details about the interviews and interview data in the next section.

Students participated in a Zoom interview that was recorded and auto transcribed. Josiam interviewed students using a semi structured interview protocol. Participants were asked questions related to how they developed an interest in engineering, what they think it takes to succeed in engineering, how prepared they feel for engineering, and their perceptions on marginalization in engineering. Participants were also asked to describe how they would respond to scenarios provided by the interviewer. Each participant responded to approximately five scenarios. Scenarios in the interview protocol were a subselection of scenarios that participants saw in the workshop. All interview participants attended the workshop. Interviews with participants lasted between 10 and 40 minutes. During the interview, Josiam took notes about ideas to follow up on and asked follow up questions to participants. We compensated interview participants for their time with a gift card.

5.1.3. Exit Survey

Johnson provided students with a link to the exit survey in the last group meeting of the program. Response to the exit survey was required. The entire exit survey included 70 questions, ranging in Likert scale and free response questions. In this paper, we were interested in responses to four open ended questions [32], presented in Table 4. Students' responses to these questions varied from one word responses to multiple sentences detailing the reason for their response.

Table 4. Exit Survey Questions

• What similarities and differences do you anticipate between your [summer bridge program] experience and your first semester of college/engineering? • How prepared for engineering did you feel before [summer bridge program]? • How prepared for engineering do you feel after [summer bridge program]? • What obstacles do you anticipate encountering in your first semester of engineering that you did not encounter during [summer bridge program]?

5.2. Data Analysis

We analyzed the three data sources thematically, looking for coherent emergent categories within as well as across the data sources [33], [34]. To analyze students' workshop responses, we typed the group written responses into a spreadsheet and looked at responses across groups and scenarios to identify patterns and trends related to which resources students most identified. To analyze the interviews, we relistened to each interview and took notes in a spreadsheet noting down any participant remarks related to their worldview, perceptions about engineering and college success, their experience in the SBP, and their reflections on marginalization. We took these notes using participants' words and consolidated them into profiles for each participant consisting of their worldview, view of the SBP, view of marginalization in engineering, and view of the university's role in responding to marginalization. Creating these profiles helped us distill down the high level themes across participants. With the exit survey, we converted each participant's response into a short phrase/theme and looked across these themes for patterns. Once we identified themes for all three data sources, we looked at the themes across the data sources and synthesized them into the key insights (super categories) presented in the next section [33].

6. Key Insights

We uncovered four key insights that inform our understanding of the expectations students' develop for engineering through the SBP. We found that students anticipated similarities and differences between the SBP and their first semester of college. Additionally, we found that students recognized that marginalization exists in engineering. Simultaneously, students expected equal opportunity in the engineering environment. Finally, we found that when asked how they would respond to challenging scenarios, students rely on what they've learned in the SBP to respond.

6.1. Anticipating Similarities and Differences

Students predicted a range of alignment between the SBP and the first semester of college, with some viewing the SBP as a mini version of college and others anticipating differences between the SBP and college.

Students described the SBP as a "mini version of college" and highlighted the extent to which it prepared them for the coursework, course load, and lifestyle of college. For example,

Jake said, *"There's lots of classes I feel like I can manage now, at least, maybe I feel like I'd do decent…it's just like getting introduced to something in a small quantity before jumping right in."* Jake found that the SBP helped prepare him to manage a lot of classes by easing him into a smaller course load than what he will experience during the semester. Another student also expressed in the exit survey that the SBP *"prepared [them] for how to approach studying, going to classes, and feeling ready for the coursework.*" Students also thought that the SBP helped them prepare not only for coursework but campus life and time management as well. Likewise, when asked about how the SBP prepared her, Melissa mentioned

> *"it was kind of like they got me used to what would be expected of me in terms of the fall semester, and then also got me used to how I would potentially be living on campus, how I would be studying on campus, how I would manage my time."*

The SBP prepared Melissa in terms of work expectations and what living and studying on campus would look like. Meanwhile, Alia thought the SBP helped her develop responsibility stating *"I feel like … a whole month really does immerse you fully all the way…and like having classes to attend as well and like on your own and just feel like, okay, you're on your own and you have to be responsible."* Alia found the immersion experience of the SBP valuable to learn how to be responsible on her own. Generally speaking, students saw similarities between the SBP and the fall semester, asserting that the SBP is like a mini version of college that helped them prepare for the coursework, courseload, campus living, and level of responsibility needed during college.

We also found that students anticipate certain differences between the SBP and the fall semester, specifically related to population size, course load, and stakes. One student in the exit survey said that in the SBP *"we operated in [a] 60 [person] group and soon we will have more than 10,000."* They continued *"However, it's not a problem. I'm glad [the SBP] is only for a small number of people cause you feel confident and not overwhelmed."* This student recognized that the SBP operates in an environment of way fewer people than a college semester, but they were not perturbed by this difference. On the other hand, another student attributed the difference between the SBP and the fall semester to be related to course load saying "*I have a feeling course load wise college is going to be a [whole] lot more required stuff and free time as well.*" This student anticipates that the fall semester will be a lot in terms of course load and requirements.

Additionally, we uncovered that students in the exit survey generally assumed that the course load and pacing would be different between the SBP and the fall semester, with students giving responses indicating a range of differing expectations for the fall semester like *"a faster pace in classes," "greater number of classes," "pace of classes … much slower than the courses here at SBP,"* and *" a larger workload but a decrease per class."* Students were in consensus that there would be differences between the SBP and the fall semester, but differed in what they thought about the pacing, courseload, and coursework. Furthermore, students also view the SBP as a lower stakes version of college because grades do not count towards their academic coursework in the SBP. A student stated that the SBP *"eases you into college and it's a safe*

place to fail and not worry about your gpa." This student did not have to worry about the consequences of failing a class in the SBP, which would not continue into the fall semester. Similarly, another student expressed that what would be different about the fall semester compared to the SBP is *"a longer timeline, more people around to support me, and I'll be more settled.* ***The only difference is now it counts****. But I won't just be doing classes and I know what to expect."* This student identified a lot of differences with the SBP and fall semester but stated that the SBP helped them generally know what to expect.

Students predicted a range of alignment between the SBP and the first semester of college, with some viewing the SBP as a mini version of college and others anticipating differences between the SBP and college.

6.2. Reflecting about Marginalization

Additionally, students' SBP experiences and observations of the demographics of SBP participants often led them to recognize that marginalization exists in engineering. However, some students recognized the existence of marginalization in engineering while also viewing engineering as a level playing field. Moreover, students held internal loci of control, believing that they were solely responsible for their engineering success. Finally, students anticipated that marginalization would affect students' ability to build community in engineering.

Some students viewed the demographics of the SBP as similar to their expectations for engineering in college, expected the SBP to have more racial/gender diversity than it actually did given its intent, and/or were unsure how the demographics of the SBP would translate to the fall semester. For example, in an interview, Alex thought the SBP was representative of the demographics in engineering, saying

> *"I think this is just because of who applied to this program, but it is representative of what I feel like is marginalization in engineering. I think we only have like 19 women in [SBP] out of 60 students. And supposedly they let all their applicants in so it wasn't like a selection thing."*

From his observations, Alex deduced that the SBP was representative of marginalization in engineering because the DEP admitted everyone who applied. Nevertheless, Alex expressed that he thought the SBP would be more diverse given who hosted it saying

> *"because [SBP] was by the diversity center, I was expecting there to be a more or less equal number of women and like a representative sample of people of color. I feel like there was more than a representative sample of people of color but like I said, there's fewer women than I expected."*

Alex was surprised by the limited number of women in the SBP given the fact that it was hosted by the diversity office. On the other hand, Thomas thought that the diversity in the SBP was strong stating that "*[DEP] really does a good job with like getting underrepresented communities … I mean the diversity is strong with this group of [SBP] kids."* However, when asked about what demographic makeup he anticipates in engineering in the fall, he said *"I haven't been there so I'm not sure if that's like what the demographics are going to look like."* Thomas was less

confident than Alex about how the demographics of the SBP would translate to the fall semester. As shown above, some students used the demographics of the SBP to inform their expectations for the demographics of the university engineering population.

Next, students' prior experiences and SBP experiences formed their expectations for the extent to which marginalization exists in engineering. Abe did not think that marginalization exists in engineering stating that *"there's a broad range of demographics that are being represented [in SBP] from ethnicity to nationality to race. Being treated as marginalized? I don't believe so either. Cause I believe we're all being treated equally and with the same respect."* Drawing from his experiences and observations of the racial/ethnic diversity in the SBP, Abe concluded that marginalization does not exist in engineering since everyone is treated equally.

On the contrary, all the other students we interviewed identified and discussed groups that were marginalized in engineering. Many of the students we interviewed identified females and/or woman as marginalized in engineering. For example, Katherine identified women as marginalized in engineering, stating *"from just a lot of things that I've seen, women in engineering do have an issue of not being listened to, or being thought of as less intelligent than their male counterparts. So I'm already anticipating and kind of already feeling that issue."* Katherine experienced and saw women being treated differently in the SBP, so she assumed that would continue in engineering moving forward as well. Katherine also identified trans people as marginalized based on what she had observed in the SBP. She said

> *"Well, I already know that there is a big issue with women in engineering being a very small group. But also just when I've interacted with some of the guys here, I definitely have a feeling that maybe they're not homophoic but I do know one in particular is transphobic, which is an issue with me. So I feel like trans individuals and women in this group [are marginalized in engineering]."*

Katherine met someone in the SBP who made transphobic remarks to her, so she concluded that trans people are marginalized in engineering. Generally, students drew on their SBP experiences and observations to determine which groups are marginalized in engineering.

6.3. Expecting Equal Opportunity

Although students identified that certain groups are marginalized in engineering, they also claimed that engineering is a level playing field. As an illustration, when asked who she thinks is marginalized in engineering, Alia responded *"I would definitely say female. Female engineers."* Alia identified females as marginalized in engineering, along with people in the LGBT community who *"might just have another hurdle to potentially jump over"* and international students because they are *"trying to get used to a completely new country, which is a major adjustment."* Alia explicitly named the most number of groups as marginalized of all of the interview participants, yet also expressed the sentiment that engineering is a level playing field. She said *"everyone else like you know, they also have their own challenges"* and then continued on saying that *"being in college definitely helps kind of like levels the playing field, because we're all taken out of our initial environments and into a situation where everyone has to*

start from ground zero." Alia viewed college as an equalizer, where everyone is starting from ground zero and has their own challenges. Furthermore, when asked about if her identities would matter to her peers, instructors, or mentors, she said *"I don't feel like I'll be treated that differently because I'm just a person, and … we all have a passion for engineering."* Alia believed that she would be treated similarly to her peers in engineering due to their shared passion for engineering. Given these points, Alia showcased a pattern we saw among students where they pinpointed that certain groups are marginalized in engineering, gave reasons why, and simultaneously believed that engineering in college would be a level playing field where people are treated similarly.

We also found that all the students we interviewed had an internal loci of control, expressing sentiments that reflected that they felt responsible for their success in engineering. When asked what it takes to be successful in engineering, students said success requires *"determination," "tenacity," "discipline," "flexible thinking," "creativity," "being able to adapt to new environments and new things,"* and *"teamwork."* For instance, Thomas said the engineering success requires *"definitely a lot of determination to stick with it, because you could easily just like drop down to like some other type of degree, from whatever engineering you were doing. And it's just it's very tempting to like give up sometimes."* Thomas believed that engineering success requires determination because it is hard, so it's tempting to give up. Likewise, Alex said that success in engineering requires *"tenacity"* and *"responsibility"* because engineering is *"not an easy field."* All the students we interviewed had strong internal locus of control and vocalized that they were responsible for their success in engineering.

Finally, students anticipated that certain marginalized identities would affect students' community building in engineering. For instance, when Melissa was asked how the experience in engineering may be different for marginalized students, she replied *"I feel it may be different, as though they feel like they can't really talk to anyone, or they can only talk to people who they feel can relate to them rather than talking to everyone."* Melissa thought that marginalized students would have different experiences in engineering because they may only feel comfortable talking to certain people rather than everyone. Alex came to a similar conclusion from drawing on his own experience explaining that

> *"Our culture has kind of made a distinction between ethnic groups right. There's White people, Black people, Hispanic people whatever. And as long as that may be, I don't really fit those groups, right? So I can find it sometimes hard to find a group of people to be with."*

In thinking about his biracial identity, Alex explained that being biracial in engineering means that it's hard for him to find a group of people to be with. Generally speaking, students in the SBP who anticipated that certain identities would matter to their peers and/or instructors expected that this experience would affect their ability to build community.

Students' SBP experiences and observations of the demographics of SBP participants often led them to recognize that marginalization exists in engineering. However, some students recognized the existence of marginalization in engineering while also viewing engineering as a

level playing field. Moreover, students held internal loci of control, believing that they were solely responsible for their engineering success. Finally, students anticipated that marginalization would affect students' ability to build community in engineering.

6.4. Responding to Challenging Situations

Students' responses to the scenarios in the workshop and during the interviews uncovered that students generically recall resources introduced to them during the SBP when asked how they would respond to challenging situations during the semester. Furthermore, students' experiences in the SBP shape their expectations for the quality of support that the university provides.

Students in the workshop and the interviews responded to the scenarios by often replying using the resources introduced to them during the SBP. Group responses to challenging scenarios introduced during the workshop included going to student support offices like student services, the student success center, and career counseling center. Students also suggested asking for help from people such as peers, counselors, career advisors, the director of [DEP], professors, mentors, tutor, and TA or office hours. These resources were echoed by interview participants when asked how they would respond to hypothetical scenarios during the academic year. When asked what he would do if an instructor is being unresponsive, Thomas said he would *"go to the TA, go to their office hours. Try as hard as possible, and if that doesn't work, I would talk to like an advisor about it and see what they can get done."* Thomas claimed he would seek out help from potentially three different academic resources if he had an instructor who was being unresponsive. Likewise, Katherine directly drew from her SBP experience stating that if she were being treated unfairly during the semester *"the best one for me to go to would be [SBP director] because she definitely rules with an iron fist around here."* Katherine saw the authority of the SBP director during the SBP, so she believed that the SBP director could be a resource if she was receiving unfair treatment. Students' in the SBP responded to hypothetical challenging events by mostly seeking out university support infrastructure that they learned about during the SBP.

In addition to students' recalling generic resources, their experiences in the SBP also inform their conceptualization of the quality of support that the university provides. In response to how engineering would be different for marginalized students, Jake stated *"I do think that Virginia Tech seems to offer pretty good help for those who really need it. It looks like there are plenty of programs for people who get involved if they feel like they do need help."* Jake's exposure to support offices during the SBP informed his opinion that the university has a lot of programs to support students who need help. On a different note, Abe talked how he anticipates the level of support he received from the SBP instructors to continue with other professors during the school year saying *"The teachers that I've had in [SBP] so far are very supportive and very helpful in the coursework, and anything we have trouble with, they're there to help us ...so I feel like that help is provided … during the school year, even if it's just a TA."* Abe assumes that his engineering instructors in the fall semester will be very supportive based on his

experience with helpful instructors in the SBP. Additionally, Alia shared with us what it was like for her to see more females in the SBP and SBP events and the effect it had on her. She said

> *I can definitely tell there is change going on, although it's still going slowly, but there's definitely change there.There is definitely more females there. There are more minorities just trying to get in, both on the male and female side, and there is support most definitely for females and you know minority people. I can tell, I don't know if they're doing it on purpose, but the [SBP] coordinators like, you know, the seminars, the faculty lunches. I can definitely tell, there are more females. I definitely appreciate that….they don't even have to talk to me... just seeing other people there, like me, helps immensely, because it just solidifies I can be that. I can be the next person, and such, and just being able to see that is very, very wonderful to see.*

Alia saw more females and people of color involved in the SBP (e.g. as participants, faculty, mentors, etc.) than in prior similar experiences, so the SBP led her to feel that there is change related to representation happening in the university, which inspired her. Students had a lot of positive experiences in the SBP related to support, which informed how they viewed the quality of support provided by the university generally.

The SBP played a role in shaping what resources students learn about on campus and how they can be used. Not only that, students' form an impression of the quality of university support during their time in the SBP based on their experiences in the SBP.

7. Discussion and Implications

The key insights we uncovered indicate that students form certain expectations about college based on their experiences in the SBP. Therefore, SBPs can be foundational introductions for students transitioning into higher education and engineering. Our key insights may be relevant for SBPs beyond the engineering ecosystem as well, as students seemed to form impressions about college life and campus to a similar extent to their impressions about engineering course load and class pacing.

Given that students expected a range of alignment between the features of the SBP (e.g. responsibility, campus life, class pacing, time management, stakes, etc.) and their first semester of college, it may be worth facilitating intentional conversations with students during the SBP to clarify their expectations. While these types of conversations did occur informally during our SBP, our data shows that students still emerged from these conversations with varying expectations of how the SBP experience would compare to their first semester of college.

We also found that students form expectations about marginalization in engineering, and these expectations are often informed by their observations and experiences in the SBP. For this reason, those who organize SBPs should be intentional about talking to students about their observations and experiences related to marginalization during the SBP. Doing so would provide students with the opportunity to process their experiences and make sense of future expectations related to marginalization. Moreover, for students who anticipate marginalization will affect their community building experiences, opportunities to learn about university support systems in this

context could be helpful. These students can benefit from voicing their concerns with each other and learning how to build community with the help from university support systems during the SBP itself. That way, students gain knowledge about university support systems in intentional ways and are more equipped to access these resources when they need/want to.

Additionally, we found that students held internal loci of control related to engineering success, where they believed that their engineering success was entirely up to them. While this may be true to some extent, we also found that consequently these students were unlikely to seek external support. Therefore, SBPs can be appropriate spaces to help students recognize that their success in engineering does not have to entirely depend on themselves and their personal resources. The university has support programs and resources that students can use to support their success, and utilization of these resources is encouraged. Given that the SBP did play a role in shaping which campus resources students learn about and their impressions of the quality of these resources, practitioners can use SBPs to intentionally construct students' impressions of university resources.

The key insights from the study shed light on student expectations based on their participation in the SBP. Many of the insights connect to the four S's as defined by Schlossberg's [17] transition theory. For students that view the SBP as a mini-version of college, they may believe that once they enter their first semester they will have previous experience with the transition, which is an aspect of the *situation* resource. Ideally, the lessons they learned from their prior experiences in the SBP will inform their ideas and coping mechanisms during their first year, thereby equipping students with additional resources they may not have had without participating in the SBP.

Our findings highlight aspects that align with the *support, self*, and *strategies* factors the students developed from their experiences in a SBP. Students mentioned that the SBP provided exposure to the DEP and the university resources that they could utilize during the semester. Additionally, students feel more equipped to adapt to the first semester, attributing the newfound confidence to their experiences in the SBP. The students identified *support* such as teaching assistants (TAs), instructors, advisors, and student support staff members that they can reach out to for aid during the academic year when they encounter challenging situations.

These ideas play a role in what the students expect in the academic year. As practitioners, we must distinguish the role of the program in the students' transition and weigh the inherent advantages and disadvantages to creating a program that models that of the first-year engineering experience exactly. Barclay [35] provides a list of questions to consider in defining an individual's resources in terms of the four S's. We have adapted these questions, in Table 5, to provide a starting point for practitioners to determine the outcomes of their SBP programs in relation to preparing students for the transition to college:

Table 5. Questions on the Four S's for SBPs Coordinators

Factors	Associated Questions
Situation	• How will this program provide a helpful experience related to the transition for the student? • After the SBP, where do you hope that the student is in the transition process? How will you determine this?
Self	• Are the students challenged or overwhelmed by the events in the SBP? • Does the student believe that their efforts in the SBP will affect their outcomes of their first year in engineering?
Support	• Does the student have the appropriate support for the transition? • Does the student know how to locate and activate forms of support for engineering students?
Strategies	• How does the student utilize various strategies to cope with the transition? • How are the students taking action to adapt to the transition from high school to college?

We hope that the questions in Table 5 can assist practitioners in creating or modifying SBPs in ways that foster the development of the four resources as described by the transition theory.

8. Conclusion

The purpose of this study was to investigate the role of an SBP in shaping the expectations that participating students have of the undergraduate engineering program. Students depart SBPs with a range of ideas on how their experience in the program will align with their experience during their first year of engineering. It is important for practitioners working with first-year engineering students to consider the impact of their programs on the development of student assets to work through the transition from high school to college. We urge that practitioners determine whether the SBPs are meant to serve as a precursor to the realities of life as an engineering student versus a supportive environment where failure and mistakes are forgiven and made into lessons to take into the first-year of engineering.

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