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Work-in-Progress: Inquiry into the career goals and achievements of graduated students after participating in an undergraduate transfer program

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Introduction

The Student Pathways in Engineering and Computing for Transfers (SPECTRA) program is an NSF-STEM that supports high-achieving low-income students who intend to transfer from a technical college to Clemson University, a large R1 institution, and pursue engineering or computing degrees. The three goals of the program are as follows: (1) provide scholarship opportunities to low-income students pursuing engineering or computing at Clemson, (2) build cohorts of transfer students to support their transition into Clemson University, (3) assess its progress internally and externally to assist the transfer students and improve the program

Having support at a community college, such as through a learning community, can promote retention, graduation rates, and help students feel more connected to their campus [1]. Our previous research suggests that the SPECTRA scholars appreciate the opportunity to connect with other transfer students, build friendships, and gain support with navigating campus life [2]. Similar transfer programs have found that students benefit from participating in undergraduate research as well as having mentor support [4,5,6]. The SPECTRA scholars had access to near-peer mentors, graduate students who taught their undergraduate research courses, and expressed that the relationship allowed them to build confidence in their engineering skills, discuss potential career paths, and learn in a relaxed environment [3]. When surveying those participating in the SPECTRA research courses, we found the SPECTRA students had a higher sense of belonging in their research course compared to traditional students in various courses across the entire engineering college [7]. Our work has shown that active students find value in their participation; however, we have not until this point analyzed the long-term impacts of the program, specifically after the participants' graduation.

S-STEM programs commonly interview and survey students as they enter and exit their transfer programs as well as to check in periodically and continually improve [8,9,10,11]. It is less common to follow up with graduated students who are in the midst of career searches, have been working engineering jobs, or who have continued on to graduate school. We are interested in exploring the long-term impacts of our undergraduate research and scholarship program on the participants' academic and career paths after graduation.

The SPECTRA program is approaching the end of its funding, and we hope to use the insights from our research to inform the design of a new transfer program. Our previous studies highlight what students find valuable when they are in the midst of their SPECTRA participation, and we hope that additional research on the graduated participants will reveal what aspects of the program the participants believe have best supported them in achieving their career goals and what aspects could be improved. If we better understand the participant-defined values of the program, the next iteration of the SPECTRA program can ensure that the valued program aspects remain intact and the least valued are subject to positive change. Our goal for this

work-in-progress paper is to outline our research methods, showcase preliminary findings from our first participant, and discuss the areas of our methodology that stand to be improved.

Expectancy Value Theory

We used expectancy-value theory as the theoretical framework of our preliminary work. Expectancy, in the context of our study, is the participant's expectations that they will achieve their goals in their chosen career path. Value is the perceived value (such as intrinsic, utility value, and cost) that they will attain from the career path [12, 13].

Methodology

Participants

The participants in our study are selected from a pool of scholars who meet three criteria: 1) they graduated from both Clemson University and the SPECTRA program, 2) they have an active LinkedIn profile, and 3) they have completed at least one interview prior to their graduation. Out of the 28 participants that have graduated, nine students meet all three criteria. To increase our sample size, we reached out to individuals who did not have an active LinkedIn but had completed at least one pre-graduation interview. These additional students increase the potential sample size to 13. A breakdown of the demographics of the graduated students and who meet the sampling criteria are shown in table 1.

Data collection

There are three methods of data collection proposed in our study. First, we will utilize interview data collected during the participants' time as students in SPECTRA. Participants for the pre-graduation interviews were recruited at the end of each semester via email. Those who accepted took part in a 30 minute semi-structured interview with at least one researcher. They were informed that information shared would be kept anonymous and that their participation would have no impact on their program standing nor their receipt of scholarship.

Second, data will be collected from LinkedIn. We searched the participants' names and found those with active profiles (a profile was considered active if they had posted at least once after graduation). Only LinkedIn posts shared after the date of the participants graduation will be used in the study. Data on LinkedIn profiles is publicly available, and the team did not collect data from private messages nor did they request access to non-publicly shared information. To promote confidentiality, we will not share direct quotes from social media or present any potentially identifying information, such as the names of employers [14].

Finally, we contacted potential participants via their LinkedIn profiles to request a follow-up interview. Those who are willing to participate will undergo a 30 minute, semi-structured interview with a protocol constructed using expectancy-value theory. The participants will be asked questions pertaining to their perceptions of their involvement with SPECTRA, the aspects of their experience they found beneficial as a student, benefits they experience in their current position, if/how their experience impacted their employment

following graduation, and how their current career relates to their past goals. At the time of writing, only one participant has been interviewed.

Demographic	All Graduated Students	Students with pre-graduation interview	Students with pre-graduation interview and LinkedIn
Gender	Women: 2 Men: 26	Women: 0 Men: 13	Women: 0 Men: 8
Race	American Indian or Alaskan Native: 4 Asian: 3 Black or African American: 3 White: 16 Not Reported: 2	American Indian or Alaskan Native: 2 Asian: 1 Black or African American: 1 White: 8	American Indian or Alaskan Native: 0 Asian: 1 Black or African American: 0 White: 8
Ethnicity	Hispanic: 5 Non- Hispanic: 23	Hispanic: 2 Non- Hispanic: 11	Hispanic: 0 Non- Hispanic: 9
First Generation	Yes: 14 No: 14	Yes: 6 No: 7	Yes: 5 No: 4
Veteran	Yes: 2 No: 26	Yes: 1 No: 12	Yes: 1 No: 8
Total	28	13	9

Table 1: Graduated student demographics and potential participants based on exclusion criteria.

Interview data analysis

Both the previously conducted interviews and the post-graduation interviews will undergo open coding, which will allow themes in the data to organically emerge. At least two coders will develop two code books based on the emergent themes; one code book will be developed for the previously conducted interviews and one code book for the post-graduation interviews, putting particular focus on career aspirations and motivations. The coders will discuss discrepancies in the emergent themes to ensure intercoder reliability and enhance the validity of the data [16]. Themes will be finalized when coder consensus is reached. The interviews will then be revisited and undergo thematic coding using the appropriate codebook. The research team will further discuss the implications of the emergent themes and codes.

LinkedIn data analysis

The authors will examine each scholar's LinkedIn profile and analyze their post-graduation employment history, public posts, and certifications/skills. Larger datasets using

qualitative data from social media may consider a more rigorous approach as suggested by McKenna et al. (2017)[15]; however, our study has a small number of participants and none of the participants are heavy users of LinkedIn. Therefore, we did not need to excessively reduce the dataset and instead will use manual coding for all social media analysis. The researchers will examine the profiles and perform preliminary content analysis to identify themes within the profiles following the recommendations of Franz et al., 2019 [17]. The research team will pay particular attention to currently held positions, posts reflecting on career achievements, and additional certifications or skills the participants underwent after graduation.

Following the thematic coding of both the previously conducted interviews and the LinkedIn profiles, coders will compare the data to evaluate the alignment of participants postings to the aspirations they voiced in the past. The research team will discuss the outcomes until all discrepancies are addressed and the findings agreed upon.

Results/Findings

As of now, our study is in the preliminary stages. All data presented in this work are in the initial stages of the coding process and may not be representative of our final results. We identified the graduated scholars who have LinkedIn profiles and are in the midst of the coding process to compare the data against the interviews prior to graduation. We reached out to all graduated scholars who have completed a pre-graduation interview to participate in a follow-up interview. At the time of submission, only one participant has responded and completed a follow-up interview. We will use this participant as an example of our preliminary data analysis for the data collected from LinkedIn and the follow-up interview session.

Pre-graduation interview and LinkedIn

In pre-graduation interviews, the participant suggested multiple career goals and aspirations including performing research, working with the Department of Defense, and potentially graduate school. The participant expressed an interest in continual learning and believed that engineering was the best path to achieve that goal:

> [...] I wanna study as much as possible before I die. Like, that's truthful and honest like opinion [...] I am so intrigued by all the different types of things that are going on in this world [...] And so that's why I mainly chose engineering.

At the time of his interview, the student posted that he was working as a mechanical engineer at an agency within the US Department of Transportation. He had one additional post on his page, but it did not connect to job motivations or aspirations.

Post-graduation interview

We get better insights from his post-graduation interview. As we have a single participant, the data is preliminary and anecdotal. The participant did not believe the SPECTRA program inspired any changes in his career plans, but his participation opened doors to careers he was interested in and made him a desirable candidate to prospective employers.

> I don't think without SPECTRA, I wouldn't have had much to speak about with prior experiences. Because of- so many people in the job market, wanting to have prior experience to- or prior experiences of being an engineer when there's not many opportunities to be an engineer without getting your hands into something. And so SPECTRA was a nice pathway into being able to utilize that. And the only other job experience that I had prior to SPECTRA was working at [fast food chain].

The participant reflected on what he found valuable during his time in the program and believed it to be the friendships and interactions with others. He highlights that professionally SPECTRA gave him the opportunity to work with teams and that helped him more effectively communicate with others, especially individuals who were not from his own academic background of mechanical engineering.

> I can definitely say the- the friendship that I've built. The people that I worked with. I still talk to some of them. [...] But in a professional sense I definitely enjoy the- the team building side of things and being able to communicate with different backgrounds, and being able to grow in that- those regards, because I know for a fact my- my communication has always been an issue throughout undergrad.

Discussion and conclusion

Limitations and improvements

The biggest limitation in our study is the sample size. The sample of current graduates is quite small due to recruitment struggles during the impacts of COVID in the early years of the program [18]. Additionally, our exclusion criteria limits our sample, and despite contacting students who do not have a LinkedIn for a follow-up interview, our study has limited generalizability. The most lacking demographic in our sample are women. All the participants who pass the exclusion criteria are men. Out of the graduated students, only two are women and neither participated in a pre-graduation interview. This perhaps indicates a need to intentionally recruit women into engineering and programs like SPECTRA [19]. While not able to do a comparison across multiple interviews, the graduated women will be contacted for a follow-up interview, as their responses may shed light on ways to address the recruitment of women into our transfer program. We will additionally contact the students who did not complete a pre-graduation interview to increase our sample size as the students may provide valuable feedback, even without an initial interview to compare to.

We are limited in our ability to contact graduated students. The students lose access to their University emails one year after graduation, and we are reliant on LinkedIn to request follow-up participation. As we interview more participants, we may partially overcome this limitation by employing a snow-ball sampling method. Also, in our search for LinkedIn profiles, we found that while multiple graduated SPECTRA participants have a LinkedIn profile, many are not active or use their LinkedIn only for sharing their current employment.

Our attempt at thematically coding our participant's LinkedIn profile proved difficult. Because of the limited data, we were unable to draw conclusions using our current method of analysis, yet. We had similar obstacles on other profiles. The participants' limited use of LinkedIn makes the comparison of past and current goals difficult, and in some cases impossible. LinkedIn may be better utilized in creating career timelines, as in Chumian et al. (2015), than in determining career goals [20]. Moving forward, we hope to recruit additional participants for the post-graduation interviews to overcome the constraints experienced through LinkedIn.

Potential as a model at other Institutions

The methods proposed in our work have potential to be scaled and adapted for use at other institutions and other transfer programs. One of our limitations is keeping in contact with graduated students. To generate meaningful data, programs may consider using platforms other than LinkedIn to recruit participants, such as building an alumni network or leveraging other social media platforms. Additionally, different institutions have unique needs and resources that must be taken into account when adapting the methodology and ensure that the research questions align with these differences. For instance, smaller institutions may have a more tight-knit social network and a stronger emphasis on peer mentoring, which could influence students' experiences and outcomes. In contrast, larger institutions might focus more on research opportunities and graduate student mentorship.

To improve consistency and comparability across different institutions and demographic groups, the study's core objectives should remain consistent. Researchers should consider using standardized follow-up interview protocols and perhaps establish specific interview intervals (1, 3, and 5 years post-graduation) to assess participants' growth, career satisfaction, and the long-term impacts of their program. Considering these questions before the start of the program would improve the data collection and analysis process. Collecting demographic data is also essential to ensure that comparisons can be made and to highlight any disparities in outcomes based on factors like gender, race, age, first-generation status, etc. A diverse participant pool will also make the findings more reflective of the student population.

Preliminary results

Preliminary analysis shows both promise and struggles in exploring how the goals and aspirations of SPECTRA students have evolved after graduation and what the participants believe to have been valuable aspects of the program. Our first follow-up interview resulted in valuable personal insights. The participant highlights an appreciation for participation in research, which has been shown to benefit undergraduates in their transition to careers by providing them a chance to develop skills and practice expertise outside of a classroom setting [21]. He describes his research experience as having value as it was of interest to potential employers. In developing the next iteration of the SPECTRA program consideration could be placed on enhancing components of the program that prepare scholars for the job market such as interview skills, resume building, or adding an optional leadership component.

Our participant highlights the importance of making peer connections, which has been a finding in our work as well other transfer programs [1,2]. Working with other transfer students allowed him to form friendships and gain experience with interdisciplinary teams. SPECTRA

supports peer connections and research through the inclusion of an undergraduate research course for its participants. The course has been shown to generate a high sense of belonging at the class level [3]. For students who have been historically marginalized in STEM, a sense of belonging, particularly when domain specific, can improve their persistence in their field [22]. Gatz et al. 2018, showed that peer mentoring fostered positive social interactions and academic guidance for women in engineering [23]. Based on this, potential suggestions for program development include additional opportunities for peer connection. Considering the lack of women graduates, mentorship opportunities could be a way to generate further connection and a greater sense of belonging in the program.

We intend to improve our sampling and analytic methodology and continue speaking with other graduated scholars to gain further insights into how to enhance the program. Understanding program impacts and perceived as benefits to the graduated scholars is important for ensuring that said scholars have the resources to achieve their career goals. Our efforts to study SPECTRA's long-term impacts could have significant implications on the design and implementation of the next iteration of an S-STEM at Clemson University.

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