

Bridging the Social Capital Gap in Historically Marginalized Populations

Stephanie Zegers, Elizabethtown College

Ms. Stephanie E. Zegers is the Assistant Director of Engineering and STEM Relationship Development at Elizabethtown College. She holds a BS in Education from Millersville University and MS in Strategic Leadership from Elizabethtown College. Ms. Zegers' research interests are experiential learning experiences, professional skills development, career pathways, and workforce development.

Dr. Sara A. Atwood, Elizabethtown College

Dr. Sara A. Atwood is the Dean of the School of Engineering, Math, and Computer Science and Associate Professor of Engineering at Elizabethtown College in Pennsylvania. She holds a BA and MS in Engineering Sciences from Dartmouth College, and PhD in Mechanical Engineering from the University of California at Berkeley. Dr. Atwood's research interests are in engineering and the liberal arts, first-generation and low-income students, internship experiences, and alternative assessment techniques including mastery-based course structures.

Bridging the Social Capital Gap for Historically Marginalized Populations in Engineering

Abstract

First-generation college (FGC), historically marginalized populations (HMP), and female engineering students often have social capital deficits that impede their transition from college to industry, despite social capital underpinning a successful career in engineering. ASEE's 2020 Survey for Skills Gaps in Recent Engineering Graduates identified communication as a critical professional skills for recent graduates. Providing students with explicit instruction on professional skills that support building social capital can be a way to address this deficit. This paper investigates student-perceived growth on specific skills within the communication purview related to building social capital: the ability to build relationships online, the ability to build professional relationships in-person, the ability to interview, and the ability to negotiate. These skills were targeted based on their contribution to developing social capital in the early years as a professional. First is the ability to build relationships both online and in-person. The adage "It's not what you know, but who you know" is often true when searching for an internship or professional position. The US Bureau of Labor and Statistics concludes that 85% of jobs are filled by networking. Secondly, the employment interview is often the deciding factor in hiring one candidate over another. Lastly, the ability to negotiate salary is often noted as a reason for inequalities in salary/wage across populations. We piloted a professional skills seminar that provides explicit instruction in these communication skills. We measured the student's perceived skill level with a Likert scale at the beginning and conclusion of the course. The instructor facilitated intentional activities to build these professional skills in the students throughout the semester. We then analyzed the pre- & post-assessment scores for individual growth in marginalized subgroups: FGC, HMP, and female-identifying, compared to counterpart subgroups: Continuing-generation, historically privileged populations, and male-identifying. The results showed positive trends of growth in each professional skill for all students and in subgroups including first-generation, historically marginalized populations, and women.

Keywords: first generation college students; historically marginalized populations; professional skills; engineering; social capital deficit

Introduction

In recent years, there has been increasing attention on STEM careers, including engineering, as a pathway for students to achieve professional success. We are seeing an increase in social-service organizations providing STEM education in elementary and secondary extracurriculars such as ALL-STAR Code, Girls Who Code, and FIRST Robotics to increase diversity in these fields as well as provide a solid pathway for social and economic mobility. While these programs are an excellent way to bring awareness and technical knowledge to historically marginalized populations, these students still face obstacles to entering the STEM workforce. One prevalent

obstacle is their social capital deficit. According to Lin, social capital is defined as “the investment in social relations with expected returns in the marketplace” (p.19, 2001). This social capital deficit can appear for undergraduate engineering students in the following ways: (a) lack of access to social supports for career planning, (b) lack of awareness or comfortability with seeking support from university resources including faculty and career centers, and (c) lack of familial emotional support for their career path (Martin, Millers & Simmons, 2014). This social capital deficit can result in degree completion failure, underemployment, and lower lifetime earnings. Providing the students with explicit instruction on professional skills that support building social capital is a critical component for engineering curricula that welcome and retain these students in engineering.

National Association for Colleges and Employers (NACE) has developed key competencies for a career- ready workforce (2022). Social capital is interwoven into all eight competencies: career & self-development, communication, critical thinking, equity & inclusion, leadership, professionalism, teamwork and technology (NACE, 2022). In this study, we focused on a few critical communication skills for building and maintaining social capital. According to ASEE’s 2020 Survey for skills gaps in recent engineering graduates, only 49% of respondents felt very prepared in communication skills upon completion of their undergraduate degree (2020). Communication skills are used for building social networks. According to Thiem and Dasgupta, “Possessing a large, resource-rich professional network, then, increases an applicant’s chances of employment, yet students from historically underrepresented groups lose out on these opportunities” (pp.225, 2022). Based on Atwood’s ongoing research around professional identity and participation in internships for undergraduate engineering students, historically marginalized populations and first-generation students are significantly less likely to have an engineering internship or co-op than their counterparts (2021). In the data-set, overall 64.8% of seniors and 5th years had “worked in a professional engineering environment as an intern/co-op” (Atwood et.al, 2021). However, only 41.5% of historically marginalized populations completed an internship (Atwood et.al, 2021) by graduation. Similarly, only 47.6% of first-generation students completed an internship (Atwood et.al, 2021). Lack of internship or co-op can lead to underemployment and significantly less lifetime earnings. Lack of internship also could be attributed to the student’s lack of social capital. According to NACE, first-generation students receive lower salary offers compared to their continuing-generation counterparts (Eismann, 2016). Additionally, self-efficacy is crucial for the individual’s ability to complete a task (Huang, 2003).

Methods

Having explicit instruction around communication skills regarding building and maintaining relationships and a professional network can help reduce the social capital gap and help prepare students for internships/ co-ops and professional positions as engineers. Explicit instruction on professional skills related to the NACE key competencies and the literature on social capital were introduced in the revision of a one-credit career-readiness skills seminar. This study looks at primarily communication skills.

The seminar class consisted of 40 engineering undergraduate students primarily in their second or third year of college. The data was divided into sub-groups based on gender identity, college generational status and whether they belonged to a historically marginalized population. Students were included in multiple sub-groups since a student has multiple identities based on these sub-group definitions. The class consisted of: 12 first-generation and 28 continuing-generation college students, 11 students from historically marginalized populations in STEM (women and people of color) and 29 from historically privileged populations in STEM, 3 female identifying and 37 male identifying students.

Communication skills were broken down into several sub-skills and had explicit instruction and activities around strengthening those sub-skills. The students assessed their self-efficacy around these communication skills at the beginning and end of the seminar through a Likert scale survey on the following statements:

1. I am able to build my social capital through online channels.
2. I am able to build my social capital through in-person interactions.
3. I am able to present myself as a confident capable candidate in an interview.
4. I am able to negotiate a job offer.
5. I feel prepared to obtain an internship or employment.

The Likert ratings consisted of:

- 1= Strongly disagree
- 2= Disagree
- 3= Neither agree nor disagree
- 4= Agree
- 5= Strongly agree

Results

All groups showed positive growth by the end of the semester in the component of ‘building social capital through online channels.’ Female was the outlier group with a higher pre-assessment average score of 4.0 versus most other groups scoring around 3.5 (Table 1a). More research is needed to see if this is a trend. Two possible conclusions are that the higher score was due to the small number of the sub-group (3 female-identifying) and or that undergraduate women are already more comfortable navigating social relationships online. The historically marginalized sub-group had the most growth in online social capital with an average pre/post improvement from 3.45 and to 4.55 (Figure 1). There was similar growth between male and female identifying students, as well as between first-generation and continuing -generations sub-groups. All sub-groups had post average scores above 4.0/5.0. Historically marginalized populations average post- assessment scores exceeded their sub-group counterpart thus eliminating the gap for this skill (Table 1b).

Table 1a: Building social capital through online channels.

<i>Groups</i>	<i>Pre-Avg</i>	<i>Post-Avg</i>	<i>Avg Growth</i>
<i>Entire Class</i>	3.50	4.28	0.78
<i>First - Generation</i>	3.58	4.17	0.58
<i>Continuing- Generation</i>	3.46	4.32	0.86
<i>Historically Marginalized Populations</i>	3.45	4.55	1.09
<i>Privileged Populations</i>	3.52	4.17	0.66
<i>Female Identifying</i>	4.00	4.67	0.67
<i>Male Identifying</i>	3.46	4.24	0.78

Table 1b: Differences in average scores between sub-groups and counterparts in building social capital through online channels.

	<i>Pre-assessment average difference</i>	<i>Post assessment average difference</i>
<i>First vs. Continuing Generation</i>	0.12	-0.15
<i>HMP vs. Privileged</i>	-0.06	0.37
<i>Female vs. Male</i>	0.54	0.42

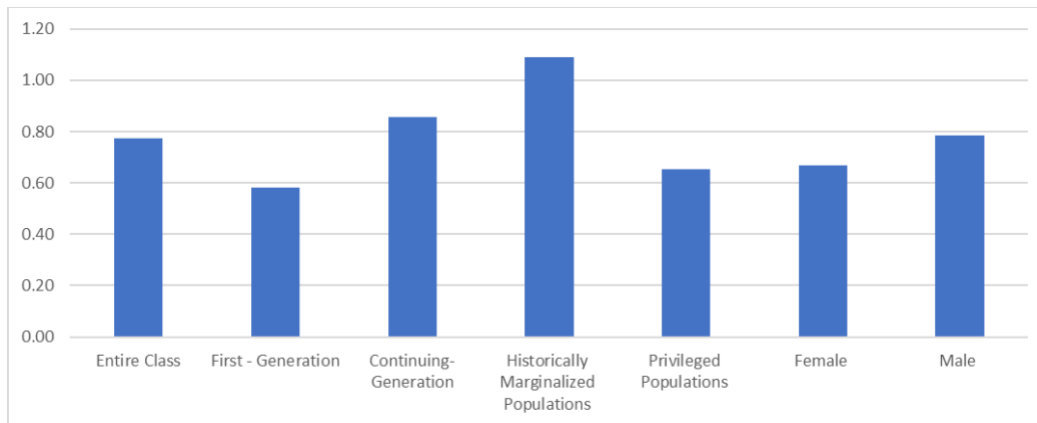


Figure 1: Average growth in building social capital through online channels.

Females and historically marginalized sub-groups showed average scores lower than the class average at pre-assessment for the component ‘building social capital through in-person interactions’ (Table 2a). Females experienced the most growth and had the highest average post-assessment score (Figure 2). In this data, the explicit instruction leveled the self-efficacy of ‘building social capital through in-person interactions’ among sub-groups and resulted in post-assessment average scores of all 4.0/5.0 and above. Females’ post-assessment average scores exceed their male counterparts thus eliminating the gap in this skill (Table 2b).

Table 2a. Building social capital through in-person interactions.

<i>Groups</i>	<i>Pre-Avg</i>	<i>Post Avg</i>	<i>Avg Growth</i>
<i>Entire Class</i>	3.38	4.13	0.75
<i>First-Generation</i>	3.33	4.00	0.67
<i>Continuing-Generation</i>	3.39	4.18	0.79
<i>Historically Marginalized Populations</i>	3.18	4.09	0.91
<i>Privileged Populations</i>	3.45	4.14	0.69
<i>Female Identifying</i>	3.00	4.33	1.33
<i>Male Identifying</i>	3.41	4.11	0.70

Table 2b: Differences in average scores between sub-groups and counterparts in building social capital through in-person interactions.

	Pre- Assessment average difference	Post -assessment average difference
First vs. Continuing Generation	-0.06	-0.18
HMP vs. Privileged	-0.27	-0.05
Female vs. Male	-0.41	0.23

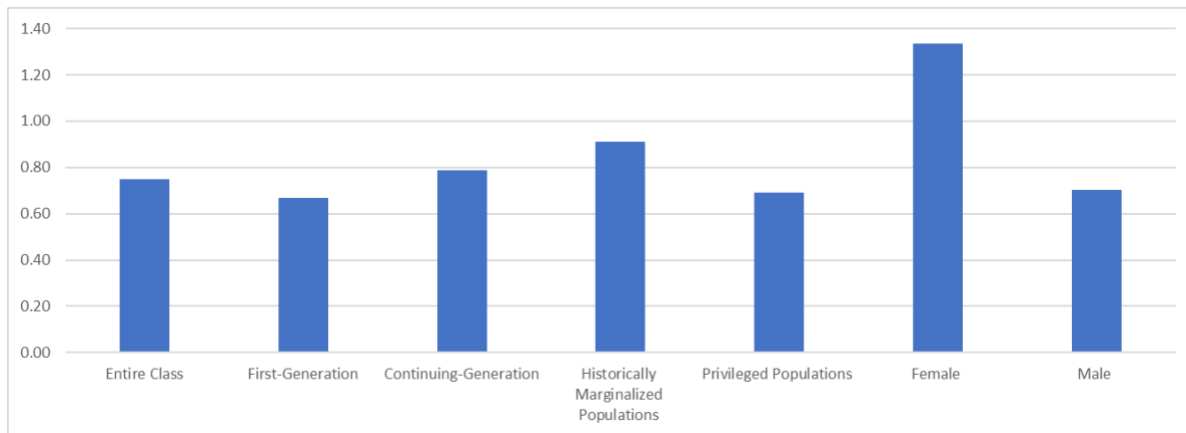


Figure 2. Average growth in building social capital through in-person interactions

Regarding interviewing, pre-assessment average scores for females, historically marginalized populations and first-generation students were lower than the class average (Table 3a). Females and historically marginalized populations had higher post-assessment average scores compared to the class average. All groups had growth in this area after instruction (Figure 3). Females led the growth with an average of 1.0/5.0 from pre to post assessment. Again, this could be due to the small data set in this sub-group. It could also be attributed to the fact that the pre-assessment average scores were the lowest. First generation and historically marginalized populations also have higher growth of 0.82/5.0 compared to their counterparts. Both historically marginalized populations and females had post assessment average scores above their sub-group counterparts thus eliminating the previous gap in interviewing self-efficacy (Table 3b).

Table 3a. Interviewing self-efficacy.

<i>Groups</i>	<i>Pre-Avg</i>	<i>Post Avg</i>	<i>Avg Growth</i>
<i>Entire Class</i>	3.58	4.18	0.60
<i>First-Generation</i>	3.33	4.17	0.83
<i>Continuing-Generation</i>	3.68	4.18	0.50
<i>Historically Marginalized Populations</i>	3.45	4.27	0.82
<i>Privileged Populations</i>	3.62	4.14	0.52
<i>Female Identifying</i>	3.33	4.33	1.00
<i>Male Identifying</i>	3.59	4.16	0.57

Table 3b. Differences in average scores between sub-groups and counterparts in interview self-efficacy.

	Pre- Assessment average difference	Post -assessment average difference
First vs. Continuing Generation	-0.35	-0.01
HMP vs. Privileged	-0.17	0.13
Female vs. Male	-0.26	0.17

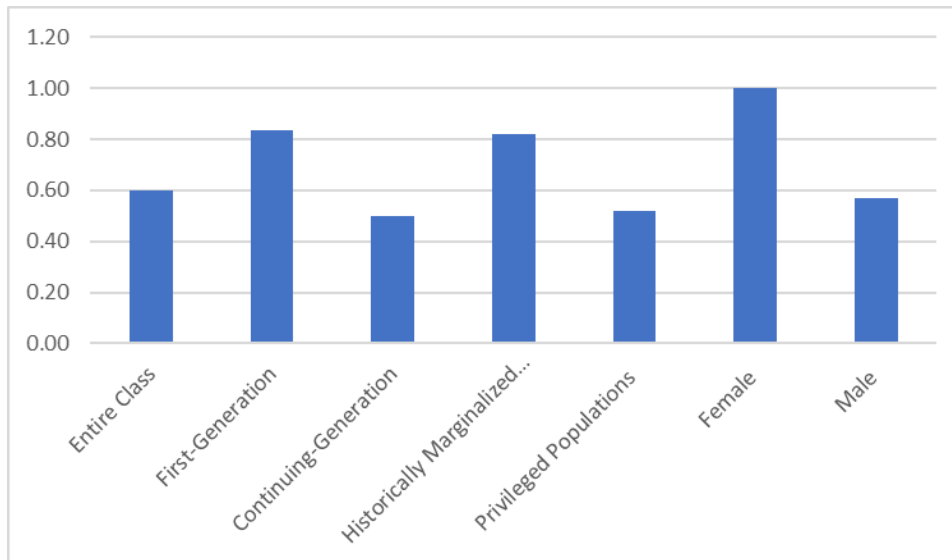


Figure 3. Average growth in interviewing self-efficacy

‘Negotiating a job offer’ had the lowest average pre-assessment scores among all sub-groups, with most falling in the 2.0/5.0 rating (Table 4a). Interestingly, the sub-groups of first-generation and historically marginalized populations had the highest pre-assessment average scores. This result may be due to the lack of awareness around negotiation skills in general which could be part of the social capital deficit. The first-generation sub-group and privileged populations were

the only sub-groups to have an average post-assessment score in the 4.0 range of ‘agree’. Negotiation skills showed the most growth considering the entire class, with an average growth of 1.0/5.0 points. The sub-groups that had growth over 1.0 point were continuing-generation, privileged populations and both genders. First-generation post-assessment average scores were higher than their continuing generation counterparts, however there was not a skill gap in the pre-assessment (Table 4b).

Table 4a. Negotiating a job offer.

<i>Groups</i>	<i>Pre-Avg</i>	<i>Post Avg</i>	<i>Avg Growth</i>
<i>Entire Class</i>	2.95	3.95	1.00
<i>First - Generation</i>	3.33	4.08	0.75
<i>Continuing -Generation</i>	2.79	3.89	1.11
<i>Historically Marginalized Populations</i>	3.09	3.82	0.73
<i>Privileged Populations</i>	2.90	4.00	1.10
<i>Female Identifying</i>	2.67	3.67	1.00
<i>Male Identifying</i>	2.97	3.97	1.00

Table 4b. Differences in average scores between sub-groups and counterparts in negotiating a job offer

	<i>Pre- Assessment average difference</i>	<i>Post - assessment average difference</i>
<i>First vs. Continuing Generation</i>	0.55	0.19
<i>HMP vs. Privileged</i>	0.19	-0.18
<i>Female vs. Male</i>	-0.31	-0.31

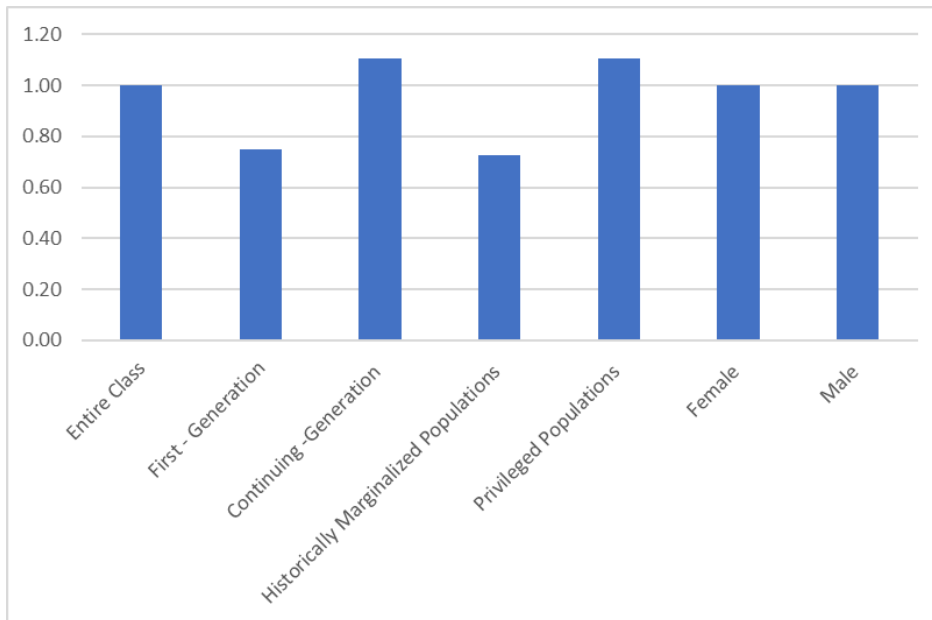


Figure 4. Average growth in negotiating a job offer

In terms of ‘being overall prepared to obtain an internship or employment’, all sub-groups had very similar pre-assessment scores between 3.5-4.0/5.0 (Table 5a). Historically marginalized populations and females had the highest pre-assessment scores. This may be due to the smaller data sets in those subgroups. All sub-groups also have similar post-assessment average scores above the rating of 4.0/5.0. Females and historically marginalized populations had the highest post assessment averages which could be due to the smaller data sets and that they scored themselves higher at the pre-assessment. All groups showed improvement (Figure 5). First-generation, privileged and female sub-groups had the most growth in the overall category. None of the sub-groups leveled the skill gap in this area (Table 5b.)

Table 5a. Overall prepared to obtain an internship or employment opportunity.

<i>Groups</i>	<i>Pre Avg</i>	<i>Post Avg</i>	<i>Avg Growth</i>
<i>Entire Class</i>	3.68	4.28	0.60
<i>First-Generation</i>	3.58	4.25	0.67
<i>Continuing-Generation</i>	3.71	4.29	0.57
<i>Historically Marginalized Populations</i>	4.00	4.55	0.55
<i>Privileged Populations</i>	3.55	4.17	0.62
<i>Female Identifying</i>	4.00	4.67	0.67
<i>Male Identifying</i>	3.65	4.24	0.59

Table 5b. Differences in average scores in overall prepared to obtain an internship or employment

	Pre- Assessment average difference	Post -assessment average difference
First vs. Continuing Generation	-0.13	-0.04
HMP vs. Privileged	0.45	0.37
Female vs. Male	0.35	0.42

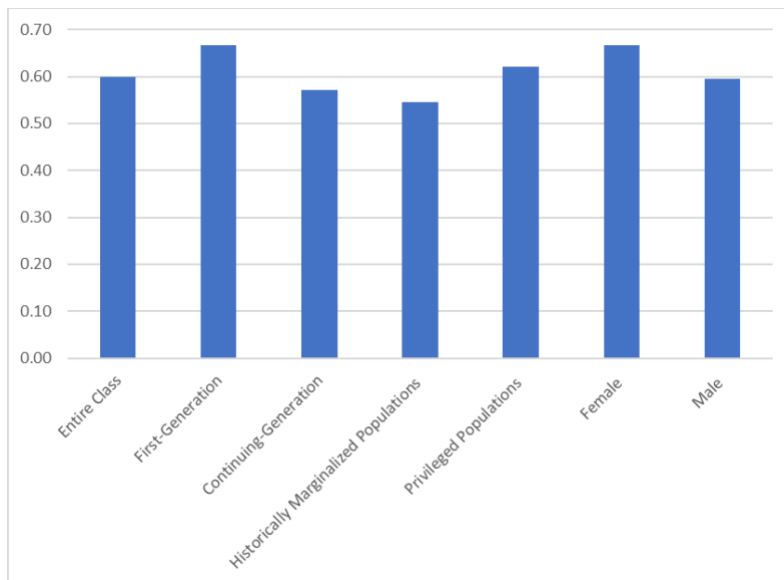


Figure 5. Average growth in overall preparedness to obtain employment

Discussion

All students' sub-groups showed growth in their self-efficacy after instruction, which according to the literature should increase their social capital in terms of being able to successfully launch a career in the engineering field. According to Bandura's self-efficacy theory, individual performance is predominantly reliant on their beliefs of their abilities (Huang, 2003). However, there are limits on solely looking at self-efficacy since individuals may be more versed in self-reflection than others. Growth range from 0.05/5.0 to 1.33/5.00. At the end of the semester, all sub-groups hit the benchmark of 'agree' or 4.0/5.0 in 'building online social capital', 'building social capital in person', interviewing, and 'overall preparedness'. Only first generation and privileged populations achieved average scores of at least 4.0/5.0 in negotiation.

First generation students' post assessment average scores were equal or above their continuing - generation counterparts in both skills sets for interviewing, negotiation, and 'overall confidence to obtain an internship or employment'. Historically marginalized populations' post- assessment average scores were equal or above their counterparts in 'building online social capital', 'building social capital through in-person interactions', interviewing, and 'overall preparedness to obtain an internship or employment'. Females' average post-assessment average scores were equal or above their male counterparts in 'building online social capital', 'building social capital through in-person interactions', interviewing, and 'overall preparedness to obtain an internship or employment opportunity'.

Providing explicit instruction and curricula around communication skills was an effective way to decrease or eliminate the gaps between sub-groups. Moving forward, the instructor could add additional curricula around negotiating a job offer to hit the benchmark of 4.0/5.0 for all sub-groups. The instructor could also provide targeted supports in skills where there still remains a counterpart deficit such as: "building social capital through in-person interactions" and 'negotiation'. These targeted supports could be available to any student that believed that they needed more practice in these areas.

Due to the small data set, it is difficult to draw conclusions on specific sub-groups. One individual can change the average substantially. We will continue gathering data from future cohorts to see if the trends hold. This research will be used to set benchmark scores for students. Ideally, we want all students to be scoring 4.0/5.0 or better in each skill. This data also could be used to improve the curriculum and instruction tailoring to the needs of the students and sub-groups. As this cohort and future cohorts complete their undergraduate degrees, the author plans on monitoring their participation in internships to explore correlation from skill self-efficacy and obtainment of engineering internships.

Works Cited

American Society for Engineering Education. (2020). ASEE Corporate Member Council Survey for Skills Gaps in Recent Engineering Graduates

- Atwood, S. & Gilmartin, S. & Chen, H. & Sheppard, S. (2021). Internship Prevalence and Factors Related to Participation. American Society for Engineering Education 2021 Annual Conference
- Eismann, L. (2016). First-Generation Students and Job Success. NACE.
<https://www.nacweb.org/job-market/special-populations/first-generation-students-and-job-success/>
- Huang, C. (2003). Self-efficacy in the Prediction of Academic Performance of Engineering Students. ASEE Gulf-Southwest Annual Conference.
- Lin, N., & Smith, J. (2001). *Social capital: A theory of social structure and action*. Cambridge University Press.
- Martin, J. & Miller, M. & Simmons, D. (2014). Exploring the Theoretical Social Capital "Deficit" of First-Generation College Students: Implications for Engineering Education. *International Journal of Engineering Education*. 30. 822-836.
- National Association of Colleges and Employers. (2022). Development and Validation of the NACE Career Readiness Competencies. <https://www.nacweb.org/career-readiness/competencies/career-readiness-defined/>
- Thiem, & Dasgupta, N. (2022). From Precollege to Career: Barriers Facing Historically Marginalized Students and Evidence-Based Solutions. *Social Issues and Policy Review*, 16(1), 212–251. <https://doi.org/10.1111/sipr.12085>