Evaluating the Impact of a First-Year Engineering Course Re-design in Students' Sense of Belonging

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Abstract

This evidence-based practice paper aims to gauge the success of implementing instructional changes to a first-year engineering seminar in the sense of belonging of students. This first-year engineering course, *EAS199: Engineering Principles* at the University at Buffalo, is a seminar that all engineering students take upon admission. The intent of this course is to maintain engineering retention at the University at Buffalo and to encourage a sense of belonging to the major and institution. While retention outcomes have been analyzed at the institutional level, no formal assessment of sense of belonging has been implemented for the course. This study starts evaluating the success of the course re-design. Our research team deployed a retrospective online survey to gauge students' levels of engineering identity, sense of belonging to their engineering major, sense of belonging to engineering classes, as well as their sense of achievement in the different course goals. Through collection of survey data among students who took the course before and after the curricular modifications (i.e. between Fall 2019 and Fall 2023), our team aims to assess the trends in our identified areas. The goal in surveying this population of students is to set a baseline for before the changes to this course were made and evaluate if there is evidence of any positive impact derived from the changes that took place in the most recent years.

The survey was deployed among students that took the course in the last four years, including students who are still enrolled in *EAS199* at the University at Buffalo. This allows for an analysis of trends in the average scores of their opinions before and after the changes in the course were implemented. Responses collected from 229 students indicate evidence of such positive trends, with the highest mean scores in engineering identity and belonging are identified among students in the latest edition of the course, Fall 2023. All but one aspect of students' perceptions of their gains showed the same positive trend. While not all the differences between the years were significant, the trends were consistently positive, showcasing that on average, the students' perception of gains from the course, including those directly related to their engineering identity and belonging, are increasing.

Introduction

The University at Buffalo took the initiative in the Fall 2022 academic semester to begin a redesign of the course *EAS199: Engineering Principles*. The course prioritizes the retention of incoming engineering students at the university by providing students with the opportunity to strengthen their academic skills such as time management and metacognition, while also introducing them to the engineering process. We have previously reported on the goals of this iterative redesign, which was motivated by the goal of making the course a more equitable, accessible, and socially just learning environment as the mindset and profile of incoming first-year engineering students has changed with time [3]. Generation Z is known to be one of the

most diverse populations with a growing desire to learn to lead and make positive changes in their communities [1]. With this, we envision contributing to the eradication of the 'weed-out' culture in collegiate engineering education, supporting students, and encouraging them to pursue their goals without fear of roadblocks.

This evidence-based research paper identifies the successes of curricular changes made to a first-year engineering program using the Content, Assessment, and Pedagogy (CAP) model and backwards design. The primary goal of this research is to identify whether the changes made to the course (a) increased students' sense of belonging to the engineering community, (b) assisted in identifying engineering skills, and (c) support their self-recognition as engineers. Through collection of survey data across three groups of students, those that took the course between 2019 and 2023, our team assesses the trend in our identified areas. The changes made to this course began in the Fall of 2022, using the responses from previous semesters as the baseline to our analysis. Using retrospective observational cross-sectional quantitative analysis of the 229 responses, we have identified major trends across student responses and demonstrate the success of the curricular changes.

The research team designed an online survey for students to take anonymously to report their experiences of the course. This survey was developed through understanding other actions taken by other universities to develop their first-year engineering programs and identifying the need for this research.

The research questions that this evidence-based practice paper aims to answer are:

1. Is there any evidence of higher levels of engineering identity and belonging among students in the re-designed versions of the course?
2. Is there any evidence of higher levels of satisfaction with the course outcomes among students in the re-designed versions of the course?

Background

Many courses in engineering are deemed as 'weed-out' courses, and research has shown that experiences in such courses can have a significant impact in retention, particularly affecting students with marginalized identities in engineering such as, gender minorities, students of color, and students with disabilities [2]. The negative impact on these communities often occurs as a result of unintended, built-in inequities, causing a low retention rate for students with such identities [2]. STEM education areas often force students into the ideology that they are not good enough to be successful in their related fields, causing a lower retention rate [3]. Instead, students with minoritized identities might be encouraged to pursue course work that could be considered not as challenging. This atmosphere of students 'not being good enough' can be attributed to the idea of 'weed-out' culture in engineering schools. This culture is based on exclusionary principles where one or more groups are encouraged not to participate due to poor academic performance with no additional assistance. Students of underrepresented communities and identities often feel that they are adding additional hours of work to maintain the expectations placed on them with little to no recognition [4].

STEM fields cannot be successful in the long term if such exclusionary practices prevail. STEM fields are meant to find solutions and improvements for a diverse society, and without the input of a diverse pool of professionals, this would not be possible. It was identified that in 2018, only 38% of women earned degrees in the STEM field in a study conducted across six large, public universities [5]. Several programs are being developed across the United States and implemented to combat the traditionally exclusionary culture of engineering and support the development of a sense of belonging to the engineering community among marginalized groups [6]. Engineering is one of the fastest growing career paths in the United States and will require the appropriate education of a diverse population to fulfill those needs [7]. As the U.S. population keeps diversifying [8], it is critical we ensure that students from different backgrounds have the support they need to transition to a successful path in engineering and other STEM areas.

Context

This evidence-based innovation project is taking place at the University at Buffalo, where the first-year engineering seminar *EAS199: Engineering Principles* takes place. The inception of the course re-design was previously reported [11] with the intention of enhancing retention of students at the first year. The overall goal is to provide a better first-year engineering experience to incoming students in general, and particularly those that have additional challenges for a successful transition to college, many of whom have underrepresented or marginalized identities. During the first two years of these improvements, which started in Fall 2022, the main instructional additions have consisted of (1) inclusion of opportunities for students' self-reflection, (2) inclusion of training in metacognition, and (3) specific modifications to course assessments.

Literature review on first-year innovations

In what follows, we present a review of some successful research-based initiatives that have succeeded in supporting students' achievement and retention through the first years in engineering.

A pilot program at the University of Portland consisted of three engineering introduction courses, designed to provide students with a holistic engineering education in their first year. This program, named Engineering+, was designed to increase student skills in communication, computer literacy, algorithmic thinking, problem-solving, teamwork, engineering design, and hands-on activities [9]. This was accomplished through exposing students to more relevant content, team-based projects, different majors, and career paths. Research conducted on the success of this program used surveys among students to determine the success rates of the changes and evaluate the student perspective. These surveys found that 87% of the students reported they felt the necessary skills to succeed in other courses were provided.

Grounded in Yosso's concept of community cultural wealth (CCW), a large polytechnic university in the U.S. employed a new course named *ENGR 101: Engineering Success.* Using the navigational wealth idea defined in Yosso's concept of CCW, the course seeks to employ students' existing strengths and assets of first-generation students and underrepresented minorities to support their success [6]. Navigational wealth is defined as the idea that students

are equipped with the necessary skills and abilities to seek out support and navigate communities where there is a dominant culture [6]. The goal of *ENGR101* is to increase students' sense of belonging and to strengthen their identity and connection to their engineering education. These goals were met by incorporating career exploration, collaboration, self-reflection, and diverse learning opportunities. The effectiveness of the course re-design was evaluated through surveys and interviews with students that took the course. The survey results showed, overwhelmingly, that the course increased their sense of connection to the engineering community. In addition, those students felt more confident in leading outreach activities regarding STEM education. There were two common themes identified from the interviews, sense of belonging and community. Students were also able to identify their enduring goals and reasons for becoming an engineer [6].

An intervention at a mid-Atlantic university showcased a positive impact in influencing students' appreciation for diversity in engineering using Professional Identity Development theory, especially as it relates to teamwork interactions and their ABET related-outcomes [10]. The intervention consisted of changes to their first-year engineering curriculum under three distinct instructors, each following the same course of curricula. Each section was added to the course to encourage the goal of understanding the importance of diversity and included significant opportunities for self-reflection. The study included the addition of several activities consisting of: an Importance of Teamwork video, an Implicit Bias Module, a Panel of Practicing Engineers, and an Ice berg Activity [10]. Each of these activities included the follow up of a reflection survey tailored to the specific activity. The research team identifies how these tasks fall into one of three categories, including why engineers should care about diversity, how to work on diverse teams, and keeping in mind the stakeholders of engineering design problems. The results of this study showed that over the course of the semester, students felt they could create a more inclusive and understanding culture when working on a diverse team of engineers. With the use of the included activities to encourage and intentionally place students of diverse backgrounds on teams, this research team was able to help students identify how to promote a healthy culture within a team.

In conclusion, there are feasible paths to implement evidence-based innovations which can help identify ways to better support our first-year students engineering identity and skill development. We do this by supporting students' development of metacognition skills, reflection abilities and awareness of resources as described in [11]. These innovations started to take place in Fall 2022 and continue to be improved upon. This paper explores at a large scale how these modifications in the last years are enhancing or not, our students engineering identity, sense of belonging, and perceptions of achievement with respect to the course goals.

Methodology

This is a retrospective observational study because we are asking students that have completed *EAS199* to provide their past experiences. While the course had modifications from year to year that were intentional in nature, they were not evaluated from an experimental (control-treatment) perspective. Instead, we are observing the evolution of specific measures of students' identity development and perceptions of the course effectiveness across the years before and after the

modifications took place, similar to a natural experimental setting [12]. Modifications of the course content and format began in Fall 2022.

Course Modifications

The course had a divided structure for about eight years, which means that there was an admitted version of the course and an intended version of the course. Admitted students were unconditionally accepted to the School of Engineering and Applied Sciences, while intended students had additional requirements to satisfy before being accepted. This was based on the applicants' performance measures submitted in their applications. The divide between admitted and intended grew scrutiny and it was deemed inequitable and placed a hierarchy. In Spring 2022 leadership at the School of Engineering made the decision to remove the divide and offer only one version of the course for all students applying and accepted to the school. Before this change, the course structure and learning objectives were heavily focused on the engineering design piece and left the academic success goals of the course (as a first-year seminar) aside.

During Spring 2022 some modifications took place, particularly the recognition of specific learning objectives related to academic success. Additionally, many practices of the actual execution of the course were revised for their equitability. In Fall 2022 a first iteration of the revamping of the course took place. It included specific units providing students with knowledge and practice on metacognitive abilities, and many aspects of academic success. However, there were many logistic challenges proving the goals for change were not paired with the resources available. The instructional team for the course kept working on a second iteration that was implemented in Fall 2023. This execution was smoother, yet there are still a lot more iterations needed to accomplish the overarching goal. The modifications made are already showing some significant improvements based on general student perception, and in particular, students from marginalized identities. An in-depth description of such pedagogical innovations can be found in [11].

Participants

An online survey was distributed in January of 2024 among students that had taken the course between the Fall 2019 and Fall 2023 semesters. An approximate total of 3600 students were invited to participate. This set of students was narrowed by course records from the corresponding semesters. Two reminders were sent to maximize response rates. A total of 312 responses were collected, which were later cleaned for quality. This number of responses is equivalent to an 8.7% response rate of the intended population. Due to the retrospective nature of this study, a potential limitation in our sample we would expect a response bias towards the extremes, i.e. the survey would likely receive more responses by those that had strongly positive or strongly negative experiences, this would be a type of selection bias. Similarly, there is a limitation of timing, since a longer period of time has passed for students that took the course in earlier years, which can potentially result in recalling bias. Yet, because of the selection bias, we would expect to somewhat counteract the recalling bias. The demographic distribution of the students belonging to each year of the cohorts invited to participate are located in Table 1.

Table 1. Demographic distribution of student cohorts invited to participate in the study.

Student Demographics		F19-S20	F20-S21	F21-S22	F22-S23	F23	Total
Sex	Female	168	178	115	118	174	753
	Male	639	592	540	494	560	2,824
Race	White or Caucasian	484	448	355	367	384	2,038
	Black or African American	44	52	51	34	53	234
	American Indian/Native American or Alaskan Native	2	4	3	0	3	12
	Asian	97	95	108	77	100	477
	Hispanic or Latino	62	71	64	61	87	345
	Two or More Races	26	21	23	17	27	114
	Unknown	48	40	18	20	33	159
Student Status	Domestic Student	764	731	622	576	687	3,380
	International Student	42	39	33	36	47	197
First Generation Status	First Generation College Student	122	111	105	83	111	532
Total		807	770	655	612	734	3,578

Data Collection

To evaluate engineering identity and belonging among participants we used existing instruments that have been extensively used for such purposes and previously validated [13]. We also expanded on these items adding specificity of such constructs, asking students how much *EAS199* contributed to such perceptions of identity and belonging. Table 2 illustrates the parallels made between the original items and the additional modified items, specific to *EAS199*. A full version of the survey is included in Appendix A. The survey was anonymous, as it did not collect any identifiers from participants. While demographic variables were collected, there was no way to trace back the responses to a particular participant, making it anonymous.

Table 2. Student engineering identity and belonging items used in the survey.

Original Items	Modified Items
1. I see myself as an engineer	EAS199 helped me seeing myself as an engineer
2. I feel comfortable in engineering	EAS199 helped me feel comfortable in engineering
3. I feel I belong in engineering	EAS199 helped me feel like I belong in engineering
4. I enjoy being an engineering student	EAS199 helped me enjoying being an engineering student
5. I feel supported in my engineering classes	EAS199 helped me feel supported in my engineering classes
6. I feel that I am part of my engineering classes	EAS199 helped me feel like I am part of my engineering classes

In addition, the survey also asked students about their perceived satisfaction with different aspects of the course, such as those related to selecting the best engineering major for

themselves, developing skills for academic success, and acquiring a basic set of engineering skills, such as teamwork and data analysis. The survey was concluded with a set of questions about the participants' demographics including sex, sexual orientation, ethnicity and race, international status, and first-generation status. The survey also included a section where students were able to share open comments about their recalled experience in the course. The survey was administered online through Qualtrics [14]. The procedures for data collection and analysis were approved by the corresponding Institutional Review Board.

Data Processing

Data was first filtered by completion, reducing the final number of observations for analysis to 229. With this data, validation of the engineering identity and belonging items was performed through confirmatory factor analysis. The performance of a three-factor structure for the instrument was satisfactory for the default items (Table 2 left column), with item 1 describing identity, items 2 and 3 describing belonging to the engineering major and items 5 and 6 describing belonging to engineering classes. The performance metrics for this instrument were a Comparative Fit Index (CFI) = 0.998, Tucker-Lewis Index (TLI) = 0.994, and RMSEA = 0.040, all of which indicate a very good fit [15]. For the modified version, most performance metrics were satisfactory, with CFI=0.98, TLI=0.94, and an RMSEA=0.17. Further attention to this last inconsistent metric is needed, yet for the exploratory purpose of this study, we deem it appropriate for use in our analysis.

Data Analysis

We conducted an analysis of means of identity and belonging through time, exploring what were the trends from beginning to end of the period under analysis. We also conducted Kruskal-Wallis tests to compare the levels of the constructs under analysis between the different years to explore if any of the identified differences found through the analysis of trends were significantly different from one another. We also conducted similar trends and group analyses using students' perceptions of their gains in (1) engineering major selection, (2) academic success skills, (3) engineering skills, and (4) community building. In addition, we used the open comments provided by students and conducted a thematic analysis identifying the main categories of positive and negative comments about the course.

Results

The number of responses per academic year per students' demographics showed that in terms of gender, women were slightly overrepresented (37%) when compared to their regular proportion in the engineering population at the University at Buffalo School of Engineering and Applied Sciences (25%). Heterosexual, White, and non-first-generation students composed the largest groups under their demographic categories. Due to the low proportion of minority students, group comparisons were not conducted at this stage.

Engineering identity and belonging

As mentioned before, the constructs of identity and belonging were mapped to the different items presented in Table 2. Engineering identity was validated to align with only item 1, and as such its

values ranged from 1 to 5. Belonging to engineering major was validated to be represented by items 2 and 3, so, its value was the sum of both items and ranged between 2 and 10. Belonging to engineering classes was validated as represented by items 5 and 6, so its value was the sum of both items and ranged between 2 and 10. When considering the yearly mean of each of the identity and belonging indicators we found that in general, there is a positive trend for each of the indicators throughout the years with higher average in the last edition of the course (see Table 3).

Students from Fall20-Spring21 and Fall21-Spring22 both had lower identity and belonging average ratings than those in Fall19-Spring20. Such indicators went on an upward trend in the following years, when the course modifications started to take place, with the highest levels existing in the latest edition of the course (Fall23). These trends are the results of students' general evaluation of their identity and belonging, coupled with their evaluation of identity and belonging derived from their experiences with the course. In general, their evaluation of identity and belonging derived from their experience with the course was lower than their overall identity and belonging for each indicator.

When performing Kruskal-Wallis tests, the non-parametric version of ANOVA, to compare the medians of the five independent groups, only the general indicator of belonging to engineering classes was statistically significantly different between the years, with its highest values in Fall23.

Table 3. Mean scores in identity and belonging measures across five years (innovations started in Fall 2022).

	F19-S20	**F20-S21**	**F21-S22**	**F22-S23**	**F23**
I see myself as an engineer	4.17	4.08	3.97	4.21	4.34
I see myself… *because* of EAS199	3.58	3.48	3.58	3.48	4.04
Belonging to major	8.02	8.02	8.06	8.36	8.87
Belonging to major *because* of EAS199	7.24	6.76	6.91	7.03	8.02
Belonging to Eng. Classes	7.85	8.06	7.08	7.92	8.58
Belonging to Eng. Classes *because* of EAS199	7.42	7.06	7.02	7.31	8.12

Significant Kruskal-Wallis comparisons are not denoted as they were executed pairwise between all years complicating representation.

Students' perceptions of their gains

When analyzing the mean students' satisfaction across years, similar trends were identified. Averages decreased for the second and third years, and most commonly came back in a positive trend for the last two years. Fall23 shows the highest satisfaction with major selection, academic

success, and engineering skills. However, there was an overall decrease in students' evaluation of their ability to create a supportive engineering community in the last year.

The Kruskal-Wallis tests showed that there was a statistically significant difference between the satisfaction of major selection across the years, and with students' satisfaction with their development of engineering skills. Differences identified for the rest of indicators were not statistically significant.

Table 4. Mean scores students' perceptions of their gains in different aspects of the course across five years (innovations started in Fall 2022).

	F19-S20	F20-S21	F21-S22	F22-S23	F23
Major Selection	10.95	10.56	10.53	9.98	12.07
Academic Success	12.9	12.45	12.08	12.82	14.43
Engineering Skills	23.19	22.41	22.39	23.94	25.43
Engineering Community	10.12	10.06	10.93	10.69	9.51

Open Responses

The survey included a free response section. This section requested that students leave any comments they have about their experiences with the course and how it relates to their college experiences. These responses were organized by year and evaluated based on the relative negative or positive connotations of the response in a thematic fashion. The breakdown of these responses is demonstrated in Table 5.

Table 5. Distribution of classified open responses per year (positive, negative, neutral)

Number of responses per type	F19-S20	F20-S21	F21-S22	F22-S23	F23	Totals
Positive	7	15	5	7	6	40
Negative	5	12	2	9	5	33
Neutral	0	3	1	1	0	5
Totals	12	30	8	17	11	78

The most frequent negative responses indicated distaste for the structure and design of the course. These responses were localized to the sections prior to the redesign of the course. We saw responses that included, "made me hate engineering,", "not helpful," "too much work," and some responses that indicated a distaste for the lack of agency over student's own grades. The largest frequency of negative responses was students indicating that the course was a "waste of time." This type of response was noted for each year. However, the positive responses identified lessons learned and takeaways of the course. These responses included comments such as, "helped me think like an engineer," "gave problem solving skills," "influenced understanding of engineering concepts," and "helpful in developing engineering skills." According to the numbers in Table 4 there was a minimal positive trend in responses where 51.28% of the total comments

received were positive. There was a greater response rate from students that took the course in F20-S21.

Discussion

The observed results provide some evidence of higher levels of engineering identity and belonging among students in the re-designed most recent versions of the course. While these differences were not statistically significantly different except for one of them (belonging to major), the positive trend showcases gains that, if sustained, can keep enhancing student engineering belonging and identity in the long term through the process of evidence-based continuous improvement. We envision to continue implementing evidence-based improvements that derive even more positive effects in belonging and identity, and keep documenting our results in a scholarly fashion, as previous research has done [10].

Similarly, our results also showed evidence of higher levels of satisfaction with the course outcomes among students in the re-designed versions of the course. However, the lower indicator in the achievement of a sense of community is important to consider further. The creation of a healthy supportive community has been documented to also positively influence student sense of belonging, identity and consequently retention [6], [16].

There was an evident difference across students in all editions of the course, showing that the levels of engineering identity and belonging due to the course were consistently lower than those reported by default. Such discrepancy could be capturing the plethora of other factors that are known to influence engineering identity and sense of belonging [17].

Finally, our analysis is only descriptive and not causal in nature. We plan to implement alternative methods to explore the potential of causality, as well as dive deeper into the descriptions of students' experiences in the course through qualitative interviews. Other future analysis of this data will include a breakdown of these trends by subgroups, paying special attention to those with marginalized identities. While sample sizes are limited at this point, the survey remains open to strengthen such numbers.

Conclusion

In this study we conducted a retrospective observational study to explore students' perceptions of their engineering identity and sense of belonging derived from their experience in the first-year engineering seminar *EAS199: Engineering Principles* at the University at Buffalo. Evidence-based innovations have been implemented in the last years of the course, allowing for an opportunity to compare the input from students before and after such innovations took place. An analysis of trends in means showcased a positive trend through time, with students reporting higher levels of engineering belonging and identity due to the course in the last academic year. Students' perception of their achievement of specific course goals and developed skills also had mostly positive trends, showcasing a potential tying to the innovations implemented.

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Appendix A

Full Survey taken by course former students

What is your current major?

- Aerospace Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Computer Science
- Electrical Engineering
- Engineering Physics
- Engineering Science
- Environmental Engineering
- Industrial Engineering
- Materials Science and Engineering
- Mechanical Engineering

- Undecided Engineering
- Other – Non-Engineering

What best describes your major choice at this time?

- I am in the same engineering discipline that I was initially interested in when I started college.
- I am in a different engineering major than I was initially interested in when I started college.
- I have transferred or I am in the process of transferring from engineering to a different major (outside of engineering)
- I do not know what my major will be in engineering or in another field.

The following question is about your general perception of engineering in general. Please select your level of agreement with the following statement.

- Strongly Agree, Somewhat Agree, Neither Agree nor Disagree, Somewhat Disagree, Strongly Disagree
  - I see myself as an engineer.
  - I feel comfortable in engineering.
  - I feel I belong in engineering.
  - I enjoy being an engineering student.
  - I feel supported in my engineering classes.
  - I feel that I am part of my engineering classes.

When did you take EAS199?

- Fall 2019
- Spring 2020
- Fall 2020
- Spring 2021
- Fall 2021
- Spring 2022
- Fall 2022
- Spring 2023
- Fall 2023
  - [if Fall 2020, Fall 2021, Fall 2019, Spring 2020 is selected, display the following:]
  - You have indicated that you took EAS199 in either Fall 2020 or Fall 2021, which type of section was your EAS199 section?
    - Accepted
    - Intended
    - Can’t remember/Don’t know

The following questions are about your general perception of engineering, satisfaction with your major selection, tools for academic success, as they relate to your experiences in EAS199. Please select your level of agreement with the following statements:

    - Strongly Agree, Somewhat Agree, Neither Agree nor Disagree, Somewhat Disagree, Strongly Disagree
        - EAS199 helped me seeing myself as an engineer
        - EAS199 helped me feel comfortable in engineering
        - EAS199 helped me feel like I belong in engineering
        - EAS199 helped me enjoy being an engineering student
        - EAS199 helped me feel supported in my engineering classes
        - EAS199 helped me feel like I am part of my engineering classes
- EAS199 Major selection content
    - Strongly Agree, Somewhat Agree, Neither Agree nor Disagree, Somewhat Disagree, Strongly Disagree
        - In EAS199 I got sufficient exposure to the different engineering majors
        - The information I obtained in EAS199 helped me select my major
        - I am satisfied with my selection of major
- EAS199 Academic Success content
    - Strongly Agree, Somewhat Agree, Neither Agree nor Disagree, Somewhat Disagree, Strongly Disagree
        - The tools for academic success I learned in EAS199 have been essential to my success in college
        - EAS199 helped me be a more reflective learner
        - What I learned in EAS199 has helped me manage my time more efficiently in college
        - I improved my study habits and/or exam taking skills as a result of what I learned in EAS199

The following questions are about your general perception of engineering skills and engineering community, as they relate to your experiences in EAS199. Please select your level of agreement with the following statements.

- EAS199 Engineering skills & knowledge
    - Strongly Agree, Somewhat Agree, Neither Agree nor Disagree, Somewhat Disagree, Strongly Disagree
        - EAS199 prepared me to work on teams and collaborate with colleagues as I continue my engineering coursework
        - I can describe the Engineering Process
        - I can apply the Engineering Process to other projects and engineering problems
        - The skills I learned in EAS199 will help me be a successful engineer
        - EAS199 helped strengthen my abilities to conduct experiments
        - EAS199 helped strengthen my abilities to analyze data

- EAS199 Community
    - Strongly Agree, Somewhat Agree, Neither Agree nor Disagree, Somewhat Disagree, Strongly Disagree
        - In EAS199 I had sufficient support in the form of TAs and Student Leaders
        - The networks I built in EAS199 have prevailed through subsequent semesters of my college experience
        - Through EAS199 I made friends and/or peers that have positively influenced my college experience

Please share any additional comments you may have about your EAS199 experience and how it relates to your college experiences.

- Open response

How do you describe yourself?

- Male
- Female
- Non-Binary / third gender
- Prefer to self-describe
    - Open response
- Prefer not to say

Which of the following commonly used terms would you use to describe your sexual orientation?

- Heterosexual/Straight
- Gay/Lesbian
- Uncertain
- Other – Please Specify
    - Open response
- Prefer not to say

Are you of Spanish, Hispanic, or Latino origin?

- Yes
- No

Choose one or more races that you consider yourself to be:

- White or Caucasian
- Black or African American
- American Indian/Native American or Alaska Native
- Asian
- Native Hawaiian or Other Pacific Islander
- Other
- Prefer not to say

Are you an International Student?

- No
- Yes

Which of the following best describes your family's financial situation when you were growing up?

- Very poor, not enough to get by on
- Had enough to get by but not many "extras"
- Comfortable
- Well-to-do
- Prefer not to say

How would you characterize your current financial situation?

- It's a financial struggle
- It's tight but I'm doing fine
- Finances aren't really a problem
- Prefer not to say

Which of the following best describes the level of education completed in your family?

- I am a first-generation college student (i.e. none of your parents went to college)
- I have one parent/caregiver with a college degree.
- I have more than one parent/caregiver with a college degree

Would you be interested to participate in a follow up interview on this topic?
Interviews will take between 30-60 minutes and will be compensated with $20 for your time.
If so, please provide your email.

- Yes, I would like to be interviewed, here is my email
  - Open response
- No, I would not like to be interviewed