



2022 SURVEY RESULTS

OVERVIEW

The Educational Environment in Engineering (E3) Survey was administered in the UW-Madison College of Engineering in Spring 2022. 1099 eligible undergraduate students and 392 eligible graduate students participated, yielding response rates of 26% and 27% respectively. Major survey topics included students' attitudes towards and experiences in the College, including sense of belonging in the College and experiences of stereotyping and harassment; evaluations of professors and teaching assistants; commitment to their choice of major; sense of confidence in engineering coursework, research, and teaching; and future career plans.

Mary E. Fitzpatrick, Ph.D.

Director of Diversity Research and Program Evaluation

Table of Contents

Acknowledgements	3
Executive Summary	4
Introduction.....	6
Survey Instrument Overview	7
Survey Results.....	8
Stereotyping and Harassment	8
Affiliation with and Sense of Belonging in the College	9
Professors	10
Teaching Assistants.....	11
Feeling Welcomed	12
Engineering Academic Confidence	12
Engineering Student Interaction.....	14
Commitment to Engineering Major.....	14
Research Group Environment.....	15
Graduate Students’ Relationship with PI/Faculty Advisor	15
Graduate Student Research and Teaching Confidence	16
College Resources.....	16
Appendix 1: Survey participant demographic breakdown	18
Appendix 2: Scale and Item Results.....	20
Appendix 3– Survey Items by Section/Scale.....	30
Appendix 4 – Methodology and Psychometrics	37

Acknowledgements

Chris Castro, Associate Dean for Inclusion, Equity and Diversity in Engineering

Clare Huhn, Associate Director, Academic Planning and Institutional Research

Nathan Jones, Researcher and Project Director, UW Survey Center

Warren Scherer, Assistant Dean and Director, Gender and Sexuality Campus Center

Christopher Slaten, Associate Professor, Educational, School and Counseling Psychology, University of Missouri

Jay Yonker, Director, Strategic Diversity Planning and Research, Division of Diversity, Equity and Educational Achievement

Executive Summary

The College of Engineering has deployed “climate” surveys to assess the educational environment and other variables related to students’ success and retention since 2008. Engineering schools and colleges across the U.S. retain students at rates that are lower than many other areas of study. The College undergraduate 6-year graduation rate for new freshman from 2016, the most recent year that can be computed, is 66.9%¹. Because of the significant investment on the part of both students and the College, graduate student retention merits similar attention. It is important to understand the factors that may relate to students leaving the College, and the overall level of student satisfaction during their educational career.

The 2022 Educational Environment in Engineering (E3) survey is the 4th wave of this effort. This report provides survey details, methodology and results, and compares results to the previous E3 survey from Spring 2019. The 2022 E3 had a very similar response rate to 2019, and this response rate is comparable to other online surveys fielded by the UW Survey Center. Overall, the demographic and departmental profile of respondents is representative of College student enrollment during the term of the survey.

There were few significant changes in most of the areas measured by the E3 survey between 2019 and 2022. However, on many measures and as in previous years, we found significant differences between groups based on participants’ gender, LGBTQ+ and racial ethnic identities.

Many experiences of stereotyping and harassment were less common for survey respondents in 2022 than 2019; however, most items measured were not at zero levels. Like 2019, a substantially higher percentage of respondents reported in-class experiences of stereotyping and being singled out in due to their social identity than experiences of harassment.

Evaluations of professors, teaching assistants, attitudes toward feeling welcomed and included, commitment to engineering major, research group environment and graduate research and teaching activities remained remarkably similar to 2019. Students who work or volunteer in research groups continue to report strong levels of satisfaction with this experience. Overall, graduate students report positive relationships with their PI or faculty advisor.

For the third consecutive survey (since 2008), undergraduate students’ sense of self-efficacy, or confidence, in engineering academic coursework declined. The decline between 2019 and 2022 was among women and students that identify as LGBTQ+, while men’s engineering self-efficacy held steady. Educational research has repeatedly affirmed the centrality of self-efficacy in student retention, so this decline is concerning. The reasons for this decline are not known and warrant additional investigation.

Measures of satisfaction with student peer interactions for undergraduate students also declined significantly since 2019. In addition, students were less satisfied in 2022 with some College resources (undergraduate learning center, study abroad) than in 2019. This may be due to the difficulty in accessing resources during the pandemic; for example, the study abroad program was suspended for several years.

¹ Academic Planning and Institutional Research (APIR). For comparison, ASEE (2017) reported 6-year graduation rates from member institutions at 59.9%. <https://ira.asee.org/benchmark-3-graduation-within-six-years/>

In 2022, we piloted 20 new items intended to measure students' sense of belonging in and affiliation with the College. Overall, undergraduate and graduate students reported medium-to-high levels on these measures. However, there were significant and large differences between groups at the undergraduate and graduate level based on gender and racial/ethnic identity. International students overall had the highest sense of belonging in and affiliation with the College.

Introduction

The E3 survey was sent to all UW-Madison College of Engineering (the College, or CoE) enrolled graduate (Grad) and undergraduate (UG) students in Spring 2022. The purpose of the survey is to measure students' attitudes toward key components of the educational environment in the College, including interactions with professors, teaching assistants, and other students, and satisfaction with college services and resources. Survey items ask students about stereotyping and harassment witnessed or experienced in class or in the College environment. Finally, the survey asks students to reflect on themselves as engineering students and share future educational and career plans.

Prior to 2022, the most recent E3 survey took place in Spring 2019. Survey changes between the 2019 and 2022 E3 instrument include:

- (1) addition of 20 new items measuring students' sense of belonging in and affiliation with the College
- (2) update of questions related to sex and gender to be consistent with campus standards; participants were asked only their current gender identity (man, woman, other), based on immediate student feedback to the survey questions as initially deployed
- (3) removal of items asking students to estimate exclusionary behavior due to interpretation difficulties and failure to add value to existing items

Previous survey data from enrolled undergraduate and graduate students were collected and analyzed in 2019. Since most items in the survey instrument remained the same, we can compare many of the student responses between the 2019 and 2022 survey years (2019 survey results can be accessed on the CoE website [here](#).) That said, when comparing and interpreting results, context matters; specifically, it is important to consider the major external events between 2019 and 2022 shaping students' experiences: a world pandemic impacting instructional modalities throughout high schools and colleges; national and global protests against racial injustice; and a politically polarized environment in the country.

Survey Instrument Overview

As described, the E3 survey invitation was sent to all undergraduates and graduate students enrolled in an engineering major in Spring 2022. Participants must be over 18 and have taken at least one College of Engineering course to be eligible.

Participants are asked to self-identify their educational career status (undergraduate student or graduate student, and for graduate students: professional degree, research Masters, coursework Masters, or Ph.D. student), major or closest department affiliation, gender identification, citizenship, racial/ethnic identity, LGBTQ+ identification, disability status, first generation student status, age, student organization affiliation, sources of funding for college, outside work for pay, college and high school cumulative GPA, and future career plans. The survey obtained students' quantitative ratings and qualitative (comments) responses in the following content areas:

1. Experiences of stereotyping and harassment by faculty/Teaching Assistants/other students
2. Sense of Belonging in the College of Engineering – 20 items are **new** to the 2022 E3
3. Experiences with professors and teaching assistants
4. Feeling Welcomed by faculty, staff, other students, departments
5. Engineering academic confidence, perceptions of student interactions and commitment to major.
6. Satisfaction with College resources
7. Environment in research labs/groups (students who have worked in research labs only)
8. Engineering teaching training & confidence (TAs only)
9. Engineering research confidence (research M.S. and Ph.D. only)
10. Relationship with principal investigator/faculty advisor (research M.S. and Ph.D. only)

Survey questions can be found in [Appendix 3](#). For survey methodology information, see [Appendix 4](#).

Survey Results

The following sections detail key quantitative results on each section of the E3 survey. In each section, we will identify any significant changes since the 2019 E3 survey, followed by between group comparisons in the 2022 E3 survey data.

Demographically, the students that participated in the E3 survey in 2022 were substantially similar in representation to 2019. The percentage of undergraduate students who identified as first-generation college students declined slightly, while this demographic group grew slightly for graduate students. For both undergraduate and graduate students, the percentage of participants who identified as domestic underrepresented minority grew by about 1%. The most significant change is the percentage of students who identified as LGBTQ+. This group of participants grew from 7% for both undergraduate and graduate students in 2019 to 14% and 11% respectively, in 2022. For the full demographic description of survey respondents and a comparison to enrollment, see [Appendix 1](#).

Throughout this document, we will use the terms “student”, “participant” and “respondent” interchangeably. **The reader should recall that the results represent the responses of 26% of enrolled undergraduates and 27% of enrolled graduate students in the College.** Thus, when we say “students” we do **not** mean all students in the College; rather, we are referring to those students who responded to the survey.

Stereotyping and Harassment

We asked students about experiences of being singled out in class, hearing stereotypical statements, and experiencing harassment based on gender, racial/ethnic and LGBTQ+ identities.

Comparison with 2019

With these items, we consider the percent of participants who answered “Yes” to each experience. Survey questions emphasized individual experiences rather than observations of experiences of peers. Comparisons to 2019 showed small and often not statistically significant changes on these items. Results comparing Stereotyping and Harassment items to 2019 can be found in [Table 2](#).

Changes in being singled out unfairly in class based on gender by faculty and other students increased in undergraduate respondents. In both the undergraduate and graduate student respondents, the percentage who responded that in class they had heard expressions of stereotypes by other students based on gender, racial and sexual orientation all declined, some significantly. Sexual and racial harassment by faculty, TAs and other students mostly declined, although these changes were statistically non-significant.

Gender and LGBTQ+ identity

As in 2019, in 2022 there were significant differences by group on responses related to experiences of stereotyping and harassment. Because patterns between undergraduate and graduate students were so similar, they are summarized together. Between group differences on Stereotyping and Harassment items can be found in [Table 2.1](#) and [Table 2.2](#).

Notable responses from survey participants who identified as women, other gender or LGBTQ+ on sexual, sexual orientation and gender stereotyping and harassment questions include:

- 33.1% of undergraduate women respondents and 16.1% of graduate women respondents have personally experienced instructors/faculty express stereotypes about men and women in class
- 52.8% of undergraduate women respondents and 13.7% of graduate women respondents have personally experienced other students express stereotypes about men and women in class
- 5.3% of undergraduate women respondents, 5.6% of undergraduate other gender respondents, and 3.7% of graduate women respondents reported experiencing sexual harassment from another student
- 43.3% of undergraduate respondents and 23.8% of graduate respondents who identify as LGBTQ+ report hearing stereotypes about LGBTQ+ people from other students in class
- 6.7% of undergraduate respondents who identify as LGBTQ+ reported being harassed by another student because of their sexual orientation.

Racial/Ethnic Category

Responses to items related to race and ethnicity showed between group differences based on the racial/ethnic identity of the respondent. Differences include:

- 11.6% of undergraduate and 14.3% of graduate domestic minority respondents have heard instructors or faculty express racial/ethnic stereotypes in class
- 33.7% of undergraduate and 37.9% of graduate domestic minority respondents have personally experienced other students express racial/ethnic stereotypes in class
- 7% of undergraduate and 6.9% of graduate domestic minority respondents reported experiencing harassment from another student based on their race or ethnicity

Affiliation with and Sense of Belonging in the College

Questions related to affiliation with the College of Engineering and sense of belonging in the College were new in 2022. The precise wording of the 20 new items can be seen in [Appendix 3](#). Items were developed in consultation with the Campus Climate Survey, from a validated instrument called the University Belonging Questionnaire (UBQ; Slaten, 2016) adapted with permission for the College of Engineering, and with the UW Survey Center. While the 20 items together have high internal reliability ($\alpha=.929$), exploratory factor analysis yielded 4 clustered subscales.

1. Belonging (9 items) = Feeling welcome, safe, excluded (reverse coded), respected, like you belong, individual differences valued, opportunities to grow
2. Affiliation/Status (4 items) = taking pride and status from association with the College of Engineering
3. Student Connections (3 items) = feeling at home, ease of relationships, feeling similar to other students in major
4. Faculty/Staff Connections (4 items) = feeling valued, connected to or cared about by College faculty or staff

Distributions for the overall Affiliation and Sense of Belonging scale and subscales were within normal bounds for normality, skewness, kurtosis and missing data. Results can be seen in [Table 3](#).

Overall, undergraduate student respondents in the College of Engineering have a middle to high sense of affiliation with and belonging in the College ($M_{UG}=3.59$, $SD=.645$). Graduate student respondents had a higher Affiliation and Sense of Belonging ($M_{GRAD}=3.82$, $SD=.705$) with the College than did undergraduate students.

Gender and LGBTQ+ identity

Undergraduate student respondents who identified as Women were significantly lower than respondents who identified as Men on all the overall scale ($M_{WOMEN}=3.49$, $M_{MEN}=3.67$). Respondents who had a gender identity of “Other” ($M_{OTHER}=2.86$) were significantly lower than their peers. Respondents who identified as LGBTQ+ were also significantly lower than their peers ($M_{LGBTQ+}=3.28$; $M_{NON}=3.63$). This pattern held on all subscales except Affiliation/Status for students who identify as Women or Other Gender.

While this same pattern held for graduate student respondents ($M_{WOMEN}=3.75$, $M_{MEN}=3.86$), the between group differences based on gender identity were not significant. Between group differences based on LGBTQ+ status were significant for graduate student respondents ($M_{LGBTQ+}=3.45$, $M_{NON}=3.85$).

Racial/Ethnic Category

Domestic minority undergraduate student respondents ($M_{MIN}=3.42$) were significantly lower than domestic majority ($M_{MAJ}=3.58$) and international student ($M_{INTL}=3.71$) respondents on the overall Belonging and Affiliation measure. This pattern generally held for sub-scales except the Affiliation/Status sub-scale. The largest differences were seen on the Belonging, Student Connections and Faculty/Staff Connections subscales.

Graduate student respondents showed similar patterns to undergraduate student respondents. Domestic minority graduate student respondents expressed lower overall levels on this scale ($M_{MIN}=3.17$) than Domestic majority graduate student ($M_{MAJ}=3.72$) and International student ($M_{INTL}=3.99$) respondents and were significantly lower on all 4 subscales. Differences across all sub-scales between domestic minority graduate student and domestic majority graduate student respondents were substantial. International graduate student respondents had the highest average scores on the overall scale and all sub-scales.

Professors

Precise wording on survey questions evaluating professors can be seen in [Appendix 4](#), and results can be seen in [Table 4](#).

Comparison with 2019

There was no significant difference between undergraduate or graduate student respondent ratings of Professors from 2019 to 2022. For undergraduate student respondents, the mean value on the 21-items evaluating Professors was identical to .01 ($M_{2019}=3.52$, $M_{2022}=3.51$), while for graduate student

respondents the means were identical to .04 ($M_{2019}=3.73$, $M_{2022}=3.76$). Because there was no mean difference over time, no survey year by sub-group analyses were performed.

Gender and LGBTQ+ identity

There were significant differences between undergraduate student respondents who identified as women, men and other gender on the mean values rating Professors. Students who identify as women ($M_{WOMEN}=3.41$), on average rated professors lower than did students who identified as men ($M_{MEN}=3.54$). Students who self-identified as other gender rated professors still lower than their peers ($M_{OTHER}=3.25$). Undergraduate students who identified as LGBTQ+ were also significantly different than their peers on mean Professor ratings ($M_{LGBTQ+}=3.37$, $M_{NON}=3.50$).

When investigating individual items on the Professor scale, significant differences were found on 14 of the 22 items. Typical response patterns based on Gender Identity are similar to the differences seen in the overall scale. There were no significant differences for undergraduate student respondents based on LGBTQ+ identity.

There were no significant between group differences on the Professor scale for graduate student respondents based on gender or LGBTQ+ identity.

Racial/Ethnic Category

There were significant differences between undergraduate student respondents who identified as domestic majority students, domestic minority students, and international students on the mean values rating Professors. As in 2019, International student respondents rated Professors the highest ($M_{INTL}=3.60$), domestic majority student respondents somewhat lower ($M_{MAJ}=3.48$) and domestic minority student respondents the lowest ($M_{MIN}=3.39$).

There were no significant between group differences for graduate student respondents based on racial/ethnic category.

Teaching Assistants

Comparison with 2019

There was no significant difference between undergraduate or graduate respondent ratings of Teaching Assistants from 2019 to 2022. Results related to Teaching Assistants can be found in [Table 4](#).

Gender and LGBTQ+ identity

For undergraduate respondents in 2022, there were no significant differences between students who identified as men, women or other gender. However, for graduate respondents, the difference between men ($M_{MEN}=3.68$), women and other gender students ($M_{WOMEN/OTHER}=3.85$) was significant, with women and other gender graduate students on average rating Teaching Assistants higher.

There were no significant differences based on LGBTQ+ identity for undergraduate or graduate student respondents.

Racial/Ethnic Category

There were no significant differences in Teaching Assistant evaluations by race/ethnicity in undergraduate or graduate student respondents.

Feeling Welcomed

The “Feeling Welcomed” items were developed in 2019 to understand how welcome students felt by Professors, Teaching Assistants, Academic Departments and Other Students. These items have been supplemented by the “Sense of Belonging and Affiliation” items that were developed for 2022. These two scales are highly correlated for undergraduate ($r=.745$, $p<.001$) and graduate students ($r=.791$, $p<.001$) but not identical. Results on Feeling Welcomed can be found in [Table 5](#).

Comparison with 2019

There were no significant changes between 2019 and 2022 on Feeling Welcomed. Mean values are nearly identical for undergraduate student respondents ($M_{2019}=3.77$ / $M_{2022}=3.76$). For graduate student respondents, the mean value rose slightly but the change did not meet the threshold for significant change ($M_{2019}=3.90$, $M_{2022}=3.94$).

Gender and LGBTQ+ identity

For undergraduate respondents, there were significant differences between students who identified as men, women or other gender on Feeling Welcomed. between men ($M_{MEN}=3.81$), women ($M_{WOMEN}=3.65$), and other gender students ($M_{OTHER}=3.11$). There were also significant differences for undergraduate student respondents who identified as LGBTQ+ ($M_{LGBTQ+}=3.52$, $M_{NON}=3.78$).

For graduate student respondents, there were no significant differences based on gender identity ($M_{FW}=3.94$), although it should be noted that the very low number of graduate respondents who reported a gender identity of Other ($N=2$), the average Feeling Welcome was much lower. There were no significant differences for students who identified as LGBTQ+.

Racial/Ethnic Category

There were significant differences on Feeling Welcomed between International undergraduate student ($M_{INTL}=3.81$), domestic majority ($M_{MAJ}=3.77$), and domestic minority student respondents ($M_{MIN}=3.58$).

For graduate student respondents, there were also differences on Feeling Welcomed by racial/ethnic category. The difference between International and Domestic Majority student respondents was non-significant ($M_{INTL}=4.02$; $M_{MAJ}=3.96$), while Domestic Minority student respondents averaged significantly lower levels of Feeling Welcomed than their peers ($M_{MIN}=3.24$).

Engineering Academic Confidence

Engineering Academic Confidence² is a 6-item scale that measures how confident students are in their ability to successfully navigate the variety of academic challenges in an engineering course curriculum, including course work (engineering, math, science) and lab work. Items also ask students to compare their engineering academic abilities to those of their peers. Engineering Academic Confidence is important because research suggests it strongly influences retention to major and to the field of engineering. Results on Engineering Academic Confidence can be found in [Table 6](#).

Comparison with 2019

Since 2019, and in a continuing trend back to 2008, there has been a significant decline in Engineering Academic Confidence for undergraduate student respondents. The analysis used a weighted population values for the comparison to 2019, thus the changes in the population of undergraduate students that responded to the survey is not responsible for the overall decline; the reasons for this decline are not known and warrant additional investigation.

For respondents identifying as men, Engineering Academic Confidence stayed steady ($M_{\text{MEN}}=3.78$). However, significant declines were seen for respondents identifying as women ($M_{2019}=3.61$; $M_{2022}=3.48$) and for respondents who identify as LGBTQ+ ($M_{2019}=3.60$; $M_{2022}=3.41$).

There was no significant change in engineering academic confidence for graduate student respondents since 2019 ($M_{2019}=3.94$; $M_{2020}=3.89$). Note that graduate student engineering academic confidence would be expected to be very high, given that these students have experienced academic success in their undergraduate careers. This continued to be the case for all graduate student respondents.

Gender and LGBTQ+ identity

Undergraduate student respondents identifying as women ($M_{\text{WOMEN}}=3.48$) or other gender ($M_{\text{OTHER}}=3.15$) were significantly different from the overall mean ($M_{\text{UG}}=3.69$), and significantly different from undergraduate respondents identifying as men ($M_{\text{MEN}}=3.78$). Undergraduate respondents who identify as LGBTQ+ were also significantly different from their peers ($M_{\text{LGBTQ+}}=3.41$; $M_{\text{NON}}=3.70$)

Graduate student respondents identifying as women ($M_{\text{WOMEN}}=3.74$) were significantly different from the mean ($M_{\text{GRAD}}=3.89$) and from their peers who identified as men ($M_{\text{MEN}}=3.91$) or other gender ($M_{\text{OTHER}}=4.86$). There was no significant difference in Engineering Academic Confidence for graduate student respondents who identify as LGBTQ+.

Racial/Ethnic Category

For undergraduate students, there were significant differences between International student, domestic majority and domestic minority respondents. International student respondents had the highest average Engineering Academic Confidence ($M_{\text{INTL}}=3.76$), which was not significantly different from the overall mean ($M_{\text{UG}}=3.69$). Domestic Majority student respondents Engineering Academic Confidence ($M_{\text{MAJ}}=3.67$) was not significantly different from the overall mean for all undergraduate student respondents but was significantly different from both International and Domestic Minority student respondents. Domestic Minority student respondents had the lowest average Engineering Academic Confidence ($M_{\text{MIN}}=3.40$), and this value was significantly different from both the overall mean for

² In psychology research literature, this construct is called “self-efficacy” (Bandura, 1977) which is defined as an individual’s belief in their ability to successfully execute tasks in a particular domain, such as engineering academic course work. We have chosen to use the more common lay term “confidence”.

undergraduate student respondents and when compared to International or Domestic Majority student respondents.

For graduate students, there were no significant differences between all graduate student respondents and International and Domestic Majority student respondents ($M_{\text{GRAD}}=3.89$). Domestic Minority graduate student respondents Engineering Academic Confidence on average was significantly different from their peers ($M_{\text{MIN}}=3.46$).

Engineering Student Interaction

Engineering Student Interaction is made of 7 items intended to measure how much students enjoy working with and interacting with their peers in engineering. Results on Engineering Student Interaction can be found in [Table 6](#).

Comparison with 2019

There was a significant decline in undergraduate students average Engineering Student Interaction from 2019 to 2022 ($M_{2019}=3.57$; $M_{2022}=3.45$). The ratings of respondents identifying as women and as LGBTQ+ declined from 2019 to 2022 more than did their peers. This pattern was not seen with graduate student respondents, who had similar average ratings in 2019 and 2022.

Gender and LGBTQ+ identity

For undergraduate students, respondents identifying as women were significantly different from the overall mean, and significantly different from respondents identifying as men or other gender on Engineering Student Interactions ($M_{\text{WOMEN}}=3.40$). Respondents who identify as LGBTQ+ had significantly lower ratings of student interactions than did their peers ($M_{\text{LGBTQ+}}=3.33$ $M_{\text{NON}}=3.46$). For graduate respondents, there were no significant differences based on gender or LGBTQ+ identity.

Racial/Ethnic Category

For undergraduate students, there were no significant differences by racial/ethnic category on Engineering Student Interactions. However, for graduate students, there were significant between group differences. Respondents who identified as International were not different from the overall graduate respondent mean ($M_{\text{GRAD}}=3.51$; $M_{\text{INTL}}=3.58$). Domestic Majority respondents were the highest on this measure ($M_{\text{MAJ}}=3.96$) and were significantly different from both the average for all graduate respondents, and different from their peers. Domestic Minority respondents were also significantly different from the overall average and from their peers. These student respondents had the lowest average rating for this measure ($M_{\text{MIN}}=3.06$).

Commitment to Engineering Major

Commitment to Engineering Major are 9 items that tap how likely the participant is to change majors as compared to completing their degree in engineering. It appears to measure the level of ambivalence students may feel about their major; however, it has not been shown to directly influence retention to

engineering. In other words, students' ambivalence does not necessarily mean they will leave engineering. It is also important to note that since 2019, this measure has been very high (median=4.0) in both undergraduate and graduate student respondents. Thus, between group differences should be interpreted with caution. Results on Commitment to Engineering Major can be found in [Table 6](#).

Comparison with 2019

There were no significant differences since 2019 for either undergraduate or graduate student respondents.

Gender Identity and LGBTQ+ Identity

For undergraduate students, respondents who identified as women ($M_{\text{WOMEN}}=3.81$) were significantly different from respondents who identified as men ($M_{\text{MEN}}=3.95$), and those who identified as other gender ($M_{\text{OTHER}}=3.69$). Respondents who identified as LGBTQ+ had lower average ratings on Commitment to Engineering than did their peers ($M_{\text{LGBTQ+}}=3.77$; $M_{\text{NON}}=3.92$). For graduate respondents, there were no between group differences based on gender identity.

Racial/Ethnic Category

There was no significant difference on Commitment to Major between groups based on race/ethnicity for either undergraduate or graduate respondents.

Research Group Environment

Research Group Environment is a 6-item measure of the peer and learning environment in research groups. Both undergraduate and graduate students who have worked in research groups in the College of Engineering completed these items. Results on Research Group Environment can be seen in [Table 7](#).

Comparison with 2019

There was no significant difference since 2019 for either undergraduate or graduate student respondents.

Gender Identity and Racial/Ethnic Category

There were no significant between group differences for either undergraduate or graduate student respondents on their evaluations of the Research Group Environment.

Graduate Students' Relationship with PI/Faculty Advisor

This measure was introduced in 2019, and it measures the level of trust and overall relationship that graduate students engaged in research experience with their Principal Investigator or Faculty Advisor. Overall, graduate students engaged in research (N=195) rate this relationship high. Results on Relationship with PI/Faculty Advisor can be found in [Table 8](#).

Comparison with 2019

Graduate respondents in 2022 on average rated Relationship with PI/Faculty identically to 2019 ($M_{2019}=4.00; M_{2022}=4.00$).

Gender Identity and LGBTQ+ Identity

There were no significant group differences for Relationship with PI on gender or LGBTQ+ identity.

Racial/Ethnic category

There were significant differences by racial/ethnic category on graduate student respondents' evaluation of their relationship with their PI/faculty advisor. Respondents who identified as International or as Domestic Majority were not different from the overall graduate respondent mean ($M_{GRAD}=4.00; M_{INTL}=4.19; M_{MAJ}=3.99$). Domestic Minority respondents were significantly different from the overall average and from their peers. These respondents had the lowest average rating for this measure ($M_{MIN}=3.71$).

Graduate Student Research and Teaching Confidence

As with Engineering Academic Confidence, graduate students involved in engineering research and teaching were asked about their training and confidence in these activities. Regarding research, items asked students involved in research about their confidence in contributing to and conducting their own research and publication ("Research Confidence"). For teaching, we asked graduate students who have been Teaching Assistants ($N=120$) about their preparation and support for teaching tasks ("Teaching Assistant Training"), and their confidence in contributing to teaching a course, developing curriculum and classroom management ("Teaching Assistant Teaching Confidence"). Results from these measures can be found in [Table 8](#).

Comparison with 2019

There was no significant difference between 2019 and 2022 on Research Confidence ($M_{2019}=3.77; M_{2022}=3.76$), Teaching Assistant Confidence ($M_{2019}=3.91; M_{2022}=3.91$) or Teaching Assistant Training ($M_{2019}=3.12; M_{2022}=3.23$).

Gender Identity, LGBTQ+ Identity, and Racial/Ethnic Category

There were no significant between group differences for Research Confidence or Teaching Assistant Confidence. There were non-significant between group differences on respondents' evaluation of Teaching Assistant Training, with International respondents rating this training lower than either Domestic Majority or Domestic Minority respondents ($M_{INTL}=3.50; M_{MAJ}=3.84; M_{MIN}=4.00$).

College Resources

Students were asked whether they had used various student services resources (Undergraduate Learning Center, Academic Advisors, Faculty Advisors, Career Services, Career Fairs, Diversity Affairs Office, International Engineering/Study Abroad, Academic Dept. Services, and CAE Labs), and if they had

used these resources they were asked to rate how helpful they were. Results on student satisfaction with colleges resources can be found in [Tables 9.1](#) and [Table 9.2](#).

Comparison with 2019

Undergraduate student respondents were significantly less satisfied with the Undergraduate Learning Center (ULC), International/Study Abroad, Departmental resources and computer labs. Note that ULC services were virtual during multiple semesters, and International/Study Abroad services were suspended throughout several years of the pandemic.

For graduate student respondents, usage of many of these services increased compared to 2019. Graduate respondents rated their Faculty Academic Advisors significantly higher than in 2019 and most College Resources more positively in 2022 than in 2019. Likely because of the smaller number of graduate students that participate in the E3 survey as compared to undergraduates, differences on these measures between 2019 and 2022 did not reach statistical significance.

Appendix 1: Survey participant demographic breakdown

Table 1.1: Undergraduate student participants

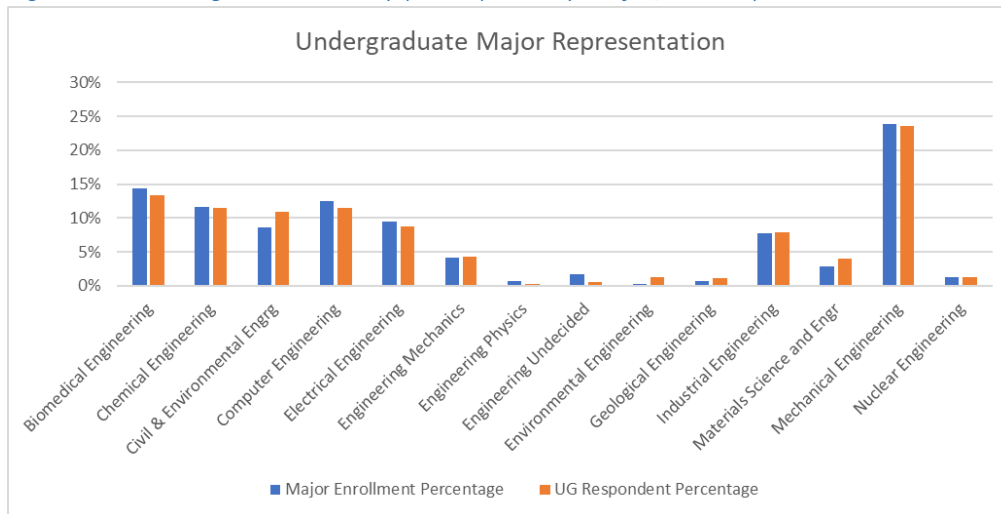
Demographic Category	Survey Respondents N	College Enrollment N	Survey Respondents %	College Enrollment %
Man	660	3089	60%	73.1%
Woman	419	1139	38.2%	26.9%
Other Gender	20	-	1.8%	-
Domestic Underrepresented Minority*	86	363	7.8%	8.6%
Domestic Majority or Not Specified	923	3401	84%	80.4%
International	103	464	9.4%	10.9%
First Generation	111	-	10.1%	-
LGBTQ+ Identity	150	-	13.7%	-
Disability Status				
All	1099	4228	Undergraduate Response Rate: 26%	

* African American, Hispanic, Native American/Alaskan Native, Native Hawaiian, Southeast Asian

** Participants with missing data on demographic questions are not included in totals or percentages.

-No data available.

Figure 1.0: Undergraduate survey participants by major, as compared to enrollment in Spring 2022



Data from UW Data Warehouse/InfoAccess, enrollment queried for survey invitations

Table 1.2: Graduate student participants

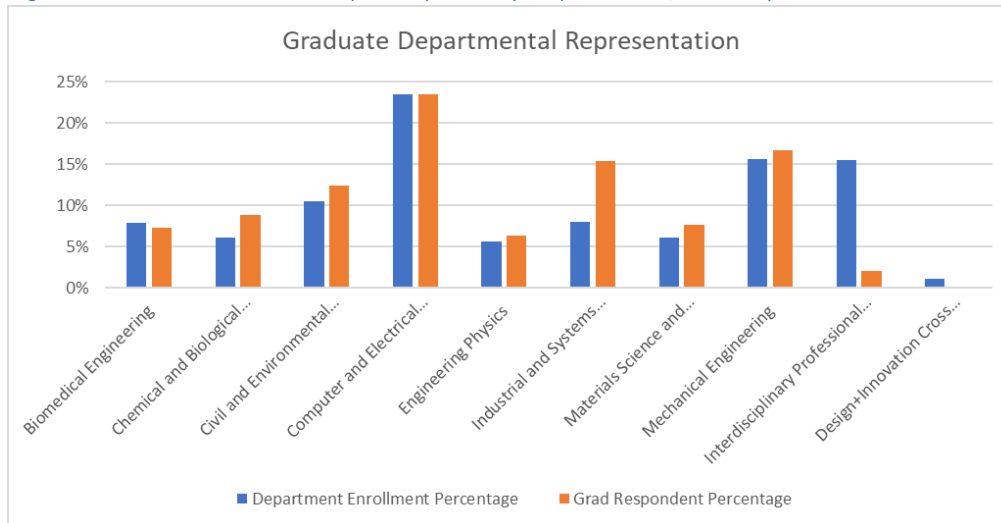
Demographic Category	Survey Respondents N	College Enrollment N	Survey Respondents %	College Enrollment %
Man	253	1049	64.5%	72.3%
Woman	137	403	34.9%	27.7%
Other Gender	2	-	0.5%	-
Domestic Targeted Minority*	29	114	7.4%	7.8%
Domestic Majority or Not Specified	162	736	41.3%	50.6%
International	205	602	52.2%	41.5%
First Generation	83	-	21.2%	-
LGBTQ+ Identity	42	-	10.7%	-
Disability Status Yes	17		4.3%	
Degree Type				
-Professional	11	202	2.8%	13.9%
-One Year MS	90	135	23%	9.3%
-Research MS	62	378	15.8%	26%
-Ph.D.	233	737	59.4%	50.7%
All	392	1452	Graduate Response Rate: 27%	

* African American, Hispanic, Native American/Alaskan Native, Native Hawaiian, Southeast Asian

** Participants with missing data on demographic questions are not included in totals or percentages.

-No data available.

Figure 1.2: Graduate student participants by department, as compared to enrollment in Spring 2022



Data from UW Data Warehouse/InfoAccess, enrollment queried for survey invitations

Appendix 2: Scale and Item Results

Table 2: Stereotyping and harassment - differences by survey year

Item	Percent responding "YES"			
	UG 2019 N=1125	UG 2022 N=1096	Grad 2019 N=295	Grad 2022 N=392
In class, singled out unfairly by faculty				
...because of your gender?	3.7	4.3	1.7	3.1
...because of your race/ethnicity?	0.8	0.9	1.0	1.0
...because of your sexual orientation?	0.4	0.6	0	0
In the College, singled out unfairly by another student				
...because of your gender?	11.7	12.8	8.9	6.1
...because of your race/ethnicity?	4.7	3.5	6.5	5.4
...because of your sexual orientation?	1.3	1.7	1.7	0.5
In class, instructors or faculty express stereotypes				
...about men and women	17.9	18.4	12.6	9.7
...about racial groups	8.3	6.0*	9.9	7.7
...about LGBTQ people.	2.6	3.3	2.4	3.6
In class, TAs express stereotypes				
...about men and women	5.9	5.1	3.8	3.1
...about racial groups	3.0	1.5*	2.0	3.3
...about LGBTQ people.	0.9	1.0	1.0	1.5
In class, engineering students express stereotypes				
...about men and women	40.5	35.5**	25.7	18.1**
...about racial groups	34.9	23.7**	25.3	16.0**
...about LGBTQ people.	15.5	15.9	10.6	10.2
Harassment by faculty				
I have been sexually harassed by an engineering faculty member.	0.5 (N=6)	0.1 (N=1)	0.0 (N=0)	0.3 (N=1)
I have been harassed by an engineering faculty member because of race.	0.4 (N=5)	0.2 (N=2)	0.7 (N=2)	0
I have been harassed by engineering faculty member because of my sexual orientation.	0.3 (N=3)	0.3 (N=3)	0.3 (N=1)	0
Harassment by TAs				
I have been sexually harassed by a TA.	0.1 (N=1)	0.4 (N=4)	0.3 (N=1)	0.5 (N=2)
I have been harassed by a TA because of race.	0.1 (N=2)	0.2 (N=2)	0	0
I have been harassed by engineering TA because of my sexual orientation.	0	0.4 (N=4)	0	0
Harassment by students				
I have been sexually harassed by an engineering student.	2.8 (N=31)	2.6 (N=28)	2.7 (N=8)	2.1 (N=8)
I have been harassed by engineering student because of my race.	0.9 (N=10)	0.8 (N=9)	2.0 (N=6)	1.0 (N=4)
I have been harassed by engineering student because of my sexual orientation.	0.4 (N=4)	1.1* (N=12)	0.7 (N=2)	0.3 (N=1)

N=Number of reports; N reported for information on specific items when percentages are low.

* = $p < .05$, ** = $p < .01$

Table 2.1: Stereotyping and Harassment by Gender and Racial/Ethnic Identity Groups

Items	Percent responding "YES"	
	UG 2022 N=1096	Grad 2022 N=392
In class, personally experienced faculty or instructors express stereotypes about women and men...		
- All students	18.4	9.7
- Women	33.1**	16.1**
- Men	8.3**	5.9**
- Other Gender	47.4**	50.0
In class, personally experienced TAs express stereotypes about women and men...		
- All students	5.1	3.1
- Women	10.6**	3.6**
- Men	1.4**	2.4**
- Other Gender	10.5**	--
In class, personally experienced other students express stereotypes about women and men...		
- All students	35.5	18.1
- Women	52.8**	13.7
- Men	23.3**	25.7
- Other Gender	78.9**	--
Have you ever been sexually harassed by another student?		
All students	2.6	2.1
- Women	5.3**	3.7
- Men	0.8	1.2
- Other Gender	5.6**	0.0
In class, personally experienced faculty or instructors express stereotypes about race/ethnicity...		
- All students	6.0	7.7
- International	6.9	4.4**
- Domestic majority	5.4	10.7**
- Domestic minority	11.6	14.3**
In class, personally experienced other students express stereotypes about race/ethnicity...		
- All students	23.7	16.0
- International	21.8	9.8**
- Domestic majority	23.0	20.0**
- Domestic minority	33.7	37.9**
Have you ever been harassed by another student because of your race or ethnicity?		
- All students	0.8	1.0
- International	1.0	0.0
- Domestic majority	0.2	1.3
- Domestic minority	7.0**	6.9**

* $p < .05$; ** $p < .01$; Differences not reaching statistical significance are shown for information purposes.

Table 2.2: Stereotyping and Harassment by Sexual Orientation

Items	Percent responding "YES"	
	UG 2022 N=1091	Grad 2022 N=392
In class, personally experienced faculty or instructors express stereotypes about LGBTQ+ people		
- All students	3.3	3.6
- LGBTQ+	10.0** (N=150)	11.9** (N=42)
- Non-LGBTQ+	2.2 (N=941)	2.6 (N=348)
In class, personally experienced students express stereotypes about LGBTQ+ people		

- All students	16.0	10.3
- LGBTQ+	43.3**	23.8**
- Non-LGBTQ+	11.6	8.6
In class, singled out unfairly by a faculty member because of your sexual orientation		
- All students	0.6	0.3
- LGBTQ+	2.7**	2.4**
- Non-LGBTQ+	0.3	n/s
Singled out unfairly by another student because of your sexual orientation		
- All students	1.7	0.5
- LGBTQ+	8.7**	n/s
- Non-LGBTQ+	0.5	n/s
Harassed by another student because of your sexual orientation		
- All students	1.1	0.5
- LGBTQ+	6.7**	n/s
- Non-LGBTQ+	0.2	n/s

*n/s = non-significant between group difference; * $p < .05$; ** $p < .01$;*

Table 3: Affiliation and Sense of Belonging

Rating Scale (1=most negative - 5=most positive)	2022 UG N=1001	2022 Grad N=288
Belonging and Affiliation (20 items)	3.59	3.82
- Women	3.49** (N=386)	3.75 (N=101)
- Men	3.67 (N=597)	3.86 (N=185)
- Other Gender	2.86** (N=18)	--
- LGBTQ+	3.28** (N=140)	3.45** (N=26)
- International	3.71** (N=84)	3.99** (N=148)
- Domestic Majority	3.58 (N=837)	3.72** (N=116)
- Domestic Minority	3.42** (N=80)	3.17** (N=24)
Belonging (8 items)	3.85	3.97
-Women	3.69**	3.90
- Men	3.96	4.02
- Other Gender	3.16**	3.11
- LGBTQ+	3.50**	3.66
- International	3.85	4.08**
- Domestic Majority	3.87	3.98**
- Domestic Minority	3.57**	3.28**
Affiliation/Status (4 items)	3.56	3.75
- Women	n/s	3.62
- Men	n/s	3.54
- Other Gender	3.00**	3.00**
- LGBTQ+	3.33**	3.38**
- International	3.84**	4.09
- Domestic Majority	3.53	3.42**
- Domestic Minority	3.54	3.15**
Student Connections (3 items)	3.44	3.56
-Women	3.35**	3.41
- Men	3.54**	3.64
- Other Gender	2.41**	3.33
- LGBTQ+	3.01**	3.01**
- International	n/s	3.72**
- Domestic Majority	n/s	3.50**
- Domestic Minority	3.16**	2.83**
Faculty/Staff Connections (4 items)	3.12	3.73
-Women	2.99*	n/s
- Men	3.23	n/s
- Other Gender	2.38**	3.00**
- LGBTQ+	2.9**	n/s
- International	3.47**	3.90**
- Domestic Majority	3.09*	3.62**
- Domestic Minority	3.09*	3.21**

Notes: (1) Some participants that identify as “other gender” may also identify as LGBTQ+. (2) Some differences not reaching statistical significance are shown for information only.(3) n/s = non-significant between group difference; *p<.05; **p<.01;

Table 4: Engineering Professors and Teaching Assistants

Rating (1=most negative - 5=most positive)	2019 UG N=1132	2022 UG N=1118	2019 Grad N=294	2022 Grad N=388
Professors (21 items)	3.52	3.51	3.73	3.76
- Women	3.48* (N=386)	3.41** (N=419)	n/s	n/s
- Men	3.54 (N=739)	3.54 (N=673)	n/s	n/s
- Other Gender	---	3.25** (N=20)	---	---
- LGBTQ+	n/s	3.37** (N=150)	n/s	n/s
- International	n/s	3.60	n/s	n/s
- Domestic Majority	n/s	3.48** (N=923)	n/s	n/s
- Domestic Minority	3.45* (N=69)	3.39** (N=86)	3.37* (N=20)	n/s
Teaching Assistant	N=1065	N=1009	N=203	N=288
Teaching Assistants (8 items)	3.59	3.59	3.65	3.74
- Women	n/s	n/s	n/s	3.86
- Men	n/s	n/s		3.68*
- Other Gender	---	n/s	---	3.81
- LGBTQ+	n/s	n/s	n/s	n/s
- International	n/s	3.77	n/s	n/s
- Domestic Majority	n/s	3.57	n/s	n/s
- Domestic Minority	n/s	3.39	3.37* (N=14)	n/s

Notes: (1) Not all students report having had Teaching Assistants, so N is lower for these items; (2) Some participants that identify as “other gender” may also identify as LGBTQ+. (3) Some differences not reaching statistical significance are shown for information only. (4) n/s = non-significant between group difference; * $p < .05$; ** $p < .01$;

Table 5: Feeling Welcomed

Rating (1=most negative - 5=most positive)	2019 UG N=1046	2022 UG N=1108	2019 Grad N=290	2022 Grad N=386
Feeling Welcomed (4 items)	3.77	3.76	3.90	3.94
- Women	3.70** (N=363)	3.65** (N=418)	3.89 (N=103)	n/s
- Men	3.81 (N=701)	3.81** (N=666)	3.91 (N=187)	n/s
- Other Gender	--	3.11** (N=20)	---	n/s
- LGBTQ+	3.52** (N=77)	3.52** (N=150)	n/s	3.80* (N=42)
- International	3.79 (N=109)	3.81 (N=103)	3.89 (N=122)	4.02 (N=204)
- Domestic Majority	3.76 (N=948)	3.77* (N=915)	3.98 (N=148)	3.96 (N=160)
- Domestic Minority	3.53** (N=69)	3.58* (N=86)	3.49** (N=20)	3.24** (N=29)

Notes: (1) Some participants that identify as “other gender” may also identify as LGBTQ+. (2) n/s = non-significant between group difference; * $p < .05$; ** $p < .01$;

Table 6: Academic Confidence, Student Interaction, Commitment to Engineering Major

Rating (1=most negative - 5=most positive)	2019 UG N=1126	2022 UG N=1096	2019 Grad N=295	2022 Grad N=388
Engineering Academic Confidence (6 items)	3.78	3.69**	3.94	3.89
- Women	3.61** (N=389)	3.48** (N=416)	n/s	3.74** (N=132)
- Men	3.85 (N=736)	3.78** (N=661)	n/s	3.91
- Other Gender	---	3.15** (N=19)	---	4.86** (N=2)
- LGBTQ+	3.60* (N=77)	3.41** (N=150)	n/s	n/s
- International	n/s	3.76 (N=103)	n/s	n/s
- Domestic Majority	n/s	3.67 (N=907)	n/s	n/s
- Domestic Minority	n/s	3.40** (N=86)	3.56** (N=20)	3.46** (N=29)
Engineering Student Interaction (7 items)	3.57 (N=1069)	3.45** (N=1104)	3.57	3.51
- Women	n/s	3.40* (N=419)	n/s	n/s
- Men	n/s	3.48 (N=662)	n/s	n/s
- Other Gender	---	3.03** (N=20)	---	n/s
- LGBTQ+	3.43* (N=77)	3.33* (N=150)	n/s	3.53 (N=42)
- International	3.46* (N=109)	n/s	n/s	3.58 (N=203)
- Domestic Majority	3.58 (N=945)	n/s	n/s	3.96* (N=158)
- Domestic Minority	3.43* (N=67)	n/s	n/s	3.06* (N=29)
Commitment to Engineering Major (9 items)	3.94	3.91	3.95	4.01
- Women	n/s	3.81** (N=418)	n/s	n/s
- Men	n/s	3.95 (N=660)	n/s	n/s
- Other Gender	---	3.69** (N=19)	---	n/s
- LGBTQ+	3.71* (N=77)	3.77** (N=150)	n/s	n/s
- International	n/s	n/s	n/s	n/s
- Domestic Majority	n/s	n/s	n/s	n/s
- Domestic Minority	n/s	n/s	3.86* (N=20)	n/s

Notes: (1) Some participants that identify as “other gender” may also identify as LGBTQ+. (2) n/s = non-significant between group difference; *p<.05; **p<.01;

Table 7: Research Group Environment

Rating Scale (1=most negative - 5=most positive)	2019 UG N=1126	2022 UG N=1118	2019 Grad N=295	2022 Grad N=388
Research Group Experience (6 items) <i>-No significant between group differences</i>	3.71 (N=207)	3.72 (N=179)	3.78 (N=180)	3.83 (N=195)

Table 8: Graduate Student Research and Teaching

Rating Scale (1=most negative - 5=most positive)	2019 Grad (N=295)	2022 Grad (N=388)
Relationship with PI + (10 items)	4.00 (N=194)	4.00 (N=195)
- Women	n/s	n/s
- Men	n/s	n/s
- Other Gender	---	n/s
- LGBTQ+	n/s	n/s
- International	n/s	4.19 (N=121)
- Domestic Majority	n/s	3.99 (N=89)
- Domestic Minority	3.57* (N=13)	3.71** (N=13)
Research Confidence + (5 items)	3.77 (N=263)	3.76 (N=269)
- Women	3.66* (N=94)	n/s
- Men	3.81 (N=166)	n/s
- Other Gender	---	n/s
- LGBTQ+	n/s	n/s
- International	n/s	n/s
- Domestic Majority	n/s	n/s
- Domestic Minority	3.26** (N=20)	n/s
Teaching Assistant Teaching Confidence** (4 items) <i>- No significant between group differences</i>	3.91 (N=103)	3.91 (N=120)
Teaching Assistant Training** (6 items)	3.12 (N=103)	3.23 (N=119)
- Women	2.90* (N=94)	n/s
- Men	3.10 (N=166)	n/s
- Other Gender	---	n/s
- LGBTQ+	n/s	n/s
- International	3.34 (N=43)	3.50 (N=67)
- Domestic Majority	2.88 (N=49)	3.84 (N=51)
- Domestic Minority	2.60* (N=11)	4.00 (N=13)

Notes: (1) Some participants that identify as "other gender" may also identify as LGBTQ+; (2) +Research Grad respondents only, ++TAs only; (3) n/s = non-significant between group difference; *p<.05; **p<.01

Table 9.1: Satisfaction with College Resources: undergraduate students

Year of Survey		How helpful is the College of Engineering Undergraduate Learning Center?	How helpful are College of Engineering Academic Advisors (non-faculty)?	How helpful are College of Engineering Faculty Academic Advisors?	How satisfied are you with College of Engineering Career Services?	How satisfied are you with College of Engineering Career Fairs?	How satisfied are you with College of Engineering Diversity Affairs Office services?	How satisfied are you with College of Engineering International Engineering Studies and Programs (study abroad)?†	How helpful are the resources in your academic department (departmental staff and chair)?	How satisfied are you with College of Engineering Computer Engineering/Computer Labs?	How satisfied are you with the size of your Engineering classes (number of students in class)?
2019	Mean	4.06	3.58	3.69	3.70	3.67	4.20	3.83	3.67	4.06	3.70
	N	681	610	690	602	849	74	219	505	911	1129
	SD	.885	1.027	.969	.906	.986	.811	1.038	.819	.725	.861
2022	Mean	3.90**	3.48	3.59	3.72	3.63	4.15	3.38**	3.56*	3.98*	3.67
	N	598	552	616	582	768	88	141	479	786	1104
	SD	.956	1.086	1.013	.909	.971	.929	1.059	.851	.766	.862

Between years significant difference * $p < .05$; ** $p < .01$

† International/Study Abroad services were suspended throughout several years of the pandemic

Table 9.2: Satisfaction with College Resources: graduate students

Year of Survey		How helpful is the College of Engineering Undergraduate Learning Center?	How helpful are College of Engineering Academic Advisors (non-faculty)?	How helpful are College of Engineering Faculty Academic Advisors?	How satisfied are you with College of Engineering Career Services?	How satisfied are you with College of Engineering Career Fairs?	How satisfied are you with College of Engineering Diversity Affairs Office services?	How satisfied are you with College of Engineering International Engineering Studies and Programs (study abroad)?†	How helpful are the resources in your academic department (departmental staff and chair)?	How satisfied are you with College of Engineering Computer Engineering/Computer Labs?	How satisfied are you with the size of your Engineering classes (number of students in class)?
2019	Mean	3.83	3.75	3.81	3.65	3.36	3.67	3.91	4.02	3.90	3.95
	N	24	55	137	113	127	9	22	165	216	293
	Std. Deviation	.917	.927	.936	.963	.981	.707	.811	.815	.827	.729
2022	Mean	4.23	3.89	4.05*	3.79	3.49	4.04	3.85	4.06	3.98	3.94
	N	53	98	221	170	184	25	40	223	233	392
	Std. Deviation	.974	1.024	.829	.878	1.086	.978	.975	.795	.751	.778

Between years significant difference * $p < .05$;

† International/Study Abroad services were suspended throughout several years of the pandemic

Appendix 3– Survey Items by Section/Scale

(RC)=Reverse Coded

DEMOGRAPHIC
Are you enrolled in a major in the College of Engineering at UW Madison?
How many years have you been enrolled at UW-Madison?
Are you an UG student or a Grad student?
What is your major? (UG)
Have you taken classes in the College of Engineering? (UG)
Have you met your departmental progression requirements? (UG)
Did you transfer to engineering from a major in another UW-Madison school or college?
Did you transfer to UW-Madison from another institution?
What Grad degree are you pursuing? (Grad)
Which engineering department are you most closely associated with? (Grad)
In what type of institution do you expect to be working? - Selected Choice
In what type of institution do you expect to be working? - None of the above, I expect to be working in a : - Text
What position do you expect to hold?
In what position do you expect to be working?
Thinking of your current and long-term educational plans, do you intend to complete a degree with an engineering major?
What is the highest level of engineering degree you would like to obtain?
For how many years do you see yourself working as an engineer?
PROFESSORS
How much do your Engineering professors care whether or not you learn the course materials?
How often do your Engineering professors encourage you to think creatively in class assignments and projects?
How often do you feel your Engineering professors place more value on their own research than on teaching engineering courses? (RC)
How often do your Engineering professors write or provide helpful comments on the materials and course assignments you turn in?
How often do your Engineering professors treat you with respect in the classroom or in office hours?
How often are you able to understand course materials (lecture notes, slides, books, etc.) in your Engineering courses?
How comfortable are you with asking professors questions in your Engineering courses?
How often do you think your Engineering professors think you have a lower ability than you actually have? (RC)
How fairly do your Engineering professors grade your work?
How seriously do your Engineering professors take your suggestions and comments in class?
How comfortable are you meeting with your Engineering professors for academic (coursework) help?
How clear are your Engineering course syllabi?
How clear are your Engineering professors' class expectations for you?

How much do your Engineering professors inspire you to study engineering?
How often do your Engineering professors keep the office hours they set for students?
How often do your Engineering professors encourage you to attend their office hours?
How often do you meet with your Engineering professors for extra help with coursework?
How often do your Engineering professors move through material too quickly? (RC)
How often do you feel overwhelmed by the amount of homework? (RC)
How often do language barriers between you and your Engineering professors make it difficult to understand course material? (RC)
How satisfied are you with your overall teaching experience with your Engineering professors?
Is there anything else you would like to tell us about your experiences with engineering professors as course instructors here at UW-Madison?
TEACHING ASSISTANTS
How effective are your Engineering teaching assistants at teaching?
How effective are your Engineering teaching assistants as communicators?
How knowledgeable are your Engineering teaching assistants about the subjects they teach?
How much have cultural differences made you less likely to meet with Engineering teaching assistants? (RC)
How comfortable are you meeting with your Engineering teaching assistants for academic help?
How satisfied are you with the assistance you receive from Engineering teaching assistants?
How often do you meet with your Engineering teaching assistants for extra help?
How satisfied are you with your overall experience with Engineering teaching assistants?
Overall, how welcome do teaching assistants make you feel in the College of Engineering?
Is there anything else you would like to tell us about your experiences with engineering teaching assistants here at UW-Madison?
AFFILIATION AND SENSE OF BELONGING (20 items)
Belonging (9 items)
Thinking about the College of Engineering overall, how often do you feel...? - Welcome
Thinking about the College of Engineering overall, how often do you feel...? - Respected
Thinking about the College of Engineering overall, how often do you feel...? – Excluded (Reverse Coded)
Thinking about the College of Engineering overall, how often do you feel...? - Safe
Thinking about the College of Engineering overall, how often do you feel...? - Like you belong
How often would you say the College of Engineering... - ...provides you with an environment where you have an opportunity to grow?
How often would you say the College of Engineering... - ...provides you with opportunities to have diverse experiences?
How often would you say the College of Engineering... - ...accepts your cultural customs?
How often would you say the College of Engineering... - ...values individual differences?
Affiliation/Status (4 items)
How much do you... - ...take pride in wearing College of Engineering clothing?

How much do you... - ...tend to associate yourself with the College?
How much do you... - ...like to tell people about being a student in the College of Engineering?
How much do you... - ...like to attend College of Engineering events?
Student Connections (3 items)
How “at home” do you feel in the College of Engineering?
How easy have you found it to establish relationships at the College of Engineering?
How similar do you feel to the other people in your engineering major?
Faculty/Staff Connections (4 items)
In the College of Engineering... - ...how much do you feel that a faculty or staff member cares about you?
In the College of Engineering... - ...how connected do you feel to a faculty or staff member?
In the College of Engineering... - ...how much have you felt appreciated by a faculty or staff member?
In the College of Engineering... - ...how much has a faculty member valued your contributions in class?
OVERALL QUALITY OF INSTRUCTION AT UW-MADISON
Thinking only about Engineering courses you have taken here at UW-Madison, what is the overall quality of teaching you have received?
Thinking only about science courses you have taken here at UW-Madison such as chemistry, physics, computer science, etc. what is the overall quality of teaching you have received?
Thinking only about math courses you have taken here at UW-Madison, what is the overall quality of teaching you have received?
Thinking only about humanities or social science courses you have taken here at UW-Madison, what is the overall quality of teaching you have received?
Is there anything else you would like to tell us about the overall quality of instruction here at UW-Madison?
ENGINEERING LAB COURSES
Have you ever had a lab in any of your engineering courses at the UW-Madison?
How valuable is your Engineering lab work?
How clearly are your Engineering lab experiments explained prior to each lab?
How satisfied are you with the technical communications training you are given in your Engineering lab courses (for example, for writing lab reports, or giving technical presentations)?
For most labs, how fairly is lab work divided up among the group members in your Engineering lab courses?
Is there anything else you would like to tell us about your experiences with Engineering labs here at UW-Madison?
COLLEGE RESOURCES - only participants who reported having used the following resources were asked to rate satisfaction
How helpful is the College of Engineering UG Learning Center?
How helpful are College of Engineering Academic Advisors (non-faculty)?
How helpful are College of Engineering Faculty Academic Advisors?
How satisfied are you with College of Engineering Career Services?
How satisfied are you with College of Engineering Career Fairs?
How satisfied are you with College of Engineering Diversity Affairs Office services?

How satisfied are you with College of Engineering International Engineering Studies and Programs (study abroad)?
How helpful are the resources in your academic department (departmental staff and chair)?
How satisfied are you with College of Engineering Computer Engineering/Computer Labs?
How welcome does your academic department make you feel?
How satisfied are you with the size of your Engineering classes (number of students in class)?
Is there anything else you would like to tell us about your experiences with College of Engineering resources at UW-Madison?
STUDENT INTERACTIONS
How valuable have you found participating in group projects in Engineering?
How much do you like studying with other students in a group in Engineering?
How much do you feel like you are part of an Engineering community in the UW-Madison College of Engineering?
How much do Engineering students at the UW-Madison help each other succeed in class?
How seriously do other students take your comments or suggestions in class or on group projects in the College of Engineering?
How often do students in your Engineering classes compete with each other? (RC)
What other comments do you have about your interactions with other Engineering students?
FEELING WELCOME
Overall, how welcome do Engineering course professors make you feel in the College of Engineering?
Overall, how welcome do teaching assistants make you feel in the College of Engineering?
Overall, how welcome do other Engineering students make you feel in the College of Engineering?
Overall, how welcome does your academic department make you feel?
EXPECTATIONS OF FIELD OF ENGINEERING
Compared to other professions, do you think the pay in Engineering is [Much less than <-> Much more than] other fields?
Compared to other professions, how flexible do you think Engineering is in allowing people to leave and come back to their careers?
Compared to other fields, how supportive is Engineering in allowing people to combine personal and family responsibilities with their work?
How much do you feel society values the work that engineers do?
How flexible is Engineering in allowing engineers to set their own work schedules?
How supportive is Engineering in allowing engineers to achieve a balance between work and personal life?
How interesting is Engineering to you?
How respected by others is Engineering as an occupation?
How important is the work of Engineers in making the world a better place?
How rewarding do you expect Engineering to be as a career?
How easy do you expect it be for you to find a job after earning an Engineering degree?
How prepared will your Engineering education make you for a job in the field of engineering?
How interested are you in declaring a non-Engineering major? (RC)

How confident are you that you prefer an Engineering major over any other possible non-engineering majors?
How much did the opinions of others affect your decision to study Engineering?
How committed are you to completing your Engineering degree?
How much do you enjoy solving Engineering problems?
How interesting do you find the content of your Engineering classes?
Overall, how satisfied are you with your current major?
Overall, how happy are you to be in Engineering?
Is there anything else you would like to tell us about your major at UW-Madison?
ENGINEERING ACADEMIC CONFIDENCE
How confident are you in your ability to succeed in your Engineering courses at UW Madison?
How confident are you in your ability to succeed in your science courses at UW Madison?
How confident are you in your ability to succeed in your math courses at UW Madison?
How confident are you in your ability to succeed in your laboratory courses at UW Madison?
How confident are you in your overall academic ability?
How confident are you that someone like you can succeed in your chosen Engineering career?
Compared to other students in your Engineering classes, do you think your abilities are [Much lower than <-> Much higher than] your peers?
ENGINEERING RESEARCH CONFIDENCE – Grad students engaged in research only
With continued training, how confident are you in your ability to succeed in conducting the research associated with your major/program?
With continued training, how confident are you in your ability to succeed in executing your own Engineering research?
With continued training, how confident are you in your ability to contribute to Engineering research publications?
With continued training, how confident are you in your ability to author your own Engineering research publications?
Compared to other students in your department/program, do you think your abilities as an Engineering researcher are [Much lower than <-> Much higher than] your peers?
TEACHING SELF-CONFIDENCE – Grad students with Teaching Assistant appointments only
With continued training, how confident are you in your ability to contribute to teaching an Engineering course?
With continued training, how confident are you in your ability to lead the teaching of an Engineering course (including developing course content) in your area of expertise?
Compared to other students in your department/program, do you think your abilities as an Engineering teaching assistant are: (worst <-> better)
How often do you feel respected by students in the courses that you teach?
TEACHING TRAINING – Grad students with Teaching Assistant appointments only
How effective is the training you have received on how to teach or how to be an instructor?
How effective is the training you have received on how to grade assignments?
How helpful is collaboration with other teaching assistants involved in your courses or in your department?
How often do you receive guidance from faculty on the courses you are teaching?

How often do you receive supervision from faculty on the courses you are teaching?
What other comments do you have about your research and teaching preparation?
RELATIONSHIPS WITH PRINCIPAL INVESTIGATOR/FACULTY ADVISOR – Grad students with Research only
How much do you trust your PI/Faculty Advisor?
How much does your PI/Faculty Advisor help you with career opportunities?
How much does your PI/Faculty Advisor help you with networking in your field?
How much feedback does your PI/Faculty Advisor give you on your own research?
How much does your PI/Faculty Advisor value your research?
How clear are the expectations of your PI/Faculty Advisor?
How often does your PI/Faculty Advisor give you more work than you can reasonably complete? (RC)
How often does your PI/Faculty Advisor give you career opportunities such as opportunities to participate in additional research, or to present at a conference?
How available is your PI/Faculty Advisor to meet with you?
How often does your PI/Faculty Advisor provide you with advice or mentoring?
What other comments do you have about your PI/Faculty Advisor?
RESEARCH LAB/GROUP ENVIRONMENT – students who have worked or volunteered in research group/lab only
How often is there collaboration between research group members?
How often are you mentored in research skills by other lab members?
How often is the environment in your research group welcoming to you?
How often are you mentored by the research group leader or PI?
How clear are the expectations for your work in the research group?
How often do you receive feedback on your skills as a researcher?
What other comments do you have about working in an Engineering research lab or research group?
STEREOTYPING AND HARASSEMMENT – note frequency questions (“How often?”) ONLY asked if respondent answered YES to “Have you ever...”
In engineering classes, have you ever heard instructors or faculty express stereotypes about racial or ethnic groups?
In engineering classes, have you ever heard instructors or faculty express stereotypes about men and women?
In engineering classes, have you ever heard instructors or faculty express stereotypes about LGBTQ+ people?
How often have you heard instructors or faculty express stereotypes about racial or ethnic groups?
How often have you heard instructors or faculty express stereotypes about men and women?
How often have you heard instructors or faculty express stereotypes about LGBTQ+ people?
In engineering classes, have you ever heard teaching assistants express stereotypes about racial or ethnic groups?
In engineering classes, have you ever heard teaching assistants express stereotypes about men and women?
In engineering classes, have you ever heard teaching assistants express stereotypes about LGBTQ+ people?
How often have you heard teaching assistants express stereotypes about racial or ethnic groups?
How often have you heard teaching assistants express stereotypes about men and women?

How often have you heard teaching assistants express stereotypes about LGBTQ+ people?
In engineering classes, have you ever heard students express stereotypes about racial or ethnic groups?
In engineering classes, have you ever heard students express stereotypes about men and women?
In engineering classes, have you ever heard students express stereotypes about LGBTQ+ people?
How often have you heard students express stereotypes about racial or ethnic groups?
How often have you heard students express stereotypes about men and women?
How often have you heard students express stereotypes about LGBTQ+ people?
In class, have you ever been singled out unfairly by a faculty member because of your race or ethnicity?
In class, have you ever been singled out unfairly by a faculty member because of your gender?
In class, have you ever been singled out unfairly by a faculty member because of your sexual orientation?
How often have you been singled out unfairly by a faculty member because of your race or ethnicity?
How often have you been singled out unfairly by a faculty member because of your gender?
How often have you been singled out unfairly by a faculty member because of your sexual orientation?
In class, have you ever been singled out unfairly by a teaching assistant because of your race or ethnicity?
In class, have you ever been singled out unfairly by a teaching assistant because of your gender?
In class, have you ever been singled out unfairly by a teaching assistant because of your sexual orientation?
How often have you been singled out unfairly by a teaching assistant because of your race or ethnicity?
How often have you been singled out unfairly by a teaching assistant because of your gender?
How often have you been singled out unfairly by a teaching assistant because of your sexual orientation?
Have you ever been singled out unfairly by another student because of your race or ethnicity?
Have you ever been singled out unfairly by another student because of your gender?
Have you ever been singled out unfairly by another student because of your sexual orientation?
How often have you been singled out unfairly by another student because of your race or ethnicity?
How often have you been singled out unfairly by another student because of your gender?
How often have you been singled out unfairly by another student because of your sexual orientation?
Have you ever been sexually harassed by a faculty member?
Have you ever been harassed by a faculty member because of your race or ethnicity?
Have you ever been harassed by a faculty member because of your sexual orientation?
How often have you been sexually harassed by a faculty member?
How often have you been harassed by a faculty member because of your race or ethnicity?
How often have you harassed by a faculty member because of your sexual orientation?
Have you ever been sexually harassed by a teaching assistant?
Have you ever been harassed by a teaching assistant because of your race or ethnicity?
Have you ever been harassed by a teaching assistant because of your sexual orientation?
How often have you been sexually harassed by a teaching assistant?
How often have you been harassed by a teaching assistant because of your race or ethnicity?

How often have you been harassed by a teaching assistant because of your sexual orientation?
Have you ever been sexually harassed by another student?
Have you ever been harassed by another student because of your race or ethnicity?
Have you ever been harassed by another student because of your sexual orientation?
How often have you been sexually harassed by another student?
How often have you been harassed by another student because of your race or ethnicity?
How often have you been harassed by another student because of your sexual orientation?
What other comments do you have about your experiences in the College of Engineering?
ADDITIONAL DEMOGRAPHIC QUESTIONS
In which if any of the following Engineering Honors Programs have you participated? Check all that apply. [LIST OF STUDENT ORGANIZATIONS]
Prior to beginning college, did you take any high school engineering courses?
What is your current UW cumulative grade point average (GPA), using a 4 point scale?
What was your approximate High School cumulative grade point average (GPA), using a 4 point scale?
For tuition purposes, are you considered an in-state or out-of-state resident?
Are you a US citizen, permanent resident or international student?
Are you a first generation US citizen?
Do you identify as a person with a disability?
Do you have at least one parent or guardian who raised you who completed a bachelor's degree?
Which of the following have you used to pay for your college education? [LIST OF SOURCES OF FUNDING]
This academic year, about how many hours per week have you worked for pay while taking classes?
What is your age?
What gender do you identify yourself with now? (man, woman, other)
Do you identify as a lesbian, gay, bisexual, queer or questioning, transgender or transsexual (LGBTQ+) person?
With which of the following racial or ethnic groups do you identify? [CHECK ALL. LIST OF RACE/ETHNICITIES. If not listed, TEXT.]

Appendix 4 – Methodology and Psychometrics

Survey Instrument

The original basis of the E3 survey was the PACE (Project to Assess Climate in Engineering) survey developed by the University of Washington. The College of Engineering fielded that survey with minimal changes in 2008 and 2015. Substantial changes were made in 2019 to allow for inclusion of graduate students and improve psychometrics of most items. Except for new items added in 2022 related to Sense of Belonging, all items and scales in E3 have been well validated with engineering student populations.

To facilitate comparisons with data in 2019 and ensure that significant difference between survey years on various constructs were not due to changes in the population mix of participants, comparison

analyses incorporated post-stratification weights jointly estimated for combinations based on: (1) gender identity (3 categories: Man, Woman, Other), (2) racial/ethnic identity (3 categories: domestic majority, domestic underrepresented minority, international), (3) student level as determined by year since matriculation/graduate student status (7 categories: first year, second year, third year, fourth year, fifth year+, M.S. student, Ph.D. student). That is, multivariate weight values were computed for each participant, and applied such that each case was weighted to match the population of enrolled students in the Spring term of the survey year. Frequency distributions of weight values show the expected mean very close to 1.0, and no weight values less than 0.55 or greater than 4.0.

Psychometric Performance of Items and Constructs

The distribution of responses for each survey item, whether new or from previous studies, was investigated for response patterns and in cases where scales will be used for predictive analyses, normalcy. Missing data overall was very low. There were no items that had unexpected, excessive, or systematic missing data.

Table 10: Internal validity of constructs

Scale/Construct Name	Number of Items	Chronbach’s α	Scale N
Sense of Belonging	20	.929	1258
Professors	22	.897	1476
Teaching Assistants	8	.857	1278
Engineering Lab Work	4	.774	1102
Feeling Welcome	4	.796	1273
Engineering Student Interaction	7	.729	1473
Engineering Career Expectations	12	.793	1463
Commitment to Engineering Education/Major	8	.659	1095
Engineering Academic Confidence	7	.859	1473
Engineering Research Confidence	5	.861	289
Engineering Teaching Confidence	4	.822	131
Engineering Teaching Training	5	.746	131
Research Lab/Group Environment	6	.812	398
Relationship with PI/Faculty Advisor	9	.881	229