Empowering Engineering Students as Allies Through Dedicated Classroom Instruction

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Abstract

Women* and other minoritized groups experience an unwelcoming environment in higher education [1-5]. This is particularly acute in Science, Technology, Engineering and Math (STEM) fields, where students have reported experiencing both explicit and subtle biased behaviors by faculty, administrators and fellow students [6-12]. The behaviors include stereotypical comments about women and other minoritized students' abilities, microaggressions, sexist humor, etc. Studies have shown that such behavior can lead to negative cognitive effects which in turn can affect student retention and graduation rates [13-15].

The aim of this paper is to document the progression and results of efforts undertaken at The Ohio State University to make the climate more welcoming for minoritized students in the College of Engineering (COE) by offering a course that encourages ally development. Ally development involves training people in the dominant social group and helping them understand the inequities placed on those in the minority [16-17]. This is especially crucial to have in engineering, where on average, the percentage of women receiving a bachelor's degree in the United States is 20.9%. Similarly, the percentage of Hispanic students receiving a bachelor's degree in the United States is 11.4%, Black/African American students is 4.2%, Native American students is .3%, and Hawaiian/Pacific Islander students is .2% [18]. Ally development, based on the framework created by Broido [19] hypothesizes that engaging students from the dominant group as allies to promote equity in engineering is an innovative strategy for creating a positive climate for minoritized students – and, in turn, ALL students – a factor that influences their retention and graduation rates [20-21].

This initiative started as an informal cohort in 2015-2016 –training students, who identify as men, to be allies for other students. The primary focus of the cohort was on gender. This cohort met weekly to learn about power, privilege, bias, and microaggressions. The participants then developed and implemented outreach activities in the university community. Taking the positive aspects of the cohort, a semester-long course was developed and offered every semester for undergraduate men students around the cohort concepts. Shortly thereafter a complementary class, for students who identify as women, was developed with similar topics as well as additions including confidence and empowerment. In Autumn 2018 the men and women's courses were rebranded as "Inclusive Leadership" courses with topics including personal brand, strengths, values, identity, power, privilege, bias, and microaggressions. The focus extended beyond gender to include race, sexual orientation, physical ability, and other categories of social identity. Gender non-binary students had the opportunity to choose between either of the two courses. In Autumn 2019, the courses' enrolled students were limited to new first year engineering students who self-selected to take part in a pilot "Inclusive Leadership Cohort". Students in this cohort took the Inclusive Leadership Course concurrently with the first two required engineering courses in their first two semesters at The Ohio State University. Due to COVID, in Autumn 2020, the courses went back to being open to all undergraduate engineering students. Finally, for the Spring of 2021, a single non-gender specific course was offered for the first time. This paper documents the perceived impact on the students who took the courses, lessons learned in each stage of the initiative, and the initial progress on the first non-gender specific Inclusive Leadership Course offered in Spring 2021.

Introduction

For women in academic programs traditionally dominated by men such as engineering, the issues of a chilly campus climate are particularly salient. At The Ohio State University College of Engineering (COE), women are currently 24.6% and underrepresented minority (URM) (Black or African American, Hispanic, and American Indian/Alaskan Native) students are 10.6% of the overall undergraduate student population [22]. In 2008 and 2012, the COE completed the PACE (Project to Assess the Climate in Engineering) project funded by the Alfred P. Sloan Foundation to identify issues that affect persistence among engineering undergraduates at 22 schools, while paying specific attention to the intersection of race, gender, and academic experience [23]. When asked to share their personal experiences within the COE, many students indicated that the climate for women and URMs was not positive and could potentially be detrimental to their educational experience. For example, some of the comments included the following:

"I'm a female, and I've had both professors and students make derogatory comments in jest about women in engineering."

"Never have I been singled out by engineering faculty due to gender, but sometimes feel that male students do not feel that females should be in the engineering classroom."

"Some professors and most male peers treat you negatively for being female, but never believe you when you point it out as an issue. It's the biggest social problem encountered as a female engineer, and it happens almost every day."

"I feel as though being black and female can cause many problems in group work and other settings. When with people that I know, there is usually no fuss, but in pre-set groups, I have found myself being pushed to the side, excluded from meetings, ignored, etc."

These comments highlight the effect that peer-to-peer and faculty-to-student interactions can have on women and URMs in engineering. Data collected in 2016 and 2018 have also shown similar results. The potential for negative cognitive effects along with the perceived hostility within majors dominated by white men such as engineering often places women and URMs at a greater risk of leaving the college or university setting prior to degree completion [14][20]. Direct support for women and URMs, along with the development of allies, are crucial to promoting a long-lasting, positive climate for students studying in these fields. If women and URMs perceive a positive and welcoming environment, they are more likely to be retained and matriculate to graduation.

Having allies, i.e., those from the dominant social group who understand the inequity placed on those in the minority, is critical in addressing issues with climate and improving the experiences for all [16]. As Munin and Speight state, "Allies are a positive, disruptive force in an overarching system of oppression that melds institutional discrimination and personal prejudice into a pervasive web of domination" [17]. In this vein, having allies from the majority social group within an environment such as The Ohio State University COE can help change the culture of the chilly climate that women and URMs face within the college. If a significant number of allies are formed, members of the majority social group within the COE can reinforce a positive climate

for all students. This concept of developing student allies through a course is a unique approach in an academic setting and thus would be an important contribution to the challenge of building strategies to retain women and URMs in engineering undergraduate programs.

The work outlined in this paper started with the creation of a cohort of 11 undergraduate and graduate men students who were trained as allies for gender equity in the COE [24]. Through participation in a one-year informal program focused on gender inequality, implicit bias, and microaggressions, these individuals gained the awareness and skills to act as allies for underrepresented groups in the COE, specifically women. The success of this initiative led to a leadership course ("Inclusive Leadership Course") being developed and offered every semester since Autumn 2015. This course utilizes the framework of ally development created by Broido [19]:

1. Students are given information needed to understand the purpose of their work as allies within the COE, including why the issue of retaining women and URMs in engineering is relevant to their work and to the field.
2. The students are then given the opportunity to reflect and make meaning of the content, how it impacts them personally, and how it impacts their peers in the COE.
3. The students then have the self-confidence to act as allies in an academic setting.

Since the original goal was to develop men as allies for women in engineering, the course was only offered to students who identified as men in the first year (2015). An analogous leadership course was offered for women students starting in Autumn 2017. Gender non-binary and transgender students had the opportunity to choose between either of the two courses. Based on the success of the two courses, an "Inclusive Leadership Cohort" was established in 2019 that catered towards first-year students. The aim of the cohort was to create a group of students who were taught the content of the Inclusive Leadership Course in their first year, potentially enabling a larger impact on their entire academic experience and potentially having a greater impact on the entire student body. The information and results contained in this paper document the lessons learned from the Inclusive Leadership Courses, the Inclusive Leadership Cohort and preliminary results from a non-gender specific version of the Inclusive Leadership Course offered in SP 2021.

The original philosophy around a single-gendered Inclusive Leadership Course was to help create an environment where students could feel comfortable challenging themselves in a trusting environment to see other points of view and assess their notion of privilege, bias and the importance of inclusive leadership. Research suggests that men are more likely to engage in uncomfortable conversations about privilege and bias in the presence of other men rather than a co-ed classroom [25]. This classroom arrangement also helps those students who identify as men from feeling defensive. The section of the course aimed at students who identify as women allows those students to openly discuss issues of confidence and gendered roles as well as identify microaggressions and implicit bias and discover strategies to overcome them. As the authors have become more aware of the students who are gender non-binary, the philosophy has shifted to classes that are not segregated by gender.

Inclusive Leadership Course Structure and Outline

The Inclusive Leadership Course is focused on equity and the practice of inclusive leadership in engineering. It leverages evidence-based models that include student engagement across three stages: information gathering (IG) to develop awareness of the nature and extent of equity challenges in engineering; meaning making (MM) to examine personal biases; and contextual application (CA) of techniques and strategies that promote inclusive engineering climates and enables students to participate in and lead diverse groups. Students also connect with industry partners who reinforce the value of inclusive work environments and the practical application of skills developed in the course as vital to an innovative and competitive global workforce. As shown in the course outline that follows, although the primary focus of the course is gender, the experience of other minoritized groups is also included in the curriculum.

In the first four weeks of the course, students have the space and the opportunity to discuss and explore different components of social identities. They watch videos, get input from industry and partake in activities exploring their own identities. Next comes the concept of power and privilege, and its connection to gender, race and socioeconomic status. From week 8 to week 10, students are introduced to the concept of implicit bias through case studies and group discussions. They are then introduced to microaggressions, and the impact they can have on women and other minorities. Discussions are had between the students who participate in the gender specific courses as the gender specific courses merge together at the end of the academic term. The non-gender specific version of the course (Spring 2021) covers similar content but it involves all students being a part of the same class from the beginning of the semester. The course outline is shown in Table 1 below.

Weeks	Module	Development Stage/Activities
1-4	Social identities	IG: Common Ground activity, social identity definition discussion MM: *The Mask You Live In* film and discussion CA: Industry/men's panel discussion, social identity workshop (gender/race/socioeconomic status, etc.)
5-7	Privilege	IG: Power and privilege definition discussion MM: Privilege workshop (gender/race/socioeconomic status, etc.) CA: Tactics of Power and Control workshop
8-10	Implicit bias	IG: Implicit bias definition and discussion MM: OSU and engineering workplace case studies CA: Implicit Association Test review and discussion
11-13	Microaggressions	IG: Microaggressions definition and I-Statement activity MM: 8 Dumb Things diversity workshop CA: Women's panel; case studies
14	Wrap up	Course reflection, discussion, and evaluation

Table 1: Inclusive Leadership Course Outline

Inclusive Leadership Course Recruiting Process

All undergraduate students in the COE are sent an email about this one credit hour elective course. Students self-select to enroll in the course based on the email as well as word of mouth

from past participants. Currently the course is an elective that is graded satisfactory/unsatisfactory and counts in several engineering majors as a technical elective. The authors are currently working to get the course grading structure changed to be letter graded which will appeal to other departments to have the course count toward their degree program. The enrollment statistics for the course since Autumn 2015 are shown in Table 2. It should be noted that the Autumn 2020 – Spring 2021 courses were only offered in a synchronous virtual format as a result of the COVID-19 pandemic. We believe that this may have contributed to the lower enrollment numbers for those semesters.

Year	Number of enrolled students who identify as men	Number of enrolled students who identify as women	Number of enrolled gender non-binary students
Autumn 2015	10	n/a	n/a
Autumn 2016	11	n/a	n/a
Spring 2017	21	n/a	n/a
Autumn 2017	10	20	n/a
Spring 2018	11	19	n/a
Autumn 2018	36	30	2
Spring 2019	17	14	n/a
Autumn 2019 (Leadership cohort)	39	32	n/a
Spring 2020	17	13	n/a
Autumn 2020	10	2	n/a
Spring 2021 (Non-gender specific section)	3	3	2

Table 2: Student Enrollment

Each semester 1-3 past participants are chosen to be Undergraduate Teaching Assistants (UTAs) for the course. The UTAs help with grading the student reflections, help to guide the discussion in the class, and meet with students for office hours outside of class. This establishment of trained men peers is modeled after the faculty program started at the North Dakota State University [26] where a network of trained men faculty work with other men faculty to promote gender equity on campus.

Inclusive Leadership Cohort Structure (Autumn 2019)

Based on the success of the Inclusive Leadership Course, it was decided to offer the course to first-year engineering students within the framework of an Inclusive Leadership Cohort. The aim of developing this cohort was to make students aware of concepts such as implicit bias, privilege, positionality, and inclusive minded thinking in their first year as college students so as to maximize the impact of the course on their experience and on the climate in the COE. The first Inclusive Leadership Cohort (Autumn 2019) consisted of 72 students taking the required introductory first year first semester engineering course (ENGR 1181) (as a cohort) plus a single gendered leadership class during the Autumn semester and the required first year second

semester engineering course (ENGR 1182) (as a cohort) for the Spring semester. Those who identified as gender non-binary or transgender had the option of choosing either version of the leadership class. This is visually depicted in the Table 3 below.

Student Population	Courses Taken in Autumn 2019	Courses Taken in Spring 2020
Those students who identify as women	ENGR 1181+ENGR 4891W	ENGR 1182
Those students who identify as men	ENGR 1181+ENGR 4891M	ENGR 1182

Table 3: Structure of the Inclusive Leadership Cohort

Inclusive Leadership Cohort Recruiting Process

All Ohio State University first year students participate in a two-day orientation event the summer before they start at the university. During this time, students and their parents learn about financial aid, residence life, student organizations, etc. and students register for Autumn classes. During the Summer 2019 orientation, the Inclusive Leadership Cohort was presented to incoming students and their parents. The authors showed a video with the faculty member and former students talking about the structure of the cohort, benefits of the cohort, and content of the leadership course. The authors also had a poster set up and were available to answer student and parent questions about the cohort immediately following the session where the video was played.

Gender Non-Specific Section of the Inclusive Leadership Course (Spring 2021)

During the Spring 2021 semester, the Inclusive Leadership Course was offered as a single section open to all genders as opposed to be being separated into a section for men and a section for women. We initially separated the sections by gender because we wanted to create a space where the men and women would feel more comfortable engaging in discussions of privilege, bias, and gender. However, upon deep reflection, we began to feel uncomfortable with how the course structure could be contributing to binary conceptions of gender and how it may be perceived as exclusionary for gender non-binary students interested in enrolling. Additionally, as we transition the course to focus on equal parts gender inequity *and* racial inequity, it felt as though separating the course by gender identity no longer seemed appropriate as we were not separating the course by racial identity. The gender non-specific section consisted of 3 students who identified as men, 3 who identified as women, and 2 gender non-binary students (as shown in Table 2).

Similar course topics and content were discussed in the gender non-specific section as the previous iterations of the Inclusive Leadership Course. However, during the weeks where particularly difficult content was presented (e.g., gendered microaggressions), we broke into small groups called "affinity groups" based on the self-identified social identity category related to the topic (e.g., gender) to provide a space for students to process the content. This allowed space for students to discuss the difficult content and confront their own biases and privilege or personal experiences being on the receiving end of bias or microaggressions with members of

their own social identity groups. We would then come back together to have dialogue as a group and learn from each other's experiences.

In addition, this section devoted more class time to explicit discussions of racial inequity than previous interactions of the course. Drawing on episodes of the Seeing White podcast series from the Center for Documentary Studies at the Duke University [27], the students listened to the episodes centered on how race was made (i.e., socially constructed) in colonial America. We then used this historical understanding of racism as a springboard to discuss racial inequity today. We also had discussions of social identity and power and privilege which were centered around considerations for racial identity.

Gender Non-Specific Section of the Inclusive Leadership Course Recruiting Process

The gender non-specific section of the Inclusive Leadership Course was open to all undergraduate students in the COE. Students were recruited similar to the previous iterations of the Inclusive Leadership Course via email informing them about the one credit hour elective course.

A Sample of the Results from Students Who Identified as Men

For students who identified as men in the Inclusive Leadership classes and the Inclusive Leadership Cohort, they were asked to respond to a group of questions regarding their identity and the perception of its impact at the start and the end of the course. They were also asked to respond to questions regarding what they enjoyed and what they learned at the end of the course. In both the pre- and post-course survey, the students answered the same set of questions most of which used a Likert-type scale. Some of the results are shown below.

The results for the semesters Autumn 2015 through Autumn 2019 for the statement, "*I am aware of the commonalities and differences that exist among people and culture*", is shown in Figure 1. On average, there was an 11% increase between the pre- and post-course survey results.
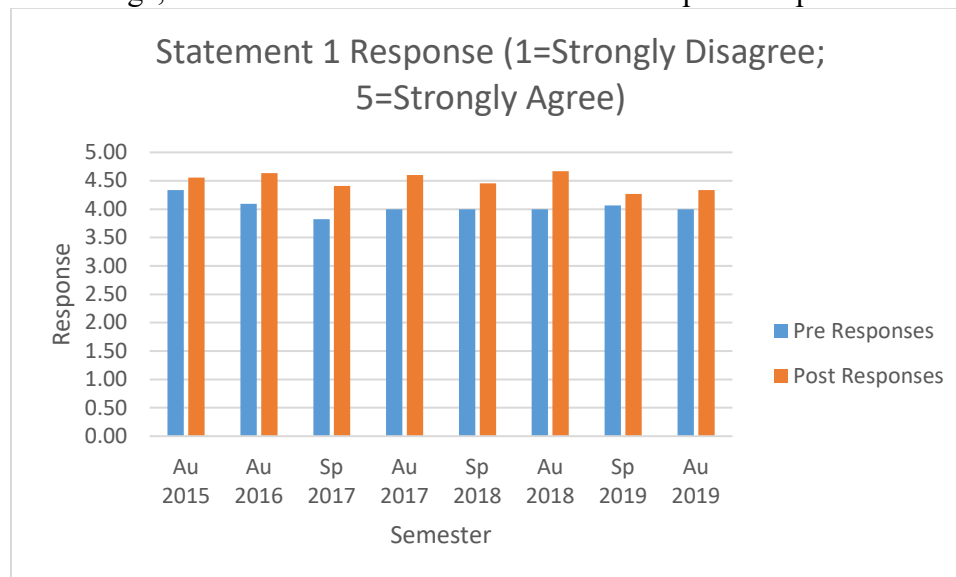

Fig. 1: "I am aware of the commonalities and differences that exist among people and culture"

The results over the semesters for the statement, "*I am able to recognize the ways in which my communication style can influence others*", is shown in Figure 2. On average, an increase of 20% can be seen over the semesters.
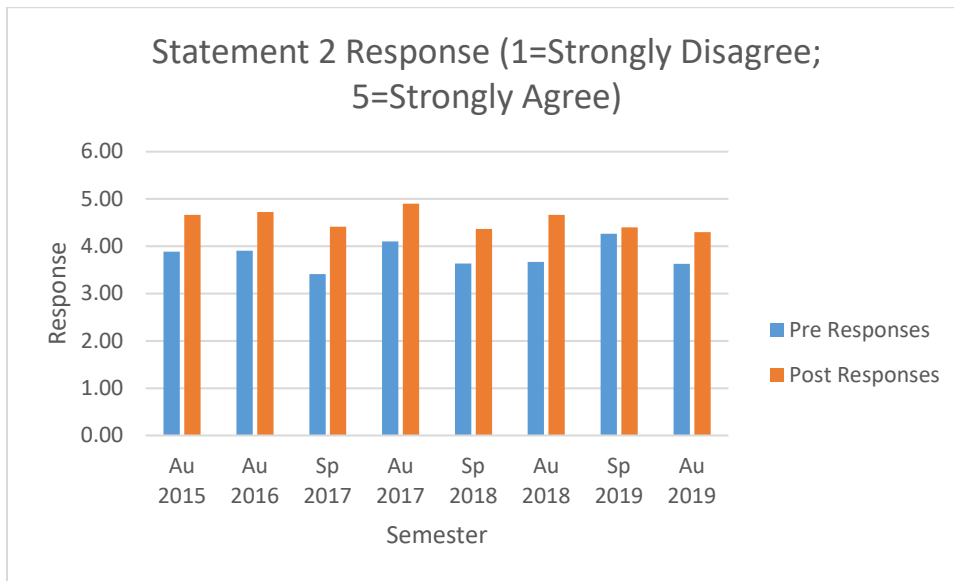

Fig. 2: "I am able to recognize the ways in which my communication style can influence others"

The results over the semesters for the statement, "*I am able to identify ways in which I can challenge or address systems of power and privilege*", is shown in Figure 3. On average, an increase of 44% can be seen over the semesters.
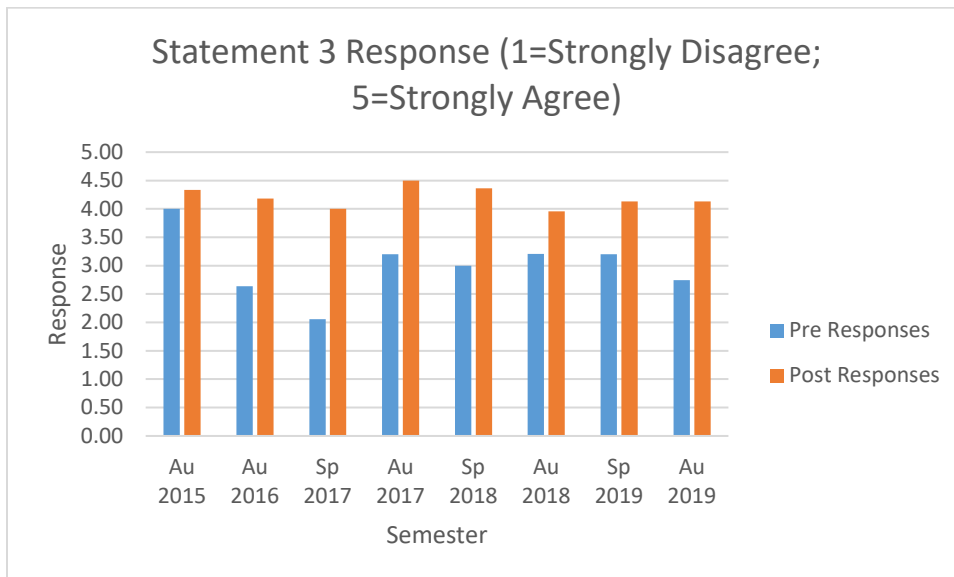

Fig. 3: "I am able to identify ways in which I can challenge or address systems of power and privilege"

The results over the semesters for the statement, "*I know how to address bias and discrimination when it arises*", is shown in Figure 4. On average, an increase of 30% can be seen over the semesters.
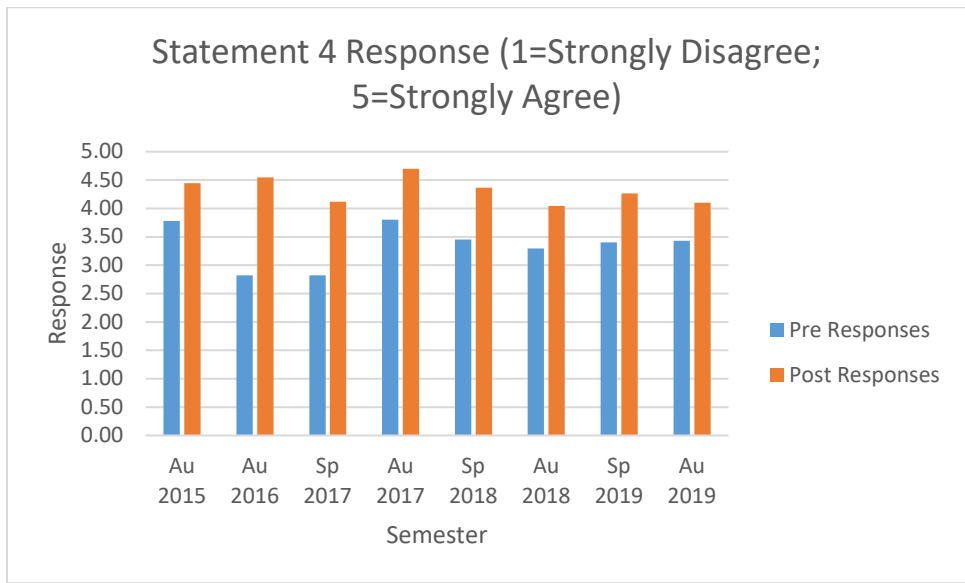

Fig. 4: "I know how to address bias and discrimination when it arises"

The results over the semesters for the statement, "*I am comfortable addressing bias and discrimination when it arises*", is shown in Figure 5. On average, an increase of 30% can be seen over the semesters.
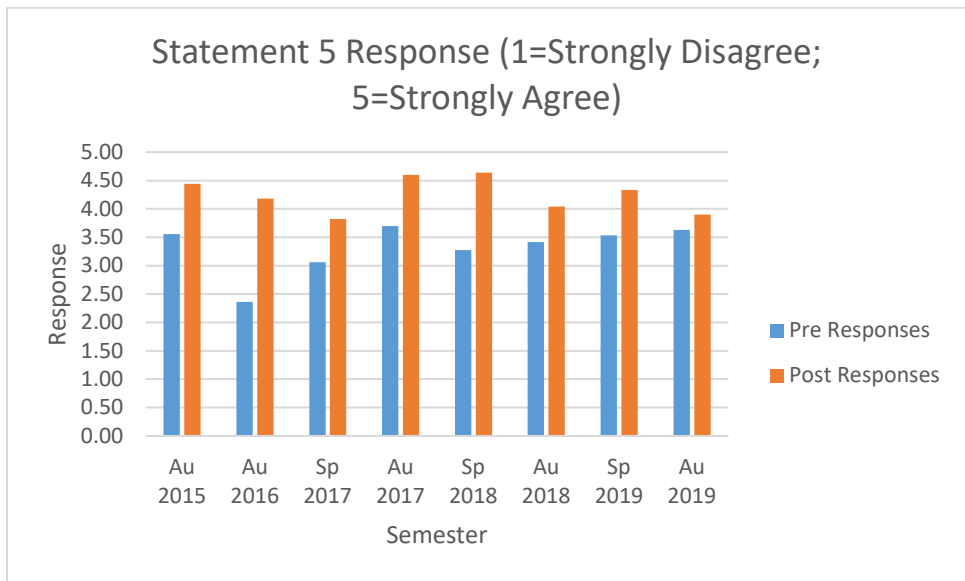

Fig. 5: "I am comfortable addressing bias and discrimination when it arises"

The results show an increase in self-reported efficacy over all the semesters the course has been offered. The perceived impact of the course can also be assessed based on students' comments:

"What I've learned here will allow me to continue to strive to be a better leader and hopefully a mentor to those who come after me. Instilling the proper values of leadership and understanding why they are important is key. Understanding why the fact that I disliked seeing the way that my female peers were treated and why I wanted to be better. This class has been fun and good for me being so new to college, I'm hoping that I'll be a good leader and ally when I see the opportunity."

"The class has allowed me to be more focused on the people around me and how my actions and words may affect them."

"I think this class, will help me in the future. I was aware of many of the issues that we have talked about in class, but actually, opening up the conversation is what helps individual and society grow. So, now it is a lot easier for me to talk about and confront these issues."

"I incorporated some of the aspects that I learned in this course such as staying curious as well as being open-minded. The values I learned and have enhanced in this class are the values that I now consider to be the most important to me."

"I gained a lot of insight into the thoughts and lives of others, especially those that may face different challenges on a daily basis. I learned more about how my words and actions can affect others, whether I intend them to or not, and how to best communicate my ideas and feelings. I learned to recognize some of my own implicit biases, and how to help minimize them in how I view and treat others. Really, I just became more aware of those around me."

"I gained a better understanding of how my actions and words can influence or affect someone even when my intention is good. I have also gained a better understanding of what women and other minorities struggle with in our country/society and in engineering. Along with that I am able to more clearly identify how privileged I am, and what I can do moving forward to elevate others and help them overcome their struggle with bias and the system."

"I gained immense insight on how to address sociocultural issues and a broadened view of difficult problems within society related to not only women but other demographics as well. It made me re-evaluate my behavior, perspective, the perspectives of those around me, and how I want my future to be. I loved the class!"

"I gained a lot of soft skills and strategies I can use in the future. This class was refreshing and different. I can honestly say I have changed by becoming much more aware of who I am and the effects of people's words and actions. When instances occurred this semester where a presenter, student, or friend used micro-aggressions or made discriminatory jokes, I directly thought of this class. Because of this class, I now have strategies to confront others appropriately, stand up for myself and others, be empathetic, and discuss rather controversial topics with others."

Lessons Learned (Thus Far) and Future Work

This paper contributes to the relatively small body of literature on strategies for engaging in planned change processes connected to gender and race relations and equity with engineering

students. The authors hope to create tested curriculum that can be implemented at various entities such as universities and industries.

In addition to impacting positive change for women and URMs in STEM, this model also promotes equity and inclusion for persons with disabilities, low socioeconomic status (SES) and other marginalizations within STEM fields. Preparation for careers in STEM will be advanced through this course as student allies learn about existing inequities and systems of oppression, and work to create a welcoming and supportive environment for all students regardless of gender, race, ability, or SES. As both the minority and the majority move into the national scientific workforce, the knowledge and skills gained through participation in this study will serve as a springboard from which to promote inclusion across all levels of scientific work in the United States.

The authors plan to continue to offer the Inclusive Leadership Course on a regular basis and continue assessing the impact of the course on the students who take it and on the climate in the COE as a whole. Also, given the positive feedback from students in the non-gender specific section of the course offered in Spring 2021, we intend to continue with the non-gender specific course offering. We feel this is necessary to ensure that gender non-binary students feel welcome and because we do not want to contribute to binary conceptions of gender. The course recently became a graded 1 credit hour course housed in the Department of Engineering Education, which will make it more sustainable in the long run due to the graded nature. In the Summer of 2021, the authors plan to expand the scope of the course to incorporate more topics of racial justice as an equal part of the existing course curriculum. It would be desired to look for trends and/or differences in students in different engineering majors and different stages of academic career (first year, sophomore, etc.). The authors are designing quantitative and qualitative metrics and methods to <u>measure</u> behavior changes as a result of this course.

The full impact of the first year of the Inclusive Leadership Cohort is not completely known as the research protocol of the study to determine the impact of the cohort was disrupted due to the COVID-19 pandemic. The cohort was not offered in the 2020-2021 academic year but will be restarted again in Autumn 2021. This concept of developing allies in the first year, if proven to be successful, can then be incorporated into the introductory engineering courses and be available to all students. This, in turn, can then have a positive effect in improving the overall climate and culture in the COE.

*Note that this paper uses the gendered terms women and men rather than the words typically affiliated with sex – female and male.

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