Looking Ahead: Student's Perceptions of Diversity Before and After A Diversity Workshop

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INTRODUCTION

The U.S. engineering workforce is not representative of the country's diverse population. While Blacks and Hispanics account for 13.4% and 18.5% nationwide, they represent only 5% and 7% in the engineering workforce, respectively. The engineering workforce is also underrepresented in gender, with just 14% of engineers identifying as female compared to 50.8% in the general population (US Census Bureau 2019; Funk and Parker 2018). LGBTQ+ populations are also underrepresented in STEM (Cech 2015). The lack of diversity in engineering has been shown to hamper both creativity and productivity (McLeod, Lobel, and Cox 1996; Ely, Padavic, and Thomas 2012; Alesina, Harnoss, and Rapoport 2016; Trenor et al. 2008; Roberge and van Dick 2010).

Lack of diversity in engineering starts long before students enter the job market and can be seen numerically in engineering education. Despite numerical increase in enrollment, minorities and women remain significantly underrepresented in engineering in undergraduate and graduate higher education (Anderson et al. 2018; de Brey et al. 2019). With low representation, populations of minorities, female-identified students, and members of the LGBTQ+ community are more likely to drop out and not graduate with a degree in engineering (Hausmann, Schofield, and Woods 2007; de Brey et al. 2019; Trenshaw et al. 2013).

As the U.S. population shows increasing racial and ethnic diversity (Craig, Rucker, and Richeson 2018), it is imperative that we take steps as engineering educators to create a more inclusive engineering education environment. Several colleges in the U.S. have introduced diversity initiatives

such as faculty/staff diversity training (O'Leary et al. 2020), diversity-focused workshops (Rheingans et al. 2018), and even mentoring programs to women and underrepresented racial and ethnic groups (Young 2018; Ikuma et al. 2019). At the University of Iowa, the College of Engineering recently established the Diversity, Equity and Inclusion (DEI) Council, and with their support, we aim to learn about first-year engineering students' perceptions of diversity. To this end, we developed a hands-on workshop to facilitate conversation about diversity and learn how the students perceive diversity. While other institutions have also adopted diversity training for first-year engineering students, our pilot study is novel because it frames the conversation about diversity from the student's perspective rather than from the perspective of training, which has been shown to be ineffective (Naff and Kellough 2003; Chang et al. 2019; Dobbin and Kalev 2018). This education-based conversational approach is novel in that it leads to the inclusion, in addition to race and gender, of other dimensions of diversity that are rarely included in diversity training, including, but not limited to, sexual orientation, non-binary gender identity, age, political views, and religious beliefs.

METHODS

The fifty minute workshop 'Celebrating Diversity in Engineering' was created and delivered by Luiza Notini and Matthew Nagorzanski as part of a teaching as research project for the Center for the Integration of Research, Teaching, and Learning (CIRTL) at the University of Iowa. The workshop was offered four times, to groups of ~ 130 students. Participants included a total of 514 incoming first-year engineering students enrolled in four different sections of a required Engineering Success for First-Year Students course in the Fall of 2019.

Students were presented general concepts about diversity, including shifting demographics in the world and scientific evidence of the benefits of diversity. After the brief introduction, students engaged in two hands-on activities designed to promote self-reflection about diversity, 'How Diverse is My Universe,' and the 'Iceberg of Identity.' The first activity had students fill in a table with different identities and marking each identity that matched various people in their lives in an effort to encourage students to think about aspects that compose one's identity and reflect on how diverse the people in their community are. This activity employs the concept of multiple classification training, which has been shown to reduce intergroup bias (Cameron and Turner 2010). The second activity, the 'Iceberg of Identity,' guided students to individually reflect on their identities and document aspects that were visible and invisible to their communities. Similar activities have been used by others (Penn, Clark, and Williams 2018; Dawson and Lee 2018) and both activities framed diversity through broad lenses, which has been shown to diminish backlash against diversity training (Holladay et al. 2003).
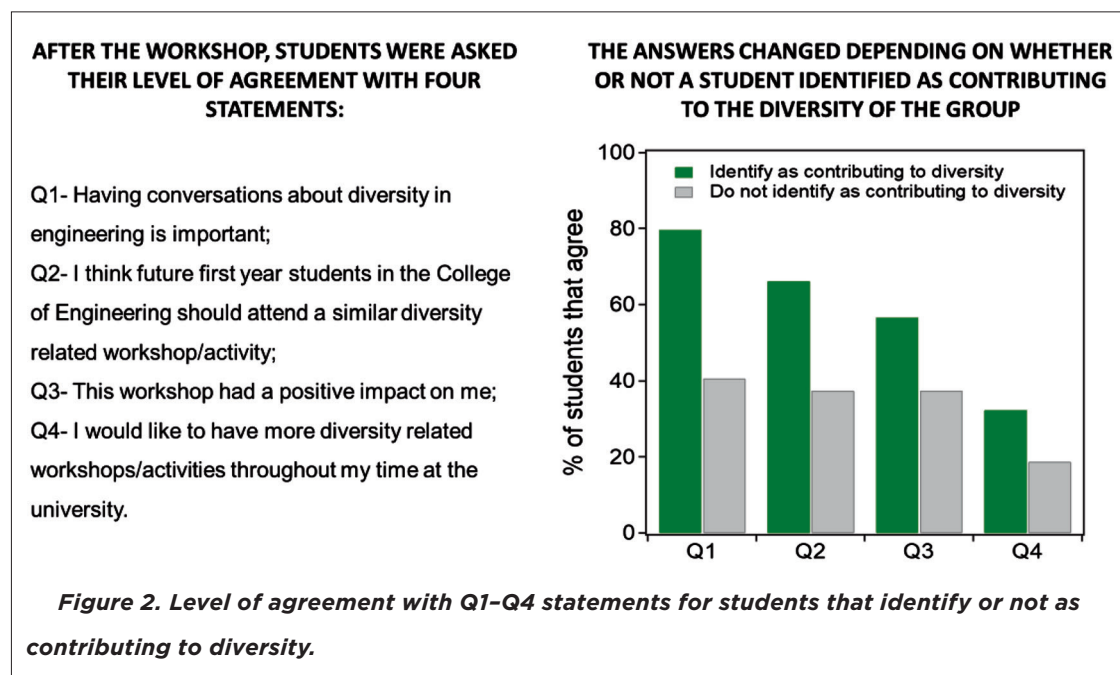
To learn about students' perspectives as diverse beings and their opinion on the importance of talking about diversity, we surveyed students before and after the workshop. To comply with rules for human subjects at our university we collected data with no identifiers, and therefore could not run participant matched pre- and post-surveys. Instead, students were randomly divided into two equal groups with one group invited to take the survey before the workshop and one after. The surveys were not mandatory, and of the 257 students who received the link to the survey before the workshop, 150 responded (58% response rate). After the workshop, 106 responded (41% response rate).

PRELIMINARY RESULTS

Sixty-one percent of the students surveyed *before* the workshop identified themselves as bringing diversity to the group. Gender (24%), race/ethnicity/nationality (23%), personal experiences/skills (21%) and being LGBTQ+ (5%) comprised the most frequent reasons listed as why students identified themselves as bringing diversity to the group. Less frequently cited reasons included age, political views, religious beliefs, state of origin, home-schooling, and rural perspective (Figure 1).

After the workshop, more students identified themselves as bringing diversity to the group (70% compared to 61% *before* the workshop). There was a clear increase in the percentage of students that considered their gender or sexual identity as bringing diversity to the group. These results suggest

DO YOU BRING DIVERSITY TO THE UIOWA COE UNDERGRAD POPULATION? IF YES, HOW?

Figure 1. How students consider themselves to bring diversity to the college of engineering and categories most cited by students.

that more students could identify aspects of themselves that bring diversity to the group after the workshop. However, a limitation of our pilot study is that it could not be determined whether these increases resulted from a change in the way the students see the subject, or if more students who saw these aspects in their identity responded to the survey or comprised the second group surveyed.

The majority of students agreed (68% agree, 26% neutral, 6% disagree) that is important to talk about diversity. The majority of students also think future students should have a similar workshop (58% agree, 30% neutral, 12% disagree) and feel that our workshop positively impacted them (51% agree, 42% neutral, 7% disagree). Unexpectedly, only 28% of the students indicated that they want more diversity-related activities (28% agree, 49% neutral, 23% disagree).

Perhaps one of the most interesting and important insights from our pilot study is that students' perceptions of diversity vary significantly depending on whether they consider themselves to contribute to diversity. When responses are separated by whether or not a student identified as contributing diversity, a clear trend is seen (Figure 2). The disparity between the responses suggests that the more students view themselves as bringing diversity, the more open to discussing and learning about the diversity they are. It is possible that students that do not see diversity in themselves benefit from already having a sense of inclusion, and therefore are not aware that others may feel uncomfortable or excluded. As a result, they might not perceive the need to talk about diversity.

It is curious that, despite two-thirds agreeing that talking about diversity is important, only one-third of the students want to have more diversity-related workshops/activities throughout their time at the

AFTER THE WORKSHOP, STUDENTS WERE ASKED THEIR LEVEL OF AGREEMENT WITH FOUR STATEMENTS:

Q1- Having conversations about diversity in engineering is important;

Q2- I think future first year students in the College of Engineering should attend a similar diversity related workshop/activity;

Q3- This workshop had a positive impact on me;

Q4- I would like to have more diversity related workshops/activities throughout my time at the university.

THE ANSWERS CHANGED DEPENDING ON WHETHER OR NOT A STUDENT IDENTIFIED AS CONTRIBUTING TO THE DIVERSITY OF THE GROUP

Figure 2. Level of agreement with Q1–Q4 statements for students that identify or not as contributing to diversity.

university. Perhaps the students were already familiar with diversity and could use more challenging conversations centered around equity (i.e., ensuring that every classmate has access to the same opportunities) and inclusion (i.e., ensuring classmates with different identities feel and are indeed valued).

NEXT STEPS

This activity, the 'Celebrating Diversity in Engineering' workshop is now held annually at the University of Iowa and administered by the Director of Undergraduate Diversity Programs. Based on our experience creating and delivering this workshop, we are implementing or considering the following next steps:

1. As a next step, we will include student inclusion agents from senior undergraduates to participate as facilitators to have first-year students see more of their senior peers involved. This was successfully implemented in Fall 2020 and will be continued going forward.

2. In addition, a next step being considered is to collect more in-depth and rigorous data on student's perception of diversity by surveying the entire class before and after as well as matching participant pre- and post- paired surveys.

3. After seeing the workshop results, one student asked: 'what will the university do about that?' This raises two interesting opportunities for next steps. First, we would include a question next time asking "What do you as students want to do about it?" Second, we would also ask students to share what they think the university should be doing via follow up listening posts or an anonymous feedback link.

4. Our intervention was a stand-alone activity and it revealed that students are interested and willing to talk about diversity issues. One activity, however, is not enough to cover these important conversations. Our next step would be to advocate for including diversity discussions into the traditional curriculum. This longer-term approach would provide an opportunity to expand the activities beyond awareness, but also include training for behavior change, as well provide a more continuous look at the evolution of their perceptions. Moreover, student feedback will allow facilitators to adjust the discussions to maintain student engagement in the workshops/activities.

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AUTHORS

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Matthew Nagorzanski is a PhD candidate in environmental engineering at the University of Iowa. Matthew's research interests involve developing polymer nanofiber composite materials and deploying these composites as passive samplers looking for emerging contaminants in air and water. While earning his Graduate Certificate of College Teaching, Matthew developed an interest in advocating for diversity issues in higher education, and in partnership with Luiza Notini developed a seminar discussing diversity with engineering undergraduates. Matthew was also part of a committee that planed University of Iowa's first Celebrating Diversity in Engineering Graduate Conference.

Michelle Scherer is a Professor and Distinguished Chair at the University of Iowa. At U. Iowa, Michelle has had the joy of teaching and mentoring students like her co-authors Luiza Notini and Matthew Nagorzanski. Michelle is an environmental engineer whose research group tries to understand reactions in water and soils to develop better ways to ensure clean water for all. She has published over 60 journal articles and her work has been cited more than 4,000 times. Michelle has served as co-chair of her college's inaugural Diversity, Equity, and Inclusion (DEI) Council and is committed to making higher education more accessible and equitable, particularly in her own field of engineering.