Teaching Tips

Development of a Low-Cost, Easy-to-Adopt Diversity, Equity, and Inclusion Program During Crisis

CASEY J. ANKENY, CODY DUNTON, RANYA VIRK, EVAN SCOTT, and NEHA KAMAT
Biomedical Engineering, Northwestern University, Evanston, IL, USA
(Received 19 January 2022; accepted 26 May 2022; published online 6 June 2022)

CHALLENGE STATEMENT

Representation within academia is critical to link engineering with societal values. Northwestern University’s Biomedical Engineering (BME) department is committed to assessing departmental climate; taking action to increase diversity, equity, inclusion, (DEI); and monitoring progress. This work outlines the implementation of a DEI committee during crisis in part due to the killing of George Floyd, the COVID-19 pandemic, and the 2020 presidential election. Like many nationwide, we worked to develop a committee when best practices were just being determined and resources were limited. Here, we describe an approach that is low-cost, transferable to other programs, sustainable, effective, and reflective.

NOVEL INITIATIVE

Committee Formation

Northwestern University’s BME department administration created an interim committee in Summer 2020. The interim committee reviewed applications to select a BME DEI committee with representation from undergraduates, graduate students, post-doctoral fellows, staff, and faculty while also accounting for diversity in terms of identity groups (including gender, sexual orientation, position, age, and race). Except for the faculty leads, service on the DEI committee will be a one-year term, with the option to renew for a second term. The committee was formed to assess the departmental climate, to take action to increase DEI within the BME community, and to monitor progress.

Inaugural Activities

The DEI committee embarked on tasks outlined in Fig. 1 below. More specifically, the DEI committee first met with several leaders on campus to determine potential resources for DEI initiatives, including Damon L. Williams (Assistant Dean for Diversity and Inclusion) as well as Celina Flowers (Assistant Provost for Faculty), among more. Based on these discussions, the committee created a website (https://www.mccormick.northwestern.edu/biomedical/diversity-equity-and-inclusion/) to disseminate information including the mission statement, committee members, current projects, future initiatives, and a link to submit concerns. The committee also led the 2020 faculty retreat as well as hosted its first dialogues and town halls. Dialogues offered the opportunity to learn about new topics and shared experiences. Topics for the dialogues included: “Understanding the Black Engineering Student Perspective”, “Women in STEM”, and “Asian Americans and Pacific Islanders (AAPI) Experiences with Racism and Solidarity”. Additionally, the dialogues were supported by expert facilitators from the

Electronic Supplementary Material

The online version of this article (doi:10.1007/s10439-007-9398-3) contains supplementary material, which is available to authorized users.

Address correspondence to Casey J. Ankeny, Biomedical Engineering, Northwestern University, Evanston, IL, USA. Electronic mail: casey.ankeny@northwestern.edu

Casey Ankeny and Cody Dunton are co-first authors.

Electronic Supplementary Material

The online version of this article (doi:10.1007/s10439-007-9398-3) contains supplementary material, which is available to authorized users.
Northwestern University community. Townhalls allowed for the BME community to share opinions, voice concerns, and come together. Please see the Supplemental Information section for more details about the events. Assessment of departmental climate began and informed the DEI committee’s action plan. The DEI committee reported the climate survey results and action plan to the community during Fall 2021. Future dialogue and townhall topics will be specific to BME departments including an engineering education discussion panel and a panel on including traditionally minoritized populations in BME technology development.

A Needs Assessment: Analyzing the Departmental Climate to Inform an Action Plan

Program evaluation uses the evidence-based practice model and will employ process evaluation based on: (1) program description, (2) program monitoring, and (3) quality assurance. This work focuses on “program description” wherein a set of program objectives were created based on a needs assessment.

A cornerstone of our needs assessment is the aforementioned climate survey, adapted from the 2018 University of South Carolina Campus Climate Survey. The adapted survey was piloted twice (December 3-10, 2020; n = 138 and May 17, 2021; n = 58) and consisted of 42 scale, 16 multiple-choice, and 6 free-response questions. Table 1 summarizes the number of respondents in each survey administration by departmental position as compared to the overall departmental numbers by position. Roughly 27% and 11% of the Biomedical Engineering community (n = 519) responded to the survey during the first and second climate survey administrations, respectively. Results were analyzed using a mixed-methods approach. This survey established a baseline for impact, has been adopted by others externally, and has been distributed internally. Questions fell into the following areas: perceptions about departmental commitment to DEI; belonging among stakeholder groups; the prevalence of discrimination, microaggressions, and negative comments; considerations of stress from outside sources that influence departmental DEI; satisfaction with departmental experiences; and view on departmental climate improvement, successes, and a path forward.

The approach of conducting a climate survey to drive future efforts has been adopted by others such as the University of California – Berkeley’s Chemistry department where a climate survey informed a student-

![FIGURE 1. DEI committee formation and inaugural activities. This schematic outlines the inception of the DEI committee, the pilot and analysis of a climate survey, creation of dialogues and townhalls, as well as formation of an action plan based on community feedback.](image)

| Position     | Administration #1 | Administration #2 |
|--------------|-------------------|-------------------|
| Undergraduates | 266               | 43                |
| MS students   | 37                | 7                 |
| PhD students  | 132               | 36                |
| Staff         | 43                | 26                |
| Faculty       | 41                | 14                |
| Unknown       | 0                 | 12                |
|               |                   | 7                 |
led DEI discussion. Additionally, the Whitehead Institute for Biomedical Research employed a climate survey which “identified issues of particular concern” in the laboratory of biologist David Sabatini and contributed to his firing. This exemplifies the ability of a climate survey to reveal unknown issues and result in change. However, the use of a climate survey to create an action plan capable of measurable change (through repeated survey administration and analysis) has not been widely reported, especially in the context of an engineering department.

**REFLECTION**

We reflected on the preliminary results of the climate study to conduct a needs assessment. This needs assessment assisted in uncovering and estimating DEI issues in our community for the ultimate goal of targeting DEI initiatives within the BME department. We used these findings to prioritize resources such as time, effort, staff, and funds. Here, we summarize both quantitative and qualitative results that directly informed the action plan developed in Summer 2021.

*Preliminary Results from Climate Survey*

As shown in Fig. 2a, over 75% of respondents agreed (combined results of “agreed” and “strongly agreed” responses) that Northwestern University’s BME Department demonstrates an institutional commitment to diversity in both administrations of the climate survey. Additionally, over 70% of climate survey respondents agreed that Northwestern University’s BME department has a welcoming climate for individuals regardless of race, gender, identity, sexual orientation, religion, and national origin.

Respondents determined the frequency they agreed with the following statement: “I have experienced a high level of stress attending or working in the BME department at Northwestern University”. During the first administration of the survey, almost 30% of respondents indicated that they experienced a high level of stress “often”. During the second administration, we saw that approximately 45% of respondents experienced a high level of stress “often”.

Furthermore, respondents reflected on the frequency of microaggressions they had witnessed over the last academic year. Microaggressions are defined as “everyday verbal, nonverbal, and environmental slights, snubs, or insults, whether intentional or unintentional, that communicate hostile, derogatory, or negative messages to target persons based solely upon their marginalized group membership”. During the first administration of the climate survey, over half of respondents reported they witnessed a microaggression over the last academic year pertaining to race, political views, age, degree program, mental health, and gender, for example. Interestingly, there was a marked increase in the percentage of respondents who stated that they did not know if they had witnessed a microaggression during the second administration as shown in Fig. 3 below. Further investigation is required to uncover potential explanation for this trend.

*Qualitative Results from Climate Survey Pilot*

Respondents were encouraged to comment freely on any topic regarding the department’s DEI initiatives.

![FIGURE 2. Institutional commitment to diversity (a) and Welcoming Climate Assessment (b). The black bars represent responses from the first climate survey pilot (Fall 2020; n=138) and the white bars represent responses from the second administration of the climate survey (Spring 2021; n=58).](image-url)
Qualitative, free response feedback from the climate survey was combined with feedback from dialogues, townhalls, and DEI committee meetings and then analyzed using basic coding for emerging themes. This analysis resulted in seven themes shown in Fig. 4: inclusion in all departmental aspects, diverse hiring of faculty and staff, listening and discussion among all stakeholder groups, recruitment at the undergraduate and graduate levels, outreach to K-12, shared DEI responsibilities among all in the BME community, transparency relating to DEI topics, and funding to support DEI efforts. For example, specific free responses from survey respondents that led to identification of themes included: a lack of diversity among student peers in the laboratory and classroom (related to Diverse Hiring), a lack of faculty acknowledgment about DEI issues (related to Shared Responsibilities), and an identification of microaggressions and intimidating hierarchical organization of administration (related to Inclusion and Transparency).

**Limitations of Climate Survey Results**

It is important to note study limitations. Although most respondents did not belong to an under-represented group, we had similar percentages of graduate student respondents belonging to under-represented groups, the international cohort, and the female identity as compared to analogous percentages in our departmental graduate population. It is important to note that faculty and staff made up a larger percentage of the overall respondents than representative in the departmental population (29% in the first administration and 26% in the second administration versus 16% in the department). There was a decline in climate survey participation in Spring 2021 as the time of administration coincided with finals and this could also partly explain why student responses were lower than the departmental composition. We will administer the survey at better times in the future, like the beginning of a quarter. Moreover, incentivization will be used in the future to increase broader participation. Lastly, it is unclear how confounding external factors, including the COVID-19 pandemic, affected responses to the...
survey questions pertaining to stress levels while working or studying in the department.\textsuperscript{7}

**Future Work: Taking Action**

The results provided insights into targeted initiatives. Briefly, qualitative analysis identified seven emergent themes to drive future work as diagramed in Fig. 5: diverse hiring, listening and discussion, recruitment and outreach, shared responsibilities, transparency, funding, and inclusion. Furthermore, quantitative analysis highlighted high stress levels for a substantial portion of the BME community (Fig. 3) as well as a higher incident rate for witnessing microaggressions than desired by the Biomedical Engineering department (Fig. 4). In addition, there was a large percentage of the community unsure of how to identify microaggressions (Fig. 4). Lastly, although most respondents found the department welcoming and had a strong commitment to institutional diversity (Fig. 2), actions will be planned to increase the number of respondents who feel positively about both aspects.

The detailed action plan consists of the following program objectives that also are summarized in Fig. 6:

1. **Assess** the departmental climate longitudinally to enable community-specific plans.
2. **Learn** about new DEI topics and others’ experiences through dialogues.
3. **Recruit and engage** K-12 and undergraduate students from marginalized backgrounds through outreach.
4. Create community platforms that allow members to **respond**, share opinions, voice concerns, and build community.
5. **Enact change** through initiatives that will foster inclusion (ex. microaggression training workshops, mentor training, and social events within the department).
6. **Report** the DEI committee’s work through publications to facilitate sharing of resources and successful interventions effectively.

Figure 6 also shows how the emergent themes correlate with the program objectives. More specifically, all program objectives were created with inclusion, and a corresponding increase in a feeling of belonging, in mind. The dialogues and townhalls offer the opportunity for listening and discussion. The dialogues also allow for the opportunity for different members of the BME community, and, more broadly, the Northwestern University community, to support DEI initiatives. Engagement opportunities with K-12 and undergraduate students from marginalized communities addressed the emergent theme of making recruitment and outreach a priority. All actions and dissemination of outcomes will be conducted with transparency. Furthermore, changes in departmental practices will improve the ability to hire faculty and staff from diverse backgrounds.

**FIGURE 6.** Northwestern University’s Biomedical Engineering DEI action plan. This schematic highlights the seven program objectives that form the action plan. The bolded verbs summarize the learning objective. The circles indicate how the program objective will be addressed. The words at the bottom of the schematic show how the program objectives relate to the seven themes that emerged from qualitative analysis from Fig. 5.
Future Work: Program Monitoring and Quality Assurance

Progress towards program objectives will be assessed during the “program monitoring” phase of program evaluation. Metrics of progress will be defined for each program objective with special attention to how to measure the objective as it relates to its emergent theme(s). In addition to monitoring progress towards specific outcomes, as is done with the program monitoring piece, the DEI committee will develop a set of standards to ensure quality programming. These standards will be selected from Martin’s dimensions9 associated with program quality, such as “durability” to ensure the impact is lasting and “responsiveness” of the DEI committee to community needs. As is stated in the DEI committee’s mission statement, “We recognize that building a department that has an equitable and inclusive environment is an ongoing, long-term effort that will require collecting information, setting goals, and continually examining our changes over time.” Thus, the flexibility and continual monitoring of this program will allow for adaptation of specific DEI goals over time that is consistent with changing demographics of the BME community as well as external political and social factors.

CONCLUSION

Northwestern University’s BME DEI efforts captured the perspective of key groups without funding. We have worked to transfer our innovative implementation to other programs at Northwestern University. Furthermore, our program evaluation plan provides a sustainable, effective way to reflect on community input and drive departmental change. With resource sharing, we can reduce implementation and time costs for others and work together to establish best practices. Future funding (for example, from departmental discretionary accounts or grants) will be necessary for personnel dedicated to sustaining DEI efforts, such as an external evaluator.

SUPPLEMENTARY INFORMATION

The online version contains supplementary material available at https://doi.org/10.1007/s43683-022-00072-5.

ACKNOWLEDGMENTS

The authors would like to acknowledge the inaugural members of the DEI committee: Professor Yonghui Ding, Michael Okun-Perlin, Samantha Huddleston, Thara Nallamouthu, Marsalis Smith, Liliana Wang, Elijah Huang, and Peter Kouassi.

AUTHOR CONTRIBUTIONS

CA drafted the manuscript and advised on the statistical analysis of the climate survey. CD performed the analysis, created graphs, and revised the manuscript. RV edited the schematics and revised the manuscript. NK created the original version of the schematics. ES and NK revised the manuscript evaluating it critically for accuracy.

FUNDING

Not applicable.

DATA AVAILABILITY

A supplemental table with event details is provided.

CONFLICT OF INTEREST

Not applicable.

ETHICAL APPROVAL

Not applicable.

CONSENT TO PARTICIPATE

Not applicable.

CONSENT FOR PUBLICATION

Not applicable.

REFERENCES

1Straus SE, Glasziou P, Richardson WS, Haynes RB. Evidence-based medicine E-book: how to practice and teach EBM. New York: Elsevier Health Sciences; 2018.
2Royse D, Thyre BA, Padgett DK. Program evaluation: an introduction to an evidence-based approach. Boston: Cengage Learning; 2015.
3Poon J. 2018 USC Campus Climate Survey, Aug. 19, 2019. https://public.tableau.com/app/profile/jonathan.poon/viz/2018UniversityofSouthCarolinaCampusClimateSurvey/2018CampusClimateSurvey. Accessed 3 Jan 2022.
4Johnson RB, Onwuegbuzie AJ, Turner LA. Toward a definition of mixed methods research. J Mixed Methods Res. 1(2):112–133. https://doi.org/10.1177/1558689806298224.
Stachl CN, Hartman EC, Wemmer DE, Francis MB. Grassroots efforts to quantify and improve the academic climate of an R1 STEM department: using evidence-based discussions to foster community. J Chem Educ. 2019;96(10):2149–57. https://doi.org/10.1021/acs.jchemed.9b00163.

Wadman M. HHMI fires prominent biologist for sexual harassment. Science 2021.

Sue DW, et al. Racial microaggressions in everyday life: implications for clinical practice. Am Psychologist. 62(4):271.

Son C, Hegde S, Smith A, Wang X, Sasangohar F. Effects of COVID-19 on college students’ mental health in the United States: interview survey study. J Med Internet Res. 2020;22(9):e21279. https://doi.org/10.2196/21279.

Martin LL. Total quality management in human service organizations. Newbury Park: Sage Publications; 1993.

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.