

Empowering Students to Assess the State of Diversity, Equity, and Inclusion on Campus

Jonathan Auerbach¹ and Christi Wilcox²

¹ Department of Statistics

² CEC Diversity, Outreach & Inclusive Learning

Volgenau School of Engineering

George Mason University

Bios

Jonathan Auerbach is an Assistant Professor in the Department of Statistics at the Volgenau School of Engineering at George Mason University.

Christi Wilcox is Associate Director and Deputy Title IX Coordinator of CEC Diversity, Outreach & Inclusive Learning at the Volgenau School of Engineering at George Mason University.

Abstract

Universities have strengthened their commitment to diversity, equity, and inclusion (DEI) over the past decade. Many have established DEI offices tasked with removing barriers that limit the participation of students, faculty, and staff. These barriers are formidable, however, and it is unrealistic to expect even generously resourced offices to identify and address all potential barriers. In this paper, we propose that instructors of project-based courses, such as coding or capstone classes, work with DEI offices to have students investigate the state of DEI on campus. We describe a class project in which undergraduate students conducted their own independent assessments and submitted a short report summarizing their findings. The lesson proved rewarding to both the students and the DEI office: Students reported a variety of trends, some of which surprised even the DEI office. Students also gained a different perspective on campus diversity and a deeper appreciation for how diversity is calculated in practice. We conclude that students are an untapped resource that can help improve campus life as they develop their statistics and data science skills.

Keywords

Diversity, Equity, and Inclusion; DEI; Capstone Design Courses or Projects; Diversity in STEM; Campus as a Laboratory; Data Science; Teaching

Introduction

Universities have strengthened their commitment to diversity, equity, and inclusion (DEI) over the past few years. Many have established DEI offices tasked with removing barriers that limit the participation of students, faculty, and staff. For example, DEI offices provide struggling undergraduate students with additional resources to complete their coursework, such as peer mentoring and study spaces. They also assist a wide range of faculty—from K-12 educators who facilitate the transition to higher education to college instructors who develop lesson plans that better resonate with students of all backgrounds.

But the barriers that limit participation are formidable. Many reflect inequities deeply ingrained in society, and when these inequities manifest as barriers, they limit participation in subtle and complicated ways. For this reason, it is unrealistic to expect even a generously resourced office to identify and monitor all the barriers that potentially limit participation. Assistance is needed.

At the same time, instructors struggle to find meaningful data that motivate students to practice data analysis and computing. The search for meaningful data is becoming more difficult as student bodies diversify since data that resonate with students of one background may not resonate with students of another. Moreover, the increase in student diversity has not been met by an increase in resources or discipline-based practices that accommodate diverse backgrounds. Thus, instructors require data that are not only meaningful but easy for all students to obtain and analyze, regardless of their background.

In this paper, we describe a project aimed at addressing these challenges. We propose that instructors of project-based courses, such as coding or capstone classes, work with DEI offices to have students assess the state of DEI on campus. We argue that this project benefits both DEI offices and instructors. DEI data are easily obtained, analyzed, and meaningful to all. Therefore, the project engages all students regardless of their background. In addition, DEI offices gain the perspective of the students that attend their institution, supported by data analytics that can inform future programs and policies.

We provide the details of our proposal in three sections. In the first section, we outline the mission of a DEI office. This background provides important context for students, who we have found are greatly motivated by aiding that mission. We then contrast our proposal with other projects that address DEI on campus. In the second section, we describe a version of the proposed project we taught at the authors' institution. We review the data available to assess DEI as well as several example measures of diversity students may choose to use in their investigation.

In the third section, we review the students' findings, focusing on trends that surprised the DEI office. We also review the results of a post-project survey students completed. We find that students'

awareness of DEI increased following the project. For example, the author’s institution has more diverse enrollment than the typical university, and the project increased the percentage of students who viewed the author’s institution as diverse and inclusive. At the same time, however, the author’s institution still lacks equity, and the assignment increased the percentage of students concerned about diversity and inclusion on campus—indicating more work is needed. We also find that while few students were aware of how diversity was measured before the project, all students were confident in their findings. This suggests students are comfortable applying the new skills they developed while working on the project.

We conclude by outlining several actions the DEI office will consider in light of the students’ findings. We also discuss some minor challenges we experienced conducting the proposed project. For example, we found that the students in the class had a limited perspective of the barriers facing faculty and staff. Yet overall, we conclude that students are an untapped resource that can help improve campus life while developing their data analysis and computing skills.

Section 1: The proposed project advances the mission of DEI offices

Diversity, Equity, and Inclusion (DEI) offices are tasked with an ostensibly simple mission—to ensure all members of the community can participate regardless of background, culture, and identity. Overcoming barriers to participation at post-secondary institutions is particularly important. A comprehensive review by the Department of Education (DOE) found that “higher education is a key pathway for social mobility in the United States” and “gaps in college opportunity contributed to diminished social mobility” (U.S. Department of Education 2016).

The DOE recommends institutions build “their capacity to collect and analyze the data required to set and track their diversity and inclusion goals.” But participation decreases at multiple points across the higher education pipeline, including at application, admission, enrollment, persistence, and completion. A large data collection and analysis effort is necessary to examine all such points. Thus, by participating in the proposed project, students join a comprehensive effort to assist the DEI office in identifying and addressing the barriers responsible for decreased participation, thereby increasing social mobility.

We note that by participating, students also further the mission of their professional associations. For example, the proposed project furthers the four objectives in the American Statistical Association’s Statement on Justice, Equity, Diversity, and Inclusion (JEDI):

1. Learn from our members and others how to identify and overcome systemic racism and hindering biases of any kind.

2. Critically reappraise and improve the effectiveness of our JEDI efforts.
3. Identify and develop resources for individuals and organizations in our professional community to enable growth and appreciation for cultural humility.
4. Share openly our diversity and inclusion efforts and the solutions we have implemented.

We end this section by comparing the proposed project to others proposed to promote DEI. Our literature search revealed a wide variety of such projects over the past few years, and we divide these projects into two categories for comparison purposes.

The first category—and the most common by far—is the creation of courses, panels, and workshops that raise awareness of DEI barriers, such as microaggressions and implicit biases. These efforts are often interdisciplinary and may also include staff and members of the community. See Lesser and Nordenhaug (2004), Lesser (2007), Rawat et al. (2017), Herrera et al. (2021), and Asgarpoor et al. (2021) for examples. The project we propose is similar in that we raise awareness of DEI barriers by having students study DEI on campus. See Section 3 for evidence that the proposed project does in fact increase awareness.

Several projects used new technology, outreach, or other strategies to make existing courses more accessible. These projects are particularly impactful when course materials are difficult for some students to access. See Gray et al. (2016), Angrave et al. (2020), Dickens (2021), and Liao (2022) for examples. We note that the last example uses students to crowdsource transcription. This is similar in spirit to our proposal, which uses students to crowdsource DEI analytics. Crowdsourcing DEI analytics can provide new perspectives on the barriers that limit participation. See Section 3 for a discussion of some of the findings students may report as a result of their investigations.

After conducting our literature search, we concluded that though a wide variety of projects have been proposed to promote DEI on campus, we could find no project that affords students the opportunity to use their data science and computing skills to further the mission of DEI offices on campus. In the remainder of this paper, we discuss how the proposed project can be conducted in practice. Our discussion is based on a version of the project we recently conducted at the author's institution.

Section 2: Students at author's institution assessed DEI on campus in a month-long project

The proposed project was assigned to sixteen students in an upper-level class offered at the author's institution. The project utilized two and a half hours of class time over two days. One class was taught by

a member of the Diversity, Equity, and Inclusion (DEI) office, in which the mission of the office was discussed. The other class was taught by the statistics instructor, in which the official DEI statistics were reviewed and three example DEI measures were demonstrated. Students were given two weeks to conduct their individual investigations and draft a report of roughly five hundred words. The reports were reviewed for accuracy and clarity, and the students were then provided another two weeks to revise their investigation and submit their final reports.

The project instructions were intentionally simple to provide students maximum flexibility. Students were asked to use official DEI statistics to answer the question: Is the authors' institution diverse? (See Subsection 2.a. for an explanation of official DEI statistics.) Students could examine the entire university or a portion of it, for example the engineering school or students in STEM programs. Students were encouraged to let their personal experience guide their analysis; however, they were instructed to answer the question (yes, no, somewhat, etc.), support their answer with the official statistics as the primary evidence, and suggest policies or recommendations.

Students were told that the DEI office at the author's institution was the target audience. The goal was to offer actionable insight that would help make the author's institution more equitable and inclusive.

2.a. Students were required to support their reasoning using official DEI statistics

The primary data for the project were the official DEI statistics published by the Department of Education's National Center for Education Statistics through the Integrated Postsecondary Education Data System (IPEDS). IPEDS is collected by a system of interrelated surveys conducted annually by the National Center for Education Statistics. The data contain detailed enrollment, funding, and graduation information from roughly 6,400 colleges, universities, and technical and vocational institutions.

The data are of extremely high quality since all institutions that participate in the federal student aid programs are required to complete the IPEDS surveys under Title IV of the Higher Education Act. The data are also well documented. Students were encouraged to complete the five module-based tutorials designed to introduce them to the IPEDS data (U.S. Department of Education 2022).

Students were taught several ways to access the data. The preferred approach was for students to use the Urban Institute Education Data Portal. The Urban Institute supports an API as well as "wrapper" packages for the `R`, `Python`, `Javascript`, and `Stata` programming languages. Most of the students in the class were familiar with `R`, and the `R` package was demonstrated in class (Urban Institute 2022).

Other approaches taught to the students include a demonstration of how to download the data directly from the IPEDS website by constructing Statistical Tables, a demonstration of how to access the complete data files, and a demonstration of a comprehensive dataset created by Urban Institute from IPEDS and other sources (Urban Institute 2020). We found it was important to provide multiple ways to access the data to accommodate students less comfortable with coding.

2.b. Students were provided with three examples of how to measure diversity

Students were taught three indices that are commonly used to measure the diversity of a group. The lack of diversity according to any of these measures may suggest the existence of barriers that prevent inclusion and the equitable distribution of campus resources. All three measures assume that the population has been divided into two or more groups. The three indices are:

Disparity Index — calculate the percentage of the population from historically marginalized communities. Often the percentage of Black or Hispanic students is used. However, students might also consider the percentage of women in STEM for example.

Diversity Index – randomly pair individuals and calculate the percentage of pairs in which more than one group is represented. Note that this index is closely related to the Simpson’s Diversity Index and the Herfindahl–Hirschman Index.

Diffusion Index – calculate the percentage of students not in the k largest groups.

Students were told they could compare universities with each other, or universities to the state or county population that contained the institution. For further reading, students were assigned to read the Urban Institute report "How Racially Representative Is Your College?" (Urban Institute 2020), which used the Disparity Index, and the Census Bureau blog post "Measuring Racial and Ethnic Diversity for the 2020 Census" (Jensen et al. 2021), which used the Diversity and Diffusion Indices. Additional readings that demonstrate diversity analyses are given by the Chronicle of Higher Education (2017), De Brey et al. (2019), and Auerbach and DeLazzerio (2022).

We note that one population may be considered more diverse than another if it has a higher index according to one or more of these measures. However, the three measures may disagree on which of two populations is more diverse. Furthermore, the measures themselves may change depending on which groups are chosen for the analysis. For these reasons, we stressed that it is incumbent upon the student to choose meaningful groups and an appropriate measure that makes sense within the context

of the students' investigation. Students were not required to use one of these measures, and several students chose alternative measures using concepts such as correlation, regression, and entropy.

Section 3: Students were split over whether the author's institution was diverse.

All sixteen reports investigated the state of diversity among undergraduate students. This was not surprising since the students authoring the reports were themselves undergraduates. Most students examined diversity in enrollment, however many also examined diversity among the graduating class or the degree the graduates received.

Roughly half the class reported positively about diversity at the author's institution, while the other half found the author's institution lacked diversity in some crucial respect. Out of sixteen reports total, thirteen (81%) considered racial or ethnic diversity, while six (38%) focused on gender diversity. Nine (56%) found the author's institution had much larger racial diversity than comparable universities. Seven (44%) reported on engineering schools specifically—most of those finding that the gender gap at the author's institution was larger than comparable engineering schools. Other surprising or notable trends reflected barriers disproportionately facing students with disabilities and older students.

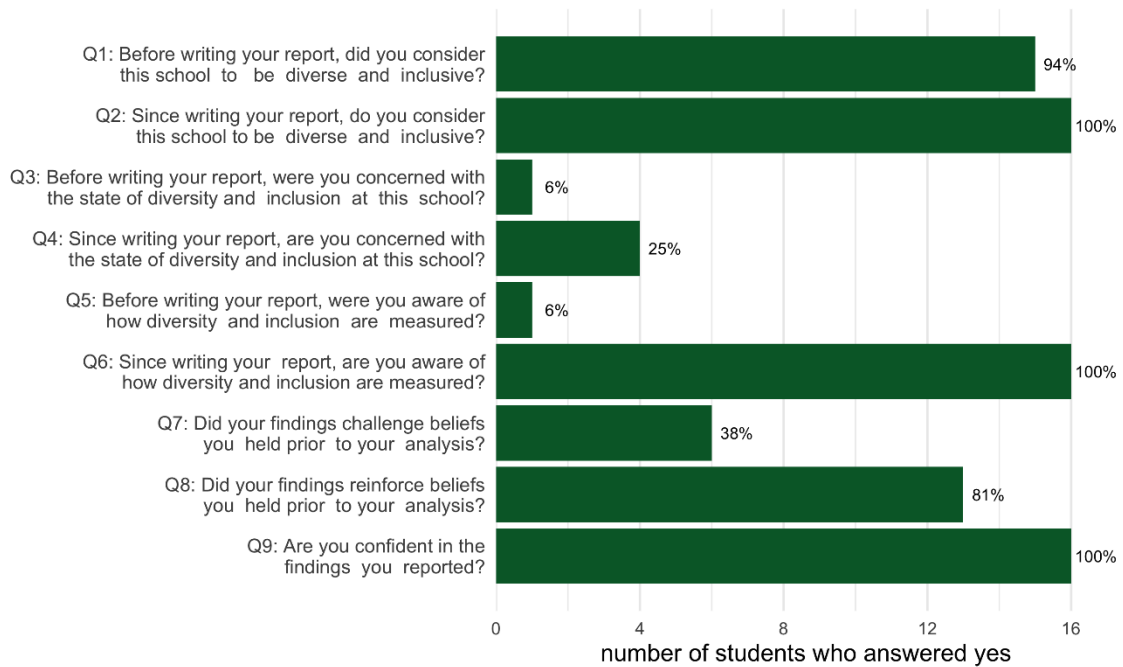
The most common recommendation was to conduct further study. Other recommendations included recruitment practices and raising awareness of diversity among campus students, faculty, and staff. Several reports suggested that the lack of diversity was itself a barrier to inclusion. That is, students may be more comfortable participating with others who share similar identities and experiences.

Following the project, we conducted a short follow-up survey to determine whether the assignment affected students' views. The survey took roughly two minutes for students to complete. To encourage truthful answers, participation was voluntary and all responses to the survey were anonymous. The survey was reviewed and approved by the authors' Institutional Review Board (IRBNet reference number 1972134-1).

All students who completed the project chose to participate in the follow-up survey. The survey results are displayed in Figure 1 below. The results indicate that students' awareness of DEI increased following the project, as measured by several questions. For example, the author's institution has more diverse enrollment than the typical university, and the project increased the percentage of students who viewed the author's institution as diverse and inclusive (Questions 1 and 2). At the same time, however, the author's institution still lacks equity, and the assignment increased the percentage of students concerned about diversity and inclusion on campus—indicating more work is needed (Questions 3 and

4). The biggest increase was an awareness of how diversity is calculated, which increased from one student who indicated awareness before the project to all sixteen afterwards. (Questions 5 and 6)

Figure 1: Students who participated in the project reported an increased awareness of diversity.



Although few students were aware of how diversity was measured before the project was assigned, all students who participated in the project were confident in their findings (Question 9). This suggests that the project helped students master the application of diversity measures in identifying barriers to participation. Confidence is important because it is aligned with developing student self-efficacy—a well-documented factor that determines whether students will use their skills in future coursework and in their chosen occupations (Han et al. 2021).

Discussion

In this paper, we proposed instructors of project-based courses, such as coding or capstone classes, assign students the task of investigating the state of diversity, equity, and inclusion (DEI) on campus and reporting their findings to the DEI office. We first discussed the mission of the DEI office. We then described a version of the proposed project we taught at the authors' institution. Finally, we reviewed the students' work and a post-report survey in which the students reflected on the project.

The lesson proved rewarding to both the students and the DEI office. In light of the students' findings, the DEI office is considering the following actions

1. Reaching out to institutions with a smaller gender gap in engineering to discuss best practices and initiatives
2. Working with offices on campus that facilitate adult learners and online learning, such as the offices of Continuing Studies and Teaching and Learning
3. Performing an audit on the current efforts to increase the retention of engineering students, identifying opportunities to retain traditional and nontraditional students.

Overall, the project ran smoothly. Students were well motivated by aiding the DEI office in fulfilling their mission. Nevertheless, two minor challenges did arise, which we believe should be considered when future versions of this project are conducted.

We found that students are limited by their own experiences. For example, undergraduate students largely experience the university through their interactions with other students—not through their interactions with faculty and staff. It is perhaps for this reason that no student chose to investigate the diversity of faculty or staff, even though such data were easily accessible. Future versions of the project might explicitly ask students to study faculty and staff diversity along with student diversity.

Another challenge was creating a uniform standard for evaluating and grading the wide variety of investigations students conducted. In particular, it was difficult to set student expectations for how the assignment would be graded. Much of this difficulty arose from the fact that we intentionally placed little structure on the assignment in order to obtain the widest set of perspectives possible. While students appreciated the importance of this flexibility, several still expressed concern over whether their answer was “correct.” Future versions of this project might address this concern by showing past projects as an example. However, doing so might limit the creativity of the students’ investigations as students may feel pressured to emulate the example provided.

Despite these challenges, we found the proposed project resonated with every student in the class. We conclude that students are an untapped resource that can help improve campus life as they develop their computing and data science skills. While there are a wide variety of opportunities for students to develop data analysis and computing skills while exploring their environmental footprint, we hope the proposed project is the first of many in which students can explore their social footprint—how campus activities may systematically advantage or disadvantage students, faculty, and staff.

Data Availability Statement

Deidentified student responses will be made available on the author's website. The IRBNet reference number is 1972134-1

References

Angrave, L., Jensen, K., Zhang, Z., Mahipal, C., Mussulman, D., Schmitz, C.D., Baird, R.T., Liu, H., Sui, R., Wu, M.S., and Kooper, R. (2020), "Improving Student Accessibility, Equity, Course Performance, and Lab Skills: How Introduction of ClassTranscribe is Changing Engineering Education at the University of Illinois," American Society for Engineering Education Annual Conference.

Asgarpoor, Jena Shafai, Meg Handley, Alisha L. Sarang-Sieminski, John Brooks Slaughter, Meagan C Pollock, Homero Murzi, and Monica Farmer Cox. (2021), "Embracing Diversity, Equity, and Inclusion in Our Classroom and Teaching," American Society for Engineering Education Annual Conference.

Auerbach, J., and DeLazzer, C.E. (2022), "Linked data detail a gender gap in STEM that persists across time and place," Harvard Data Science Review, 4, 2.

Chronicle of Higher Education. (2017), "Diversity Index." <https://www.chronicle.com/package/diversity-indexes/>

De Brey, C., Musu L., McFarland, J., Wilkinson-Flicker, S., Diliberti, M., Zhang, A., Branstetter, C., and Wang, X. (2019), "Status and Trends in the Education of Racial and Ethnic Groups 2018. NCES 2019-038," National Center for Education Statistics. <https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2019038>

Dickens, J. C. (2021), "The Data Science Public Schools Outreach Project: An Initiative for Diversity and Inclusion in Statistics." CHANCE 34.1.

Gray, C., de Cresce El Debs, L., Exter M., and Krause, T.S. (2016), "Instructional Strategies for Incorporating Empathy in Transdisciplinary Technology Education." American Society for Engineering Education Annual Conference.

Han, J., Kelly T., and Knowles, J.G. (2021), "Factors Influencing Student STEM Learning: Self-Efficacy and Outcome Expectancy, 21st Century Skills and Career Awareness," Journal for STEM Education Research, 4.

Herrera, D., Leader C.M., Patel S., and Behrouzi, A. (2021), "Student-Led Summer Diversity Workshops for Built-Environment Majors." American Society for Engineering Education Annual Conference.

Jensen, E., Jones, N., Orozco, K., Medina, L., Perry, M., Bolender, B. and Battle, K. (2021), "Measuring Racial and Ethnic Diversity for the 2020 Census." US Census Bureau.

<https://www.census.gov/newsroom/blogs/random-samplings/2021/08/measuring-racial-ethnic-diversity-2020-census.html>

Lesser, L.M., and Nordenhaug, E. (2004), "Ethical statistics and statistical ethics: Making an interdisciplinary module," Journal of Statistics Education, 12.3.

Lesser, L.M. (2007), "Critical values and transforming data: Teaching statistics with social justice," Journal of Statistics Education, 15, 1.

Liao, S.M. (2022), "SCRATCH to R: Toward an Inclusive Pedagogy in Teaching Coding," Journal of Statistics and Data Science Education.

Rawat, K., Lawrence E.E., and Gooden O.D. (2017), "Mobile Aerospace Education Lab (m-AEL): A NASA Supported K-12 "Roadshow-In-A-Box" Initiative to Advance Aviation/Aerospace Education in Underserved Counties." American Society for Engineering Education Annual Conference.

Urban Institute. (2020), "How Racially Representative Is Your College?"

<https://apps.urban.org/features/college-racial-representation/>

Urban Institute (2020), "Racial and Ethnic Representativeness of US Postsecondary Education Institutions." <https://datacatalog.urban.org/dataset/racial-and-ethnic-representativeness-us-postsecondary-education-institutions>

Urban Institute. (2022), "Education Data Explorer." <https://educationdata.urban.org/data-explorer/explorer> <https://educationdata.urban.org/documentation/schools.html>

U.S. Department of Education, Office of Planning, Evaluation, and Policy Development (2016), "Advancing diversity and inclusion in higher education: key data highlights focusing on race and ethnicity and promising practices." <https://www2.ed.gov/rschstat/research/pubs/advancing-diversity-inclusion.pdf>

U.S. Department of Education, National Center for Education Statistics. (2022), "Integrated Postsecondary Education Data System (IPEDS)."

Main website <https://nces.ed.gov/ipeds/use-the-data>

IPEDS tutorials <https://nces.ed.gov/ipeds/use-the-data/overview-of-ipeds-data>