



## An Exploratory Study of Intentionality Towards Diversity in STEM Faculty Hiring (Research)

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Dr. DesRoches has served as Chair of the ASCE Seismic Effects Committee (2006-2010), Chair of the executive committee of the Technical Council on Lifeline Earthquake Engineering (2010), and Board of the Earthquake Engineering Research Institute (EERI). He is currently a member of the executive committee of the National Academy of Sciences Roundtable on Risk, Resilience, and Extreme Events, a member of National Science Foundation (NSF) Engineering Directorate Advisory Committee, and is a member of the National Academies Board on Army Science and Technology (BAST). Dr. DesRoches has received numerous awards, including the Presidential Early Career Award for Scientists and Engineers (PECASE) in 2002 — the highest honor bestowed upon scientists and engineers in the early stages of their careers. Most recently, he was a recipient of the 2007 ASCE Walter L. Huber Civil Engineering Research Prize, the 2015 ASCE Charles Martin Duke Lifeline Earthquake Engineering Award, the Georgia Tech Outstanding Doctoral Thesis Advisor Award (2010), and the Georgia Tech ANAK Award (2008). The ANAK award is the highest honor the undergraduate student body can bestow on a Georgia Tech faculty member.

Dr. DesRoches earned his Bachelor of Science in Mechanical Engineering in 1990, a Master of Science in Civil Engineering in 1992, and a Ph.D. in Structural Engineering in 1998 — all from the University of California, Berkeley. He was inducted into Berkeley's Academy of Distinguished Alumni from Civil and Environmental Engineering in 2015.



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He has published several articles in the Transportation Research Record, other journals and conferences on these and other related topics. He is currently serving on the Transportation Research Board (TRB) Committee on Aircraft/Airport Compatibility and is a past member of the TRB Committees on Traffic Flow and Characteristics and Transportation Network Modeling. Stephen is also a member of the American Society for Engineering Education (ASEE).

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# An Exploratory Study of Intentionality towards Diversity in STEM Faculty Hiring (Research)

## Abstract

Despite efforts over the past few decades to promote diversity and foster inclusive campus climates, there is still underrepresentation of Blacks/African Americans, Latinx/Hispanics, and Native Americans (including Native Hawaiians and Alaska Natives) within the STEM professoriate nationwide. For students who are members of these groups, the culturally isolating experience this deficit creates can weaken one's academic self-perception, and hinder performance in STEM disciplines. This paper explores the relationship between intentionality towards diversity and inclusion in faculty job postings and corresponding faculty demographics at a variety of US postsecondary institutions. The research questions we are investigating are:

- In what ways are diversity and inclusion implicitly and explicitly addressed in the evaluated job postings?
- Does intentionality towards diversity and inclusion in job postings vary based on the type of position advertised (i.e., tenured/tenure track versus non-tenure-track) or institution type (i.e., Basic Carnegie Classification)?

Using HigherEdJobs.com, we conducted an advanced search of all open science and engineering faculty positions containing the keywords “data science”, “data engineering”, “data analysis”, or “data analytics.” Each result posted in September 2019 that advertised a full-time tenured/tenure-track or non-tenure track faculty appointment for at least one academic year at a US college or university was recorded. All qualifying job postings were qualitatively analyzed for active, intentional recruitment of URM candidates. Intentionality towards diversity and inclusion varied significantly across job postings. While some had no reference to diversity beyond a required one-sentence equal employment opportunity (EEO) statement, others explicitly addressed inclusion within the announcements, and still others required a standalone diversity statement as part of a complete application.

The results will help to inform strategies for recruiting URM faculty in STEM disciplines, which may lead to improved opportunities to create cultures of inclusion and support for diverse students (undergraduate and graduate) and postdoctoral fellows.

## Introduction

Black/African American, Latinx/Hispanic, and Native American (including Native Hawaiian and Alaska Native) faculty members continue to be underrepresented among the STEM professoriate nationwide, in spite of wide acknowledgement of the problem and efforts to more effectively recruit members of these groups. In 2018, only 2.4% of tenured and tenure track engineering faculty were African American, and only 3.8% were Hispanic [1], despite African Americans and Hispanics comprising an estimated 13.4% and 18.3% of the US population, respectively [2]. The need for professors from underrepresented minority (URM) groups is not only felt on university campuses. Rather, the deficit impacts all stages of STEM pathways, from

education to the workforce; the exclusion of diverse perspectives and lived experiences from classrooms and industry spheres ultimately stunts the potential for advancement within STEM disciplines overall.

The National Science Foundation (NSF), through its Alliances for Graduate Education and the Professoriate (AGEP) program, “seeks to advance knowledge about models to improve pathways to the professoriate and success for historically underrepresented minority doctoral students, postdoctoral fellows and faculty... in specific STEM disciplines and/or STEM education research fields.” Rice University, Texas Southern University, and the University of Houston received AGEP funding in 2019 to support a project ultimately intended to increase the number of URM faculty in data engineering and science (DES) disciplines. One component of the project is an investigation of systemic barriers that may impede the recruitment and appointment of URM talent to faculty positions.

The longstanding, deep-rooted tradition of exclusion within academic spaces can only be overcome with focused, intentional effort. Foundational literature on colloquial concepts of intentionality describes the traits of an intentional actor, including having beliefs about the consequences of their behavior, desire for a given consequence or outcome, awareness of their behavior, and the skill necessary to complete the intentional action [3]. This definition of intentionality adequately describes every day, interpersonal behavior, but it does not account for systemic factors that may unconsciously influence one’s actions. Within the context of racialized power structures and commitments to dismantle those structures, the concept of intentionality should be amended.

There is a seemingly reflexive tendency among some white faculty members to engage with issues of diversity and inclusion from a color-evasive, purportedly “race-neutral” perspective [4],[5]. They may believe attempting to refuse to engage with racial dynamics is sufficiently inclusive. Sensoy and DiAngelo described one hiring committee chair who reviewed applicant curriculum vitae (CV) by solely comparing each applicant’s number of publications, publication journal quality, and awarded grant funds [6]. This chair probably assumed that such a depersonalized CV review would be the most “objective,” and therefore impervious to bias. However, his approach neglected to account at all, for example, for the additional, invisible workload often foisted upon faculty of color [7], [8], who are frequently assigned additional professional and institutional responsibilities not expected of their white colleagues. When diversity and inclusion efforts do not confront the racialized power structures contributing to “objective” differences between candidates, they simply reinforce the systems of inequity that make them necessary.

In light of abundant documentation of the harm caused by color-evasive [9] ideology in higher education [6], [10] - [12], attempting to passively ‘opt out’ of a history of discrimination cannot be considered a truly intentional effort to diversify the professoriate. Rather, in recruitment of URM faculty, intentionality is evidenced in thoughtful, proactive disruption of normative hiring processes.

The present study explores instances of explicit and implied attitudes of intentionality towards diversity and inclusion within job announcements for faculty positions at a variety of US

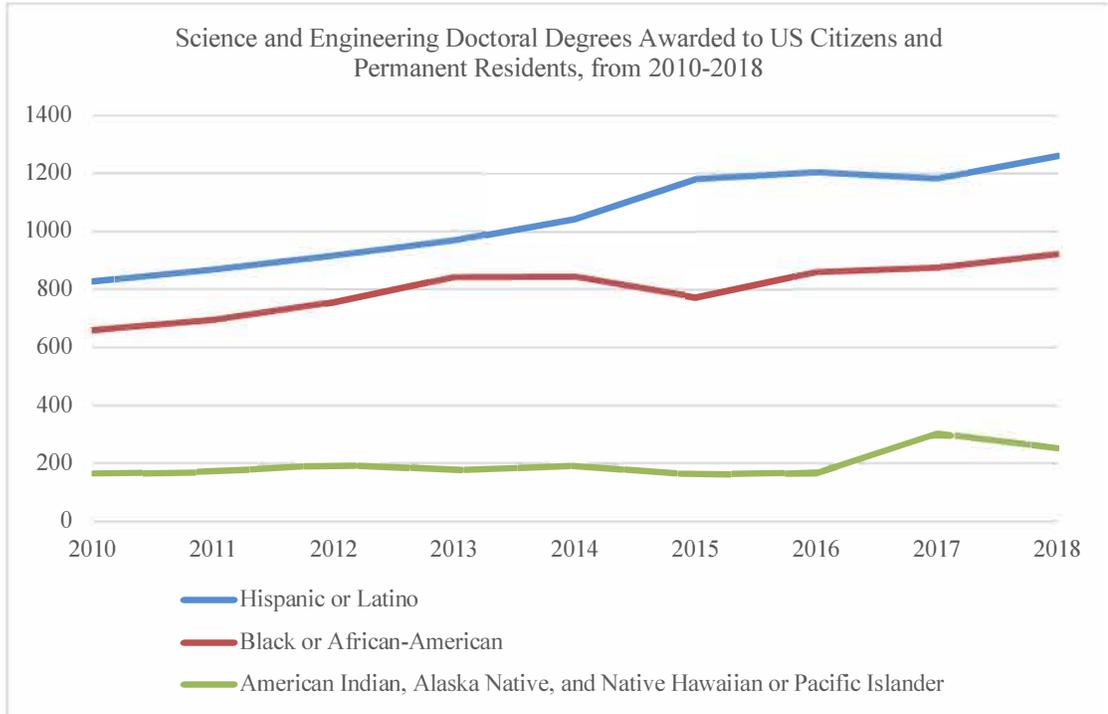
postsecondary institutions. Uncovering trends in the ways that institutions attempt to address a lack of diversity among their faculty will help to clarify opportunities for improvement, and inform later work on a larger scale. We conclude with a series of examples demonstrating highly intentional language, and the ways in which intentional recruiting of URM applicants can be expressed across all major sections of a job announcement.

## ***Background***

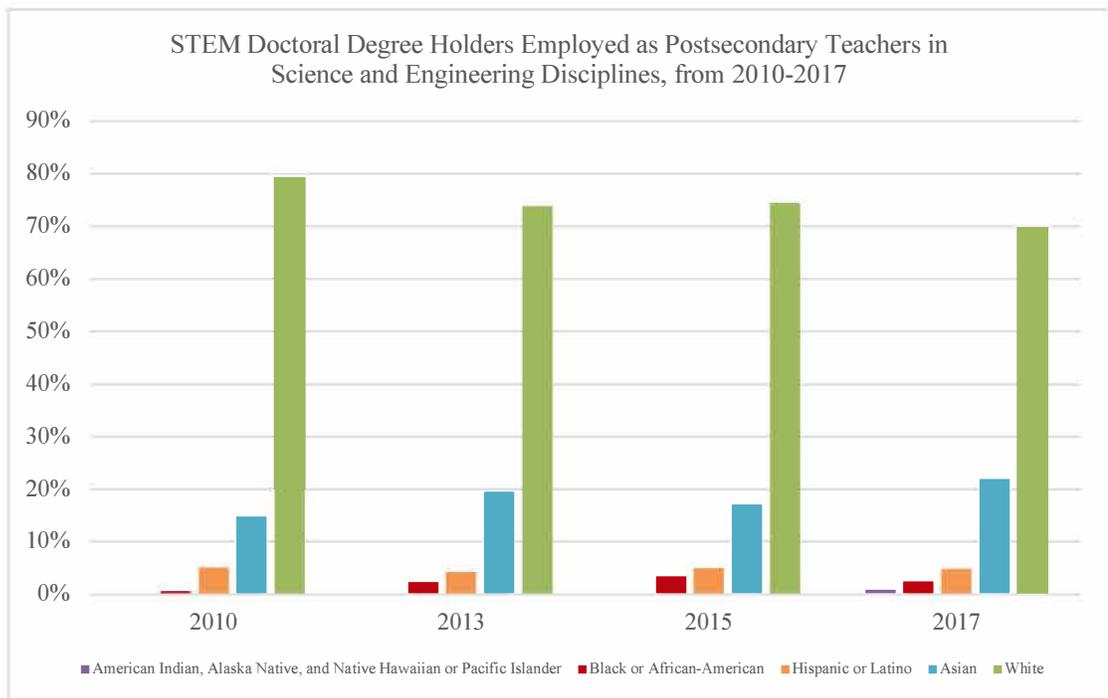
*Myth of the STEM Pipeline:* The dearth of faculty members from URM backgrounds in STEM has historically been attributed to ‘pipeline problems.’ Sue Berryman was one of the first to use the metaphor of an educational pipeline [13] as a way to describe the standardized path from secondary schooling through Ph.D. completion. When one refers to a problem with the STEM pipeline, they typically refer to ‘leaks’, i.e., attrition [14]. While this model is intuitively understood, it misrepresents the reality of employment in STEM fields as existing inside a social vacuum, where hiring decisions are largely rational and based on merit.

As discussed by Pawley and Hoegh, metaphors as pervasive as the educational pipeline are not simple conversational tools, but shape the way we think, acting as a “‘common sense’ frame of reference [14].” Allowing the idea of a pipeline to inform our thoughts, or act as a framework for research, is problematic [15] given that major assumptions informed by the pipeline are often false. Namely, many argue that the lack of diversity among STEM faculty reflects a commensurate lack of qualified graduates, but this is incorrect. Data trends show that, despite improving trends in STEM doctoral degree completion among members of underrepresented groups [16], their representation among the professoriate has been relatively stagnant in recent years [11], [17]. Figure 1 shows an increase in the numbers of URM Ph.D. graduates in science and engineering disciplines (excluding social and behavioral sciences) from 2010 through 2017 (the figure extends through 2018; however, our calculations are based on 2017 to allow comparison with the most recent faculty data, which is presented in Figure 2). On average, the increase in the number of graduates is roughly 53%; increases in graduates who are Hispanic, African American, and Native American were 43%, 33%, and 83%, respectively. Although the fractions of URM faculty generally increased during that time period, their fractions fell far below their respective group’s representation in the US population (Figure 2). On average, Hispanics, African Americans, and Native Americans comprised only 4.8%, 2.2%, and 0.3% of tenured and tenure track science and engineering faculty, respectively.

One statistical model showed that, even given exponential growth in the pool of Ph.D. graduates from URM groups, the composition of faculty would remain stagnant even through the year 2080 [16]! Those truly invested in repairing the ‘leaky pipeline’ should question solutions which deflect the burden of underrepresentation onto persons from underrepresented groups themselves. We must instead shift attention to understanding why institutions are failing to attract and retain talent that already exists. In other words, we must question why URM Ph.D. graduates are pursuing careers outside of academia, in some cases leaving the professoriate to do so [18]. Are their decisions strictly based on personal preferences? Are they encountering systemic barriers to entering into or advancing in academic careers? Are there other factors? Is a combination of factors at play?



**Figure 1: Trends in doctoral degree completion among three underrepresented racial/ethnic groups from 2010-2018 [17]**



**Figure 2: Demographic trends among postsecondary STEM faculty with STEM doctoral degrees, from 2010-2017 [19]**

*Hiring in Higher Education:* In recent years, more attention has been given to diversity in faculty hires. Much like the Rooney Rule in the National Football League, many institutions

require that at least one underrepresented minority or woman is in the final applicant pool that is invited for interviews. And much like the Rooney Rule, this practice has not resulted in change in the compositions of faculty based on race, ethnicity, or gender, especially in STEM fields. Search committees are often required to undergo training before their service begins. The typical trainings do not yield the desired results in many cases because they are usually focused on implicit bias, and as such, do not address the explicit biases that exist among some committee members; they are heavily skewed towards gender, which does not address issues related to racism in hiring; and they do not address positive biases that skew committee members' reviews in favor of candidates from better known institutions, which are typically less diverse, especially with regards to underrepresented racial and ethnic minorities in STEM. Therefore, despite the reported desire to hire more members of URM groups [20], the typical faculty recruitment process at many institutions simply results in a "homogeneous replication of the faculty body" [21].

*Race and the Language of Targeted Recruiting towards URMs:* Omi and Winant defined race as the embodiment of social conflict, which throughout US history has barred people of color from full participation in all occupations [22]. While a very small fraction of people of color were able to become scientists and engineers prior to the 1960s, racial minorities were largely segregated from these fields in the US until the passage of the Civil Rights Act [23], [24]. However, the underrepresentation of racial minorities in STEM fields persists today despite the presence of a legal framework that is intended to prohibit discrimination. One way employers have successfully attracted more job candidates from underrepresented groups has been through targeted recruitment [25]. Targeted recruitment encompasses a number of practices, including messaging through language, used by employers to strategically attract job candidates from a given group. Broadly, targeted recruitment works by appealing to the shared traits and experiences of members in a particular social group [26].

Different expressions of targeted language demonstrate intentionality to varying degrees. For instance, The Equal Employment Opportunity Commission (EEOC) enforces laws to protect employees from various groups from discrimination. Job postings are required to have an EEOC-compliance statement that expresses equal opportunities for persons from all backgrounds regardless of race, gender, disability, sexual orientation, and other identities. As a legal requirement, the inclusion of an EEOC statement signifies commitment to minimum standards rather than true intentionality towards diversity on the part of hiring institutions.

## **Data and Methods**

To answer the research questions, an advanced search was performed on HigherEdJobs.com for the keywords "data science", "data analytics", or "data analysis" across all engineering and sciences disciplines. Recorded results included all faculty appointments - both full-time and part-time, tenure-track and non-tenure track, from two-year and four-year institutions - that were advertised in September 2019. Results were excluded for appointments lasting less than one academic year, for appointments at institutions outside of the United States, and if the listed keywords were not pertinent to the position itself (e.g., if a background in data science was a required qualification, but job responsibilities did not include activities related to data science).

We collected 168 total postings and, for this study, selected 21 that were representative of the widest variety of institutional characteristics, including type and geographic location. Table 1 shows the variety among institutions along dimensions such as Basic Carnegie Classification, type of control, and geographic location. For each selected announcement, we recorded the tenure track status for the appointment, the department in which the position was available, and whether the advertised position was a joint appointment (see Table 2).

**Table 1. Institutional Characteristics of Postings Surveyed**

<i>Basic Carnegie Classification</i>	
Associate's and/or Baccalaureate Colleges	6
Master's Colleges and Universities	6
Doctoral Universities	9
<i>Type of Control</i>	
Private	6
Public	15
<i>Geographic Location</i>	
Midwest	2
Northeast	3
West	9
South	7

We analyzed all body text of the 21 selected announcements through deductive coding as described in Saldaña [27] using NVivo 12 for Mac. First, all text was categorized and coded to an appropriate announcement section, as described in Table 3, and then coded as containing targeted, ambiguous, or non-targeted language. Targeted language subcodes were derived from major protected classes as defined by the EEOC, groups who are underrepresented in STEM fields, and Avery & McKay's research on targeted recruitment [25]. Two researchers separately coded each announcement until achieving code saturation. Finally, coding disagreements between the researchers were discussed and resolved using the codebook dictionary (see Appendix).

Table 3 contains the Kappa values calculated by NVivo for interrater comparison. Overall, NVivo calculated a weighted Kappa statistic equal to 0.99. Kappa values were above 0.98 for all upper-level codes, indicating excellent agreement between coders [28]. Cross-tabulation in NVivo was also used to analyze ways that institutions utilized targeted language within the different sections of job announcements. The results of these cross-tabulations are discussed in the Results and Analysis section.

**Table 2. Job Posting Characteristics**

<i>Track</i>	
Non-Tenure	5
Tenure	15
Other*	1
<i>Department or School Name</i>	
Mathematics Specified Only	2
Engineering Specified Only	3
Computer Science Specified	6
Learning Sciences Specified	1
Statistics/Biostatistics Specified	5
No Department Specified	4
<i>Joint Appointment</i>	
Not specified	16
Potential	2
Yes	3

\* One institution included in this study does not have a tenure system for faculty.

**Table 3. Kappa Aggregated Statistics for each Upper-Level Code.**

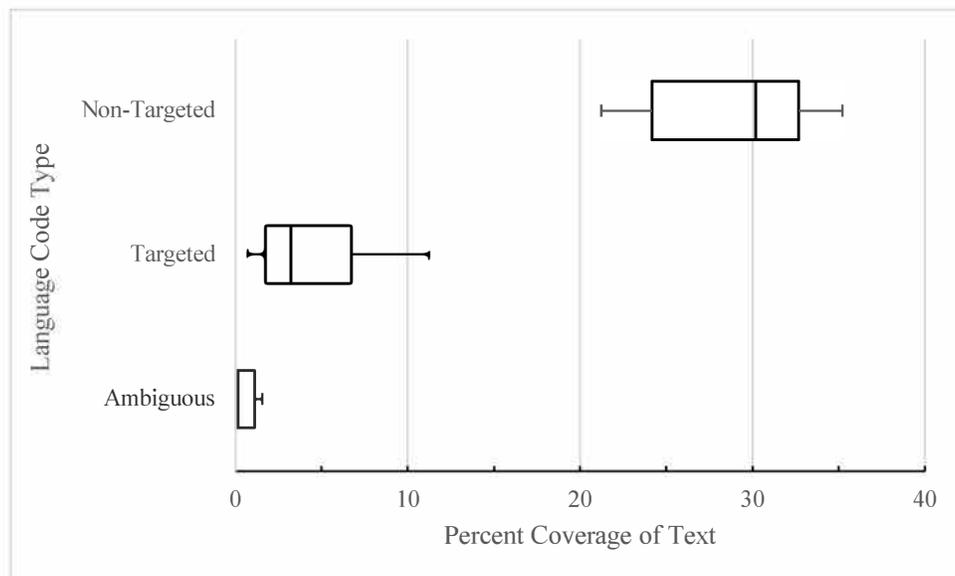
<b>Code</b>	<b>Description</b>	<b>Weighted Statistic</b>
Ambiguous language	A statement with a term or phrase that <b>both</b> referred to underrepresented <b>and</b> non-underrepresented groups in STEM.	1.00
Non-targeted language	A statement <b>without</b> a term or phrase related to an underrepresented group in STEM.	0.99
Targeted language	A statement <b>with</b> a term or phrase related to an underrepresented group in STEM.	0.98
Sections of Announcement	A portion of a job announcement with a specific heading or a main guiding topic, i.e., Qualifications, Application Instructions, etc.	1.00

## Results and Analysis

Non-targeted language was used significantly more than targeted or ambiguous language, with half of all postings having at least 10 times more non-targeted than targeted language. All other postings contained at least twice as much non-targeted language. Ultimately, the relative absence of targeted language illustrates a major missed opportunity in the use of job announcements as a tool in the recruitment of underrepresented applicants.

All 21 job postings contained non-targeted text. Across all postings, non-targeted language comprised 21-35% of the total body text, with a median of 30%. The presence of targeted language was also widespread, with 20 out of 21 postings containing some kind of targeted language. However, when targeted language was present, it had much less coverage across a typical job announcement. Across all announcements, targeted language had 0-11% coverage, with a median of 3%. Ambiguous language was present in 8 of 21 postings. Among these eight postings, ambiguous language accounted for 2% of a posting's text at most.

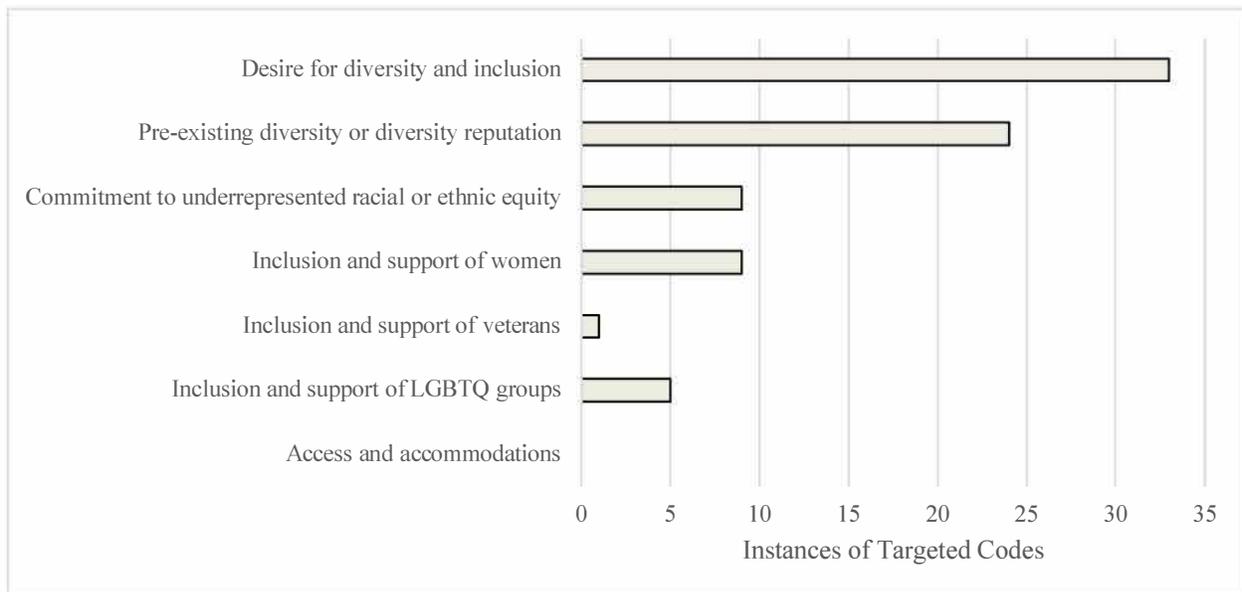
Figure 3 summarizes our findings on the coverage of all language types in a boxplot, illustrating the skewed distributions of coverage among the different types.



**Figure 3. Boxplot of the percent coverage of targeted, non-targeted, and ambiguous language per job posting text.**

The majority of existing targeted language was coded as a desire for diversity and inclusion or a reference to pre-existing diversity or diversity reputation. Figure 4 displays all references to targeted language by specific subcode. Of 81 instances of targeted language across all job postings, 33 were coded for desire for diversity and inclusion, and 24 for pre-existing diversity or diversity reputation. There were only nine total references to underrepresented racial minorities. Targeted language was also observed regarding the inclusion and support of women (9 times), inclusion and support of LGBTQ groups (5 times), and the inclusion and support of veterans (1 time). No job announcements addressed access and accommodations for people with disabilities.

The frequent use of the umbrella term “diversity” contributed to the overall lack of intentionality towards the recruitment of underrepresented minorities to DES positions. Although racial diversity is arguably included within this term, its use alone does not convey intentionality towards their recruitment. While it is good and accepted for an institution or department to publicly champion diversity and inclusion, doing so in a few sentences within a job announcement is not truly intentional, and does not make clear how a desire for diversity and inclusion or pre-existing diversity translates to a specifically concerted effort in hiring underrepresented racial minorities within a search committee. In all postings reviewed, there was no language about specific hiring practices that would have resulted in greater intentionality communicated to a prospective applicant. The most intentional language we found directly referred to a commitment to underrepresented racial or ethnic equity, because, at the very least, it directly referred to the target group.



**Figure 4. Subcodes for targeted language based on identity.**

To more intentionally and effectively recruit URM candidates, departments need to both do their own work to improve hiring practices and leverage resources that already exist on their campuses, which can be featured in their postings. We found a very brief example of a posting publicizing a campus resource in this excerpt:

*[Institution] is an ADVANCE institution ... [The] University’s School of Electrical and Computer Engineering is committed to advancing diversity in all areas of faculty effort including discovery, instruction, and engagement.*

While there is little information about the way being an ADVANCE institution translates to improved hiring practices, the applicant is at least made aware of an institutional resource whose main mission is to increase the presence of women in the professoriate. This university is a large, research-intensive, land grant institution, and has several pre-existing resources aimed to benefit

underrepresented racial minority students in STEM. However, none of these other resources are discussed in the announcement. For instance, this university is one of the few with an AGEP program that is institutionalized across the entire campus. Underrepresented minority graduate students in any department are able to participate in the AGEP program to network with other graduate students, better prepare for a faculty position, and receive a small stipend. Inclusion of this information would have been an even stronger, more intentional communication of an on-campus culture that truly prioritizes inclusivity.

As shown in Table 4, text coded to “desire for diversity and inclusion” and “pre-existing diversity or diversity reputation” was most often found in descriptions of institutional contexts. However, that targeted language was only found in descriptions of institutions or schools and departments; no announcements utilized targeted language in descriptions of an institution’s surrounding city. Within the descriptions of institutions or schools and departments, we only found two (2) instances of commitment to racial or ethnic equity.

**Table 4. Targeted Language in Descriptions of Institutional Contexts**

<i>Targeted Language</i>	<b>Institutional Context</b>		
	<i>Surrounding Area</i>	<i>Institution</i>	<i>School or Department</i>
Access and Accommodations	0	0	0
Commitment to underrepresented racial or ethnic equity	0	1	1
Desire for diversity and inclusion	0	7	5
Inclusion and support of LGBTQ groups	0	3	1
Inclusion and support of veterans	0	1	0
Inclusion and support of women	0	4	2
Pre-existing diversity or diversity reputation	0	9	3

The lack of targeted language regarding institutions’ cities is particularly troubling. Potential faculty from underrepresented racial groups will be aware of racialized dynamics within different cities, like integration of housing and schooling, or area trends in police violence towards people of color. Within a job announcement, targeted language about an institution’s city demonstrates to the reader that the hiring committee is aware of the importance of the multitude of issues that underrepresented faculty must navigate when attempting to find a supportive community. For example, a posting for a position at an HSI in the Southwest highlights the pre-existing diversity surrounding the university and the university’s view that it is an asset to the intellectual merit of research:

*[The city] is a highly livable, bicultural community of almost 700,000 people that offers affordable homes and attractive neighborhoods. It has been named among the safest*

*large US cities. [The city] experiences almost 300 days of sunshine annually, and residents enjoy outdoor activities year-round. The City is adjacent to demographically and geologically diverse areas, making it an ideal venue for academic programs and research studies on topics of national interest, such as bilingual education/language acquisition, border environment and immigration, environmental sustainability and infrastructure, health disparities, and international trade and commerce.*

Even if the surrounding community lacks representation of racial minorities, an institution could demonstrate ways it is working with the surrounding community to prevent discrimination against members of minority groups, perhaps by guaranteeing safe and equitable housing with a local financial institution or housing authority.

We found much more targeted language in descriptions of institutions and departments; as noted, the most common types of targeted language were “desire for diversity and inclusion” or “pre-existing diversity or diversity reputation.” There were only two cases that directly addressed a commitment to underrepresented racial or ethnic groups, which we saw as a missed opportunity. As with institutions’ surrounding cities, prospective underrepresented faculty will be well aware of the racial demographics of institutions they are applying to, both with regards to students and faculty. Using targeted language to demonstrate a commitment to underrepresented groups communicates that the problem is being acknowledged, and clearly establishes equity and inclusion as institutional priorities. Below is an excerpt from one posting that features several targeted codes in its institutional description, including commitment to underrepresented racial or ethnic equity, inclusion and support of women and LGBTQ groups, desire for diversity and inclusion, and pre-existing diversity or diversity reputation:

*As one of the most diverse liberal arts colleges in the country, we have a strong record of academic success with first-generation students, students of color, Latinx students, LGBTQ students, and other underrepresented students. [The college] has recently become a Hispanic-Serving Institution. Applicants with expertise and experience in supporting and promoting success for Latina/o students are encouraged to apply. [The college] encourages diversity in hiring and particularly welcomes applications and nominations from women, gender non-binary individuals, and minorities.*

The excerpt above features a rare reference to institutional hiring practices and encourages the applications of minorities; however, more specificity regarding actual search committee practices and how they promote diversity would better demonstrate accountability to prospective and current URM faculty. Discussion of department-specific practices that would maximize successful minority applicant hiring, such as practices that ensure the equitable review of minority applications, would be an even more intentional way to for this institution to recruit more faculty from underrepresented groups.

As shown in Table 5, targeted language was only utilized when discussing two of the three major categories of qualifications, the first being personal attributes or ‘power’ skills, and the second being prior experience. The majority of targeted language within these types of qualifications coded to “desire for diversity and inclusion.” When discussing applicants’ personal

attributes and ‘power skills’, desire for diversity and inclusion was often expressed in terms of “commitment”, “contribution” or “ability,” as in the excerpt below:

*Successful candidates for our faculty positions will demonstrate evidence of a commitment to advancing equity and inclusion. The Department is interested in candidates who will contribute to diversity and equal opportunity in higher education through their teaching, research, and service.*

Similarly, we found that the cross between the code for desire for diversity and inclusion and the code for prior experience occurred most often in the context of commitment or ability, as well as “service,” as in the following excerpts:

*Serious consideration will be given to professional service, including service promoting access to and diversity in higher education and the academic profession.*

*Demonstrated commitment to a diverse, non-traditional, first-generation student population.*

**Table 5. Targeted Language in Qualifications Requirements**

<i>Targeted Language</i>	<b>Qualifications Type</b>		
	<i>Personal Attributes or Power Skills</i>	<i>Prior Experience</i>	<i>Technical skills</i>
Access and accommodations	0	0	0
Commitment to underrepresented racial or ethnic equity	0	1	0
Desire for diversity and inclusion	6	5	0
Inclusion and support of LGBTQ groups	1	1	0
Inclusion and support of veterans	0	0	0
Inclusion and support of women	1	1	0
Pre-existing diversity or diversity reputation	3	1	0

In every case where technical skills were coded, all statements were written in a non-targeted manner, in the form of simple statements requiring applicants to have a Ph.D. in a particular field of study. We consider the lack of targeted language in technical skills to be another missed opportunity, especially within data science disciplines. There’s a great deal of discussion in the media and among professionals of the intersection between society and data science applications, such as stories of biased algorithms that effectively discriminate against racial minority groups. One way that targeted language could have been used in descriptions of technical qualifications would have been statements asking that faculty have expertise in the development of socially-conscious research, or research that challenges accepted norms and

practices in the field. Additionally, postings could have listed interdisciplinary experience between data science fields and fields such as African-American and Black Studies, Critical Disability and Race Studies, Chicana/o Studies, or Indigenous Studies as a technical qualification. Finally, calling for faculty to have specific skills with theory or research methodologies such as Indigenous Methods, Critical Race Theory, or Intersectionality would also have been a highly intentional way to recruit faculty from underrepresented groups. While not all URM faculty applicants will have these kinds of technical skills, calls for these skills reflect a department’s desire to develop research in a way that benefits all of society.

As shown in Table 6, more than half of targeted language coded within job descriptions and responsibilities was coded to “pre-existing diversity or diversity reputation.” In these cases, the job postings failed to describe ways candidates would fulfill these responsibilities, making it seem as if those aspects of the position were not as important as more detailed pieces of job descriptions that were coded as non-targeted. Some descriptions of job responsibilities cross-coded with “pre-existing diversity or diversity reputation” included common duties in academic positions. Descriptions of these responsibilities frequently used words like “teaching”, “advising”, or “mentoring,” as in the following excerpt, which uses all three:

*Furthermore, the successful candidate will have a strong commitment to teaching, advising, and mentoring undergraduate and graduate students from diverse backgrounds.*

**Table 6. Targeted Language in Job and Application Requirements**

<i>Targeted Language</i>	<b>Job and Application Requirements</b>		
	<i>Job description and responsibilities</i>	<i>Application materials or instructions</i>	<i>Diversity and Inclusion Statement</i>
Access and accommodations	0	0	0
Commitment to underrepresented racial or ethnic equity	0	2	1
Desire for diversity and inclusion	3	9	3
Inclusion and support of LGBTQ groups	1	0	1
Inclusion and support of veterans	0	0	0
Inclusion and support of women	1	1	1
Pre-existing diversity or diversity reputation	7	2	2

Alternatively, some postings described job responsibilities primarily within the framework of institutional climate, or awareness of issues, as in the following two cases:

*Demonstrates a sensitivity toward and respect for the myriad of diversities represented in the student population, colleagues and service area;*

*The competitive candidate must be committed to fostering a culturally diverse atmosphere for faculty, staff, and students.*

While these responsibilities are very important, they read as non-essential aspects of the job when contrasted with the language used to describe non-targeted job responsibilities, because there is little in the way of accountability offered to the reader. For instance, below is an excerpt of a non-targeted job description that is detailed, clear, and precise:

*The Department of Mathematics and Statistics ... is seeking to fill a nine-month tenure-track Assistant Professor position in the area of Data Science to begin August 16, 2020. The research emphasis should be on statistical learning, statistical modeling for big data analytics, and/or high-performance analytics. The successful candidate will be expected to: (1) develop her/his independent research program in Data Science, (2) interact with and contribute to interdisciplinary research at [the University], (3) advise and mentor students, and (4) have a strong commitment to high quality teaching.*

In the non-targeted statement above, detailed requirements are listed that constrain the research requirements of the position. A reader can see the ways they would be held accountable in their job. The structure of the job description shown immediately above is much different than the structure of targeted statements shown earlier, which are very open-ended in terms of the ways an applicant might actually fulfill their responsibilities.

One way postings could have mentioned job duties in a targeted way would have been to make their descriptions more structured, e.g., rather than mentioning a broad commitment to “fostering a culturally diverse atmosphere for faculty, staff, and students” departments could discuss the need for faculty to create research programs that would attract larger numbers of underrepresented racial minority students; specific areas of service, like programs or spaces on campus that serve underrepresented minority students and faculty; or initiatives to create more equitable hiring practices.

In the sections of postings detailing application materials or instructions, targeted language was mainly coded to “desire for diversity and inclusion.” In these cases, many postings asked prospective applicants to include statements about their work related to diversity and inclusion, as in the following excerpt:

*Contributions to D&I: Candidates should submit a 1-page statement on Contributions to Diversity and Inclusion. [The University] is committed to access, inclusion, and diversity and is actively developing a strategic plan to advance Diversity, Inclusion and Access ... The diversity and inclusion statement should describe your past experience and proposed activities to advance access, inclusion, and diversity at [the University].*

In some cases, like the one above, the posting referenced specific mission statements the university had made towards diversity and inclusion. In others, such as the following excerpt, application requirements with targeted language were much less clear about the institution's stance on diversity and inclusion:

*[A] statement on how your teaching and scholarship align with the commitment of the CS Department to foster an inclusive and diverse academic community;*

Linking to an institutional diversity and inclusion statement again helps to communicate intentionality, albeit at a minimal level. Intentionality could be targeted even more by also discussing within the posting the ways the search committee will value previous work in spaces like campus cultural centers or professional societies like NSBE, SACNAS, AISES, or previous mentoring through institutional programs like AGEF, MEPs (Minority Engineering Programs), or LSAMP in the hiring process.

Three postings contained standalone diversity and inclusion statements. While these statements expressed intentionality in terms of making diversity and inclusion important, again, they did not connect to clear ways applicants would be valued for their previous work, or outline specific ways the search committee's hiring practices aligned with the diversity and inclusion statement. The excerpt below is an example of a diversity and inclusion statement that is totally disconnected from accountability in hiring practices:

*Diversity and Inclusion Statement: At [the College], we celebrate the storied backgrounds of our campus community. We operate with a shared commitment to represent and serve the diverse population of [the state] and to encourage the exchange of ideas that respects and honors the lived experiences of our students, staff, and faculty. We foster a culture of inclusive excellence so our members can live authentically, fully engage, and flourish. In order to strengthen the college and progress its mission, the college dedicates itself to intentional and ongoing reflection to meeting the evolving needs of [the College], the surrounding communities, and the State.*

In the first row of Table 7, we again report institutional breakdown by Basic Carnegie Classifications. Our analysis including postings from six Associate's and/or Baccalaureate Colleges, six Master's Colleges and Universities, and nine Doctoral Universities. Below the first row, the counts of targeted language subcodes among the different institution types are displayed. We found that the most intentional type of targeted language – commitment to underrepresented racial or ethnic equity – was only utilized in postings by Master's Colleges and Universities. Those institutions also had the highest numbers of codes for inclusion and support of LGBT groups and women. They were equal with Doctoral Universities in codes for desire for diversity and inclusion, or pre-existing diversity or diversity reputation, even though there were fewer Master's Colleges and Universities represented in our sample.

**Table 7. Intentionality by Institution Type**

<b>Institution Type</b>	<b>Associate's/Baccalaureate</b>	<b>Master's</b>	<b>Doctoral</b>
<i>Count of Institutions</i>	6	6	9
<i>Count of Targeted Language Subcodes</i>			
Access and accommodations	0	0	0
Commitment to underrepresented racial or ethnic equity	0	6	0
Desire for diversity and inclusion	8	15	15
Inclusion and support of LGBTQ groups	0	8	0
Inclusion and support of veterans	1	0	0
Inclusion and support of women	2	6	3
Pre-existing diversity or diversity reputation	9	9	9

Upon closer examination, the six subcodes for commitment to underrepresented racial or ethnic equity came from postings authored by only three institutions. Factors outside of institutional type may help to explain the greater intentionality in postings from these institutions. All three institutions had MSI status, and two of the three were located near historic centers of Black and Latinx populations. We cannot at this point make any strong conclusions as to whether institution type, MSI status, or geographic location lend themselves to greater intentionality in job postings because of this study's sample size. The other three of the six Master's Colleges and Universities in this study did not post targeted language with a commitment to underrepresented minorities; neither did three of the other six MSI status institutions in the study.

We sampled fifteen tenure track postings, five non-tenure track postings, and one posting from an institution that does not have a tenure system among its faculty (Table 8). One of the five non-tenure track positions spoke of a commitment to underrepresented racial or ethnic equity, while two of the fifteen postings for tenure-track positions featured that subcode. Due to the low number of non-tenure track postings reviewed, we cannot make any preliminary conclusions as to how a posting's intentionality might be associated with the track of the position being offered.

**Table 8. Intentionality by Track**

<b>Track</b>	<b>Tenure</b>	<b>Non-Tenure</b>	<b>Other</b>
<i>Count of Institutions</i>	15	5	1
<i>Count of Targeted Language Subcodes</i>			
Access and accommodations	0	0	0
Commitment to underrepresented racial or ethnic equity	5	1	0
Desire for diversity and inclusion	37	1	1
Inclusion and support of LGBTQ groups	8	0	0
Inclusion and support of veterans	1	0	0
Inclusion and support of women	10	1	0
Pre-existing diversity or diversity reputation	21	5	1

## Conclusion and Recommendations

The most important aspect of crafting a job announcement that is highly intentional in the recruitment of URM applicants is to have and to advertise institutional interventions that are already in place for improving the recruitment and hiring of underrepresented minority applicants. In terms of communicating greater intentionality within the different sections of a job posting, we used our previous suggestions from the discussion above to edit actual text from job postings, demonstrating what highly intentional targeted statements could look like in institutional contexts (Table 9), required applicant qualifications (Table 10), and job and application requirements (Table 11). We realize that not all of these examples will be applicable at all institutions; however, we see these examples as constructive regarding the types of changes departments and institutions could make in order to be more intentional with their language, and better convey commitment to diversity and inclusion through job postings.

In Table 9, the examples we share are related to the ways descriptions of institutional context can demonstrate acknowledgement the nature of racial discrimination in the US, of which housing discrimination and police brutality at schools are two common manifestations. The following two examples for institutional and departmental contexts align with our overall definition of intentionality given earlier. These two examples provide detailed and concise information about hiring practices that would lead to a greater intentionality being conveyed in job postings.

**Table 9. Examples of Intentional Targeted Language about Institutional Contexts**

Context	Topic	Example
Surrounding Area	Housing and family	<i>As part of our Concierge program, we have partnered with our credit union to guarantee fair and equal housing loans to all employees throughout the surrounding community. We provide access to childcare with personnel that undergo implicit bias training to ensure child safety.</i>
	Attention to local issues	<i>The University monitors Office of Civil Rights reports of local schools for disproportionate punishment by race and police brutality and communicates this information to parents.</i>
Institution	Publicizing campus-wide programs already in place	<i>In 20XX, the President instituted a campus-wide initiative that requires all search committees to implement fair and equitable hiring practices to limit racial bias in the hiring process. All search personnel in any department are required to have participated in the initiative to take part in a search committee.</i>
Department	Department-specific improvement of hiring practices	<i>Our department is taking a leadership role in addressing the nationwide problem of underrepresentation of racial minority faculty in Computer Science. We have implemented bias prevention measures, such as ensuring that our search committee is staffed by at least 50% underrepresented minority representatives. We also apply bias prevention measures to the promotion and tenure process where we work to rectify past unacknowledged labor that that underrepresented members of the faculty often find themselves doing.</i>

The examples we share in Table 10 all feature short terms and phrases that instantly add more intentionality to job postings. In the first example, we reference a pedagogy developed in Critical Race Theory in Education called culturally-responsive curriculum, which has gained widespread notoriety throughout all levels of education. For qualifications or prior experience in service, we added “bias-conscious review process” to quickly convey that there was concerted effort being made by members of the hiring committee to better consider the types of service people do. We incorporated targeted language regarding recruitment to show how job postings can speak towards issues of underrepresentation in the student body while also speaking about the position. In the area of technical skills, we added scholarly fields that are critical of normative practices within STEM disciplines to encourage applicants whose work speaks to the need for change.

**Table 10. Examples of Intentional Targeted Language about Qualifications Requirements**

<b>Qualifications</b>	<b>Topic</b>	<b>Example</b>
Personal attributes or power skills	Values teaching	<i>Furthermore, the successful candidate will have a strong commitment to developing curriculum for diverse audiences using culturally-responsive curriculum that reaches all students.</i>
Prior experience	Service Recruitment	<i>We strongly consider all forms of service through our bias-conscious review process.</i>  <i>Successful work in the recruitment of underrepresented racial minority graduate students is desired as we have begun a new initiative to reach parity with these groups’ proportions within our state population as our standard.</i>
Technical skills	Forms of knowledge	<i>Successful applicants must hold a Ph.D. degree in Industrial Engineering. We desire candidates with research applicable to the relationship between race and technology in fields such as Science, Technology, and Society, Anthropology, Sociology, or Linguistics as demonstrated through graduate coursework, dissertation, or publications.</i>

In Table 11, we primarily demonstrate how language about accountability could be included in job postings. For research, we re-worked an earlier job posting we had criticized above into a statement that used targeted language while detailing the actual responsibilities that an applicant would be held accountable in performing. In the final two examples, we demonstrate ways to show intentionality by requesting applicant diversity statements, and also add detail conveying that the statement would be taken very seriously in the review process.

The general lack of intentionality in the recruitment of historically underrepresented minorities speaks to the rift that exists between the communication of underrepresentation as a national problem and its treatment at the department level, where actual progress needs to be made. As data science is a relatively new field, DES departments and professionals have abundant opportunities to rectify underrepresentation at its inception and create a lasting culture

of representation. However, such a culture can only be instilled if recruitment is done in a way that allows prospective applicants to really see themselves at the institutions with open positions. While institutions have widely accepted non-specific language about diversity and inclusion into their announcement lexicon, targeted language towards historically underrepresented minorities could go much further. Demonstrating greater accountability in hiring practices, for instance, would allow prospective applicants to have confidence that the institutions they are applying to value their presence and are respectful of their work. While a national problem, underrepresentation begins at the institutional level. It is because the vast majority of STEM institutions lack the proper representation of historically underrepresented racial minorities that the national disparity emerges. Only when institutions intentionally and collectively change their practices will we begin to make progress towards solving underrepresentation.

**Table 11. Examples of Intentional Targeted Language about Job/Application Requirements**

Qualifications	Topic	Example
Job description and responsibilities	Research	<p><i>A major goal of our research is to attract funding from the NSF Broadening Participation in Engineering program. The successful candidate will be expected to: (1) develop quantitative and qualitative research using critical theory and methods such as Critical Race Theory, Black Feminist Thought, Traditional Ecological Knowledge, or Indigenous Methods (2) interact with and contribute to interdisciplinary research at the University with faculty in Ethnic Studies, African American Studies, Indigenous Studies, or Chicana/o Studies (3) recruit students from underrepresented racial minority groups into an undergraduate research experience (4) and develop evidence-based culturally responsive teaching.</i></p>
Application materials or instructions	Work towards diversity and inclusion	<p><i>Candidates should submit a 1-page statement on Contributions to Diversity and Inclusion. We strive to make our review process transparent as possible, and candidates asked to interview will be given a rubric as to ways we have trained search committee members to review your contributions in a holistic manner that values the different paths and important differences that motivates the work they do.</i></p>
Diversity and inclusion statement	Highlighting commitment towards the hiring of diverse groups	<p><i>In our department, we acknowledge the continued effort to reach parity with our state's racial minority groups. In line with our diversity and inclusion statement (<a href="#">link here</a>), we have established new practices that will evaluate applications more equitably, including ways search committees recruit and evaluate applicants to ensure improvements in hiring. You can <a href="#">link</a> to see our process <a href="#">here</a>.</i></p>

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## Appendix -Codebook

<b>Code/Subcode</b>	<b>Description</b>	<b>Weighted Statistic</b>
Ambiguous language	A statement with a term or phrase that <b>both</b> referred to underrepresented <b>and</b> non-underrepresented groups in STEM.	1.00
Non-targeted language	A statement <b>without</b> a term or phrase related to an underrepresented group in STEM.	0.99
Targeted language	A statement <b>with</b> a term or phrase related to an underrepresented group in STEM.	0.98
<i>Access and accommodations</i>	A statement with a term or phrase related to access and accommodations for people with disabilities, or directly about people with disabilities.	1.00
<i>Commitment to racial or ethnic equity</i>	A statement of the importance of racial/ethnic diversity, advertisement of identity-conscious hiring policies	1.00
<i>Desire for diversity and inclusion</i>	A statement of the value of diversity and inclusion, or of a desire for campus diversity and inclusion	0.99
<i>Inclusion and support of LGBTQIA+ groups</i>	A statement about the promotion of inclusion and support of LGBTQIA+ groups.	1.00
<i>Inclusion and support of veterans</i>	A statement about the promotion of inclusion and support of veterans.	1.00
<i>Inclusion and support of women</i>	A statement about the promotion of inclusion and support of women.	1.00
<i>Pre-existing diversity or diversity reputation</i>	A promotion of pre-existing diversity among faculty and/or student body, inclusive campus attitudes, or diversity reputation/awards.	0.94
Sections of Announcement	A portion of a job announcement with a specific heading or a main guiding topic.	1.00
<i>Application materials or instructions</i>	A portion of a job announcement that requests materials to be included in the application or instructions for completing the application.	0.99
<i>Compensation</i>	A portion of a job announcement that alludes to wages or benefits associated with the position.	1.00
<i>Description of surrounding area</i>	A portion of a job announcement that describes the area surrounding the institution.	1.00
<i>Description of institution</i>	A portion of a job announcement that describes the institution.	0.99
<i>Description of school or department</i>	A portion of a job announcement that describes an academic department or school.	0.99
<i>Diversity &amp; inclusion statement</i>	Standalone diversity and inclusion statement, separate from an EEOC statement, within the main body of the job listing.	1.00

<b>Code/Subcode</b>	<b>Description</b>	<b>Weighted Statistic</b>
Qualifications	Employer-defined traits and characteristics required or desired in the posting.	0.97
<i>Personal attributes or 'power skills'</i>	Employer-defined traits and characteristics that are necessary to complete a job responsibility either individually or as a team.	0.97
<i>Prior experience</i>	A completed experience that demonstrates the possession of a skill or attribute.	1.00
<i>Technical skills</i>	Skills related to a scholarly field of interest, e.g., education requirements, research experience, etc.	0.98
EEOC Statement	An EEOC statement of any kind.	1.00
<i>Boilerplate EEOC</i>	A sub-type of EEOC statement that is separated from the main body of the job posting, and is displayed in small font.	1.00
Job description and responsibilities	A portion of the job announcement that describes the position and duties associated with the position.	1.00
Other	Statements that do not fall into the codes described above such as legal statements or disclosures.	1.00