

# Call without Response: Faculty Perceptions about Diversity, Equity, and Inclusion

## Kaitlyn Anne Thomas (Student)

Kaitlyn is an engineering education doctoral student at the University of Nevada, Reno. Her background is in civil engineering. Her research focus is women in engineering and mental health.

## Derrick Satterfield

Derrick Satterfield is a doctoral candidate in Engineering Education at the University of Nevada, Reno. His research focuses on engineering graduate students' experiences and motivation centered on career planning and preparation.

## Jeanne Sanders

Jeanne Sanders (she/her/hers) is a postdoctoral researcher in Engineering Education at Arizona State University. She graduated with her Ph.D from North Carolina State University in the Fall of 2020. She is pursuing a career supporting socially just causes. Her research interests include raising awareness for and supporting students, faculty, and staff with gender-expansive, romantic, and sexual minority identities.

## Adam Kirn (Associate Professor)

TBD

## Kelly J Cross (Assistant Professor)

Dr. Kelly J. Cross is a data-informed, transformational mission-focused culturally responsive practitioner, researcher, and educational leader. She earned her Bachelors of Science in Chemical Engineering from Purdue University in 2007 and Masters of Science in Materials Science and Engineering from the University of Cincinnati in 2011. Cross completed her doctoral program in the Engineering Education department at Virginia Tech in 2015 and worked as a post-doctoral researcher with the Illinois Foundry for Innovation in Engineering Education at the University of Illinois at Urbana-Champaign (UIUC). Dr. Cross worked in the Department of Bioengineering working to redesign the curriculum through the NSF funded Revolutionizing Engineering Departments (RED) grant. She is a member of the ASEE Leadership Virtual Community of Practice (LVCP) that organizes and facilitates Safe Zone Training workshops. Dr. Cross has conducted workshops on managing personal bias in STEM, online and in-person, in addition to faculty training on power and privilege. Her research interests include diversity and inclusion in STEM, intersectionality, teamwork and communication skills, assessment, and identity construction. Her teaching philosophy focuses on student centered approaches such as problem-based learning and culturally relevant pedagogy. Dr. Cross' complimentary professional activities promote inclusive excellence through collaboration. She is an NSF CAREER awardee, delivered multiple distinguished lectures, and has received a national mentoring award.

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Keywords: *Faculty; Engineering*

## **Abstract**

Current and historical sociopolitical national events have brought diversity, equity, and inclusion (DEI) to the forefront of discussion in academia. In response to this surge in social awareness of DEI, universities nationwide put forth plans and proposals for inclusive campus communities and initiatives to promote diversity. Educators, including engineering faculty, play a critical role in guiding students through these complex conversations. Based on this responsibility, we need to understand the state of faculty's knowledge levels and willingness to engage in these topics. The purpose of this study is to perform a systematic literature review of engineering education journals and conference proceedings to answer the research question: What themes emerge in current and previous EER on engineering faculty readiness to address DEI topics in their programs and classrooms?

Our literature review consisted of a search through three conference-paper and five journal-article databases for faculty beliefs about DEI from 2000 to 2021. Any student-centered studies and non-engineering faculty studies were excluded. Once a preliminary set of articles was found, we performed secondary and tertiary rounds of exclusion to compile a set of 22 articles that addressed our research question. This limited number of articles demonstrates that faculty beliefs about DEI are not commonly studied or discussed in engineering education research (EER). Because DEI is an essential topic in education and engineering, this result suggests a significant gap in EER community knowledge. With this gap in mind, we thematically analyzed the 22 articles that met the inclusion criteria to understand what faculty beliefs EER has focused on.

The main result of this analysis was our proposed model, the Problematization-to-Action Continuum (PTAC), which highlights faculty's readiness to make change efforts toward promoting DEI. The PTAC model is a single-axis continuum that contains three defined points (each end and the center). On one end, engineering faculty do not acknowledge there are problems concerning DEI, and there are no actions taken toward bettering these issues. In the center, faculty acknowledge that there are problems but feel they lack knowledge to take actionable steps to alleviate them. On the other end, faculty recognize patterns of inequity and actively intervene to promote inclusive practices. The largest grouping of papers on the PTAC (N=11 of 22) was located at the center of the model, revealing that there is an acknowledgement of the need for increased DEI efforts, but little action has been taken toward these efforts.

Overall, this literature review showed that there is an understanding of the responsibility to act regarding DEI efforts but a lack of knowledge or resources to execute and sustain DEI practices and policies. Future work involves investigating faculty's role in action plans for DEI policy change. By addressing faculty's role in these initiatives, we can support engineering faculty to engage in meaningful dialogue with all stakeholders and implement research-based strategies for improving DEI in their local academic institutions. The collective impact of strategically including faculty in DEI efforts will further the national conversation about the importance of DEI to make lasting change in our educational system.

## Introduction

Researchers have discussed the necessity for enhancing diversity, equity, and inclusion (DEI) in the context of academic institutions for years. Further, recent sociopolitical events surrounding racial injustice have reignited the importance of DEI for many institutions across the country. In response to this surge in social awareness of DEI, engineering departments and colleges have prioritized plans and proposals for inclusive communities on campus and initiatives to diversify faculty and students [1].

Research shows that hindrances of DEI change efforts are systemic and require an analysis of all organizational structures within a system [2]. Through these efforts, it has been suggested that engineering leaders in academia, including faculty, share the responsibility of educating themselves and others about topics surrounding DEI. This process includes engaging in difficult conversations, in which understanding local context is essential to change efforts. Due to this responsibility, understanding engineering faculty beliefs about DEI is necessary to utilize positive change and inclusive practices. By articulating engineering faculty beliefs about DEI, we can begin to shape and reshape the academic cultures that promote, ignore, or hinder DEI efforts.

Understanding the literature surrounding engineering faculty beliefs is vital and necessary to create a starting point for top-down systemic changes that allow for more diverse, equitable, and inclusive environments that promote opportunities for all. This paper is part of a larger study that aims to capture the beliefs of engineering faculty in the United States surrounding DEI in the university context. We begin to explore this topic through a systematic literature review of engineering education journals and conference proceedings to compile articles that examined engineering faculty beliefs about DEI. We are specifically interested in their willingness to pursue change efforts towards producing more inclusive and equitable academic environments.

In this full research paper, we aim to answer the research question: **What themes emerge in current and previous EER on engineering faculty readiness to address DEI topics in their programs and classrooms?** To capture the ways engineering faculty beliefs are discussed in engineering education literature, we developed a categorization continuum model to map the perceptions of faculty in literature on a scale measuring problematization and readiness for action. The Problematization-to-Action Continuum (PTAC) ranges from the engineering faculty beliefs of no problematization of DEI topics or action to address them to complete problematization of DEI topics and processes of taking action to address them. We mapped the literature collected in this review onto the PTAC model to get a general understanding of the state of engineering faculty beliefs regarding DEI in the United States higher educational system. The implications of this work lay the foundation for lasting change efforts on the part of faculty who share the responsibility of promoting diversity, equity, and inclusion in the academic environment.

## Background

Faculty serve as the core of many institutions by concurrently developing new knowledge while also supporting the development and growth of the next cohort of students. As leaders and role models, they set the precedence for many students on what the field of knowledge prioritizes. Due to their influence on students [3], [4], classroom practices [5], and program culture [6], [7] they are a key group to examine in movements surrounding diversity, equity, and inclusion within institutions and STEM programs. However, faculty influences on DEI can be just as

damaging as they are supportive considering the limited faculty or graduate student training around DEI in engineering.

Within engineering specifically, the long-held culture has been one centered on meritocracy and the assumption that everyone has equal opportunities [8], as exemplified by design teams [9]. This view of equivalency problematically denies what students bring into the classroom and ignores their needs in addition to overlooking the well-documented educational inequities in the United States. For example, students who attend school while working to pay for school do not have the time or financial freedom for unpaid internships and extracurricular engineering team activities. As a result, students without the privileges to take advantage of these extracurricular opportunities acquire less experience and skills during their time in school. Faculty who do not acknowledge this inherent inequity embedded in engineering cultural beliefs may not be able to give the support needed to their students to succeed based on the students' situated experiences in and out of the classroom. Based on this connection between faculty importance to students and the influences of DEI in engineering culture, examining the state of and ways in which engineering faculty beliefs influence the experiences of students and other faculty is paramount.

## **Methods**

### *Methodology*

To answer our research question, we chose to perform a systematic literature review [10]. The benefits of using a literature review include the ability to examine a wide range of research using specific search terms to get a general understanding of how literature has presented engineering faculty beliefs about DEI. Second, the only limitation to our gathering information is access to literature databases. Therefore, a literature review is a timely, cost-effective way to gather a large amount of data about the state of our topic.

### *Researcher Positionality*

To provide context to this work and the aspects of our experiences that shape the ways we approach research, we have provided positionality statements for each member of the research team [11].

Author 1: I am a heterosexual, white woman raised by two working-class parents in a double-income household. Both parents are first-generation college graduates from the Midwest, and they raised me and my two siblings in Orange County, California. I graduated from a private, teaching-focused university in Texas with a Bachelor's and Master's degree in civil engineering with an emphasis on structural engineering. I worked for three years as a civil engineer before going back to school and pursuing engineering education. My education and career in engineering took place in predominantly white, male settings. As a result, not only was DEI rarely discussed in my engineering career, but I could not easily point out systems of oppression embedded in the culture that limit other people groups in the profession. Because I am on the journey of learning to be an ally for DEI, I understand the process of moving to different places on the PTAC model, and I realize the work that must be done to progress toward allyship for diverse populations.

Author 2: As a white, cisgender, heterosexual, middle-class, married man from a nuclear family, I strive in my research to bend my privilege to support those with traditionally underserved identities. In my work, I leverage a pragmatic worldview. Therefore, I approach each problem or question with the most practical, and reliable tools for the application. In leveraging tools within a new context, I always ensure the reliability and validity, quality and rigor, or legitimization of

the research design. As an older brother to a sibling with special needs, I have always been interested in social processes to understand why people think and behave in particular ways based on contextual cues. These experiences and facets of identity shape my pragmatic worldview, and only by recognizing and noting them can I strive to reduce their influence on my research.

Author 3: I have the privileges of an able-bodied, white, cisgender woman who is a national citizen. I have two parents who graduated from college, one with a PhD, and they raised me in a middle-class family from a lower-income, rural area in North Carolina. I attended a predominately white private school through high school and a historically and predominantly white public university for my bachelor's and doctoral degrees in electrical engineering. As a queer-identified person, I have a vested interest in examining what motivates change toward inclusion. I believe that people must feel heard to intrinsically shift their views; lasting and impactful change must involve stakeholders both in positions of power and oppression; and power differentials inherently foster injustice.

Author 4: I am a gay, able-bodied, white cisgender man and faculty member in engineering education. My experiences with passing and covering in engineering influence my goals to create just, equitable, and inclusive engineering environments. My experiences shape continual critical reflection on my positionality and have led to the centering of equity, inclusion, and cultures of care in my work. Moreover, I recognize how my identities allow for access to privilege and how I must actively work against defaults that reproduce inequality and exclusion. To work towards my goals, I have explored the ways undergraduate and graduate engineering education systems as designed by faculty serve to marginalize students and create homogenized systems of beliefs that reproduce existing systems of education and work. Particularly, my work centers the voices of students to understand the ways ecosystems shape students' actions.

Author 5: I am Black, female, same-sex loving, engineering professor with strong beliefs around spirituality. I am a first-generation PhD in my family and was raised in a racially and economically segregated large city in the Midwest. My research agenda is to broaden participation in engineering. My previous research investigated the experiences of multiple marginalized groups including women of color and members of the LGBTQ spectrum. I typically take an intersectional approach to identity in research and I am passionate about giving voice to those often overlooked in the business of educating engineers in the U.S.

### Data Collection

To address the research question, we performed a systematic literature search, in which we searched multiple databases encompassing three conference paper venues and five journals for faculty beliefs about DEI topics from 2000 to 2021. These publication sources were selected due to being highly cited within the field of engineering education. First, we focused on engineering faculty as the subject of the literature with the main search term being "engineering faculty." Therefore, any student-centered studies and non-engineering faculty studies were excluded. Next, we searched for keywords in the literature with two separate inclusion criteria. We searched for the keywords "diversity" or "equity" or "inclusion," and "beliefs" or "perceptions." With these keywords, we wanted to capture literature that mentions DEI and examines faculty beliefs.

To appropriately scope the literature review, we used multiple exclusion criteria. First, any literature focusing on undergraduate, graduate, or postdoctoral students was omitted. Also,

literature published before the year 2000 was also excluded as much has changed in the field of DEI since the 1990's. Lastly, any guest editorials or conference proceedings which did not include a paper were excluded from the literature review. Figure 1 plots the papers used in the literature review according to their publication year, and Figure 2 plots them by publication sources for the literature in this review.

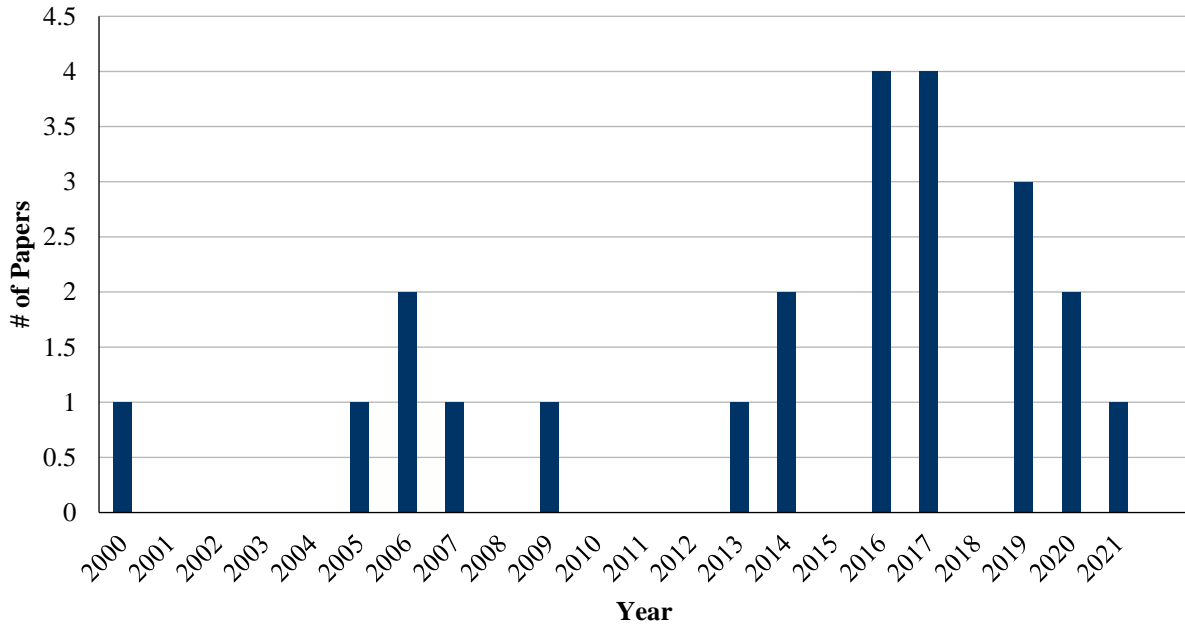


Figure 1: Number of papers in literature review according to their publication year

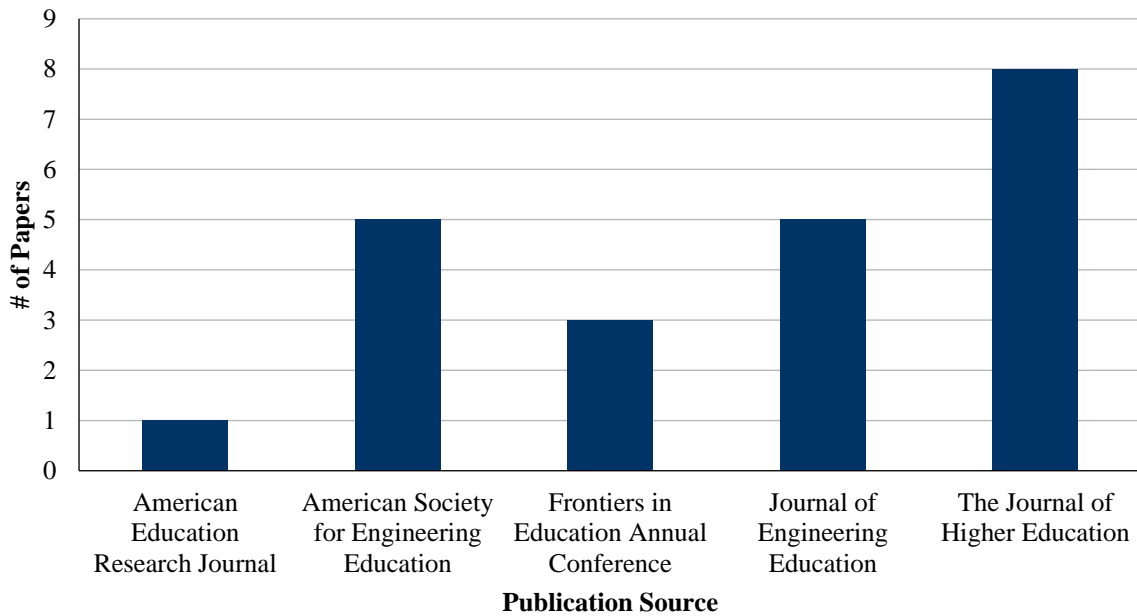


Figure 2: Publication source for all papers in the literature review

### Data Analysis

The literature review followed the methodology outlined in Borrego et al. [10]. We accumulated a number of articles in an initial database search of the journals and conferences. Once a preliminary set of 892 articles was found, we performed secondary and tertiary rounds of inclusion and exclusion as we read through the articles and determined if they addressed our research question. The decided inclusion and exclusion criteria are listed below.

1. The paper was published between 2000 and 2021.
2. The paper was a peer-reviewed conference or journal paper.
3. The publisher was a prominent engineering education venue.
4. The paper focused on engineering faculty as a population, either
  - a. Exclusively
  - b. Or along with other populations (e.g., students, administrators).
5. The paper focused on engineering faculty perceptions or beliefs about diversity, equity, or inclusion.

The results of these searches are shown in Table 1. The initial 892 articles were narrowed down to 22 articles.

*Table 1: Article Counts for the Database Search Process*

Journal	Search term: “engineering faculty beliefs” OR “engineering faculty perceptions” AND (diversity OR equity OR inclusion)	Citations after Title and Abstract Review	Citations after Methods Review	Citations at full read through
American Education Research Journal (AERJ)	4	1	1	1
ASEE Annual Conference Proceedings	83	20	5	5
Frontiers in Education (FIE) Proceedings	10	5	4	3
Journal of Engineering Education (JEE)	543	43	13	5
Journal of Higher Education (JHE)	177	81	24	8

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Fully excluded publications have been removed from table (Chemical Engineering Education, Journal of Diversity in Higher Education, and Journal of Research in Science Teaching).

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After excluding all articles that were out of the scope of this literature review, we performed a thematic analysis on the 22 remaining articles to create a literature tree that highlighted the main themes in the articles. After an initial read-through of the articles, we devised five preliminary themes based on keywords and topics found in the papers. These themes turned into five distinct categories of how faculty interpreted ideas regarding DEI. The results of this paper focus on one branch of the literature tree.

## Results

### Problematization-to-Action Continuum

The result of this paper is a set of distinct differences in engineering faculty's readiness to make change efforts toward supporting DEI with specific regard to problematization and action steps. In efforts to illustrate this result, we searched for a model that shows the spectrum of DEI beliefs from problematization to action. However, in the scope of our literature review, we did not find such a model. As a result, we developed the PTAC to provide a clear visualization of the result of this study.

The PTAC model is a continuum that contains three classifications (each end and the center). On one extreme end, faculty do not acknowledge there are problems surrounding DEI, and there are no actions taken to alleviate these issues. In the center, faculty acknowledge that there are problems but lack knowledge to take actionable steps. On the other extreme end, faculty recognize patterns of inequity and actively intervene to promote inclusive practices. To account for papers that included faculty in multiple locations, the continuum was given two more locations between each end and the center, shown in Figure 3. As a result, the PTAC spans five locations in total that the papers in this literature review were categorized into. The articles were mapped along the whole of the continuum based on our coding of the faculty beliefs in the papers. Figure 4 shows how the papers are dispersed on the continuum.

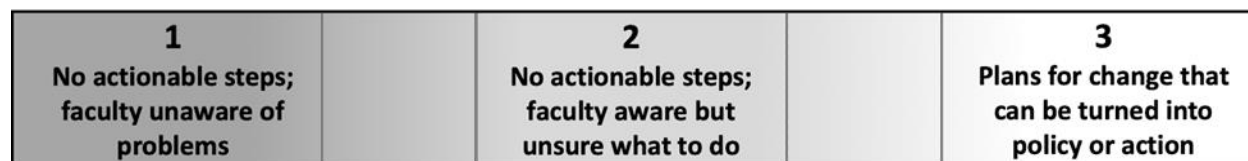
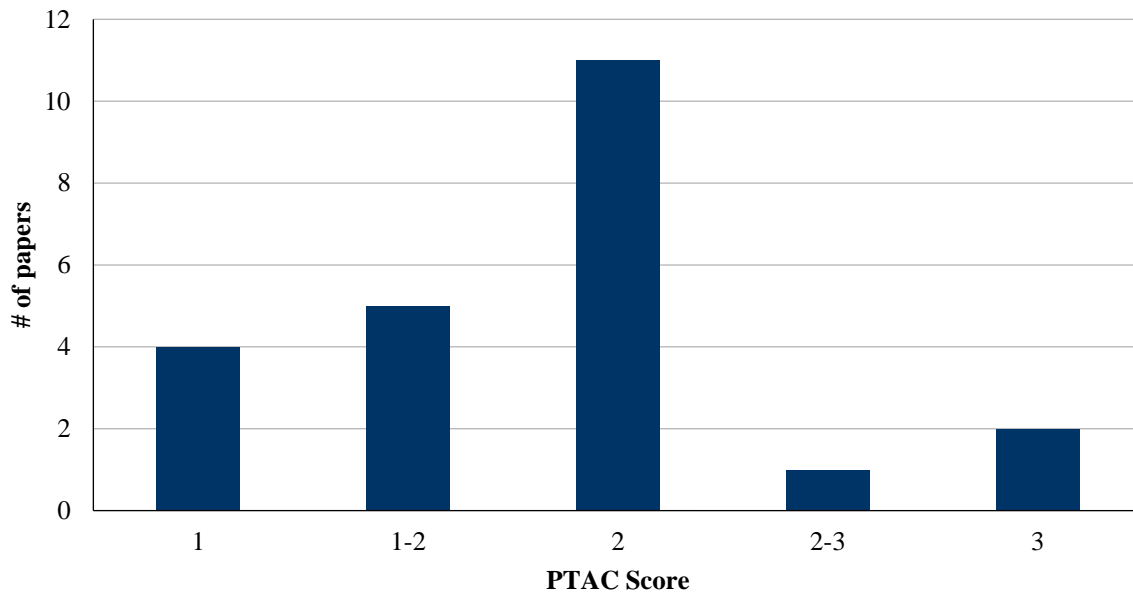


Figure 3: Problematization-to-action continuum





*Figure 4: Paper counts after mapping onto the PTAC*

The first result that the PTAC reveals is that the largest group of papers, 11 in total, appear at location 2. This means that faculty are in the location of awareness without action. In other words, most faculty in this literature review have awareness of DEI topics in academic settings, but the faculty have not taken action to address or alleviate these matters. To examine why these faculty are aware but not acting, we compared the papers at location 2 with the papers at location 3, which shows faculty who have moved toward actionable change with regards to DEI. One of the two papers at location 3 documented the following changes made at an institution to impact the career trajectories of faculty women in STEM: university-level policy change to make tenure process more explicit, interrupt exclusionary practices, re-gendering efforts, evenly distributed workloads, and modified work assignments when returning from caregiving [12]. The second paper at location 3 examined faculty workload equity by “identifying specific kinds of work practices and conditions that departments might cultivate to correct what is not working and proactively design toward greater perceptions and realities of workload equity” [6, p. 762]. The difference between these two papers at location 3 and the 11 papers at location 2 is the move from “recommendations,” a word used heavily to imply future action in many papers, to change in the form of policy and practices in the university or department. Also, some papers at location 2 [13], [14] speak not only to faculty but also to policymakers and administrators (i.e. authorities who can enable change at higher levels than faculty) to promote DEI and take steps toward action. These papers reveal that actionable change to promote DEI may begin with faculty beliefs, but the stakeholders involved must also extend past faculty to institutional authorities.

In most articles ( $n=17$  of 22), the majority of faculty in the paper shared the same beliefs about DEI (the papers were mapped at locations 1, 2, or 3). However, some articles ( $n=6$  of 22) revealed that faculty in the paper shared varying beliefs about DEI (the papers were mapped in intermediate between 1-2 or 2-3). Since faculty showed varying levels of awareness and readiness to take action, these articles were mapped between the categories on the continuum. These articles mapped between locations 1, 2, and 3 show that faculty perceptions regarding DEI are not homogeneous across the sample populations in a given paper. Despite this difference of

faculty DEI beliefs in academic programs, these faculty share the responsibility of promoting a culture that welcomes conversations and policies that promote DEI. Also, these papers show that DEI must not only matter to some but to a critical majority of faculty in a department or institution to foster an environment that is truly open and ready for change regarding DEI issues.

Though we gathered literature from 2000-2021 for this literature review, the PTAC shows that faculty beliefs have not shifted toward actionable steps linearly with time. Figure 5 shows the average PTAC score of all the papers based on publication year. This graph shows that there has not been a noticeable increase in the average score as time has progressed. This means that faculty perceptions about DEI have not moved toward actionable change or even toward acknowledging the need for change over the last 20 years.

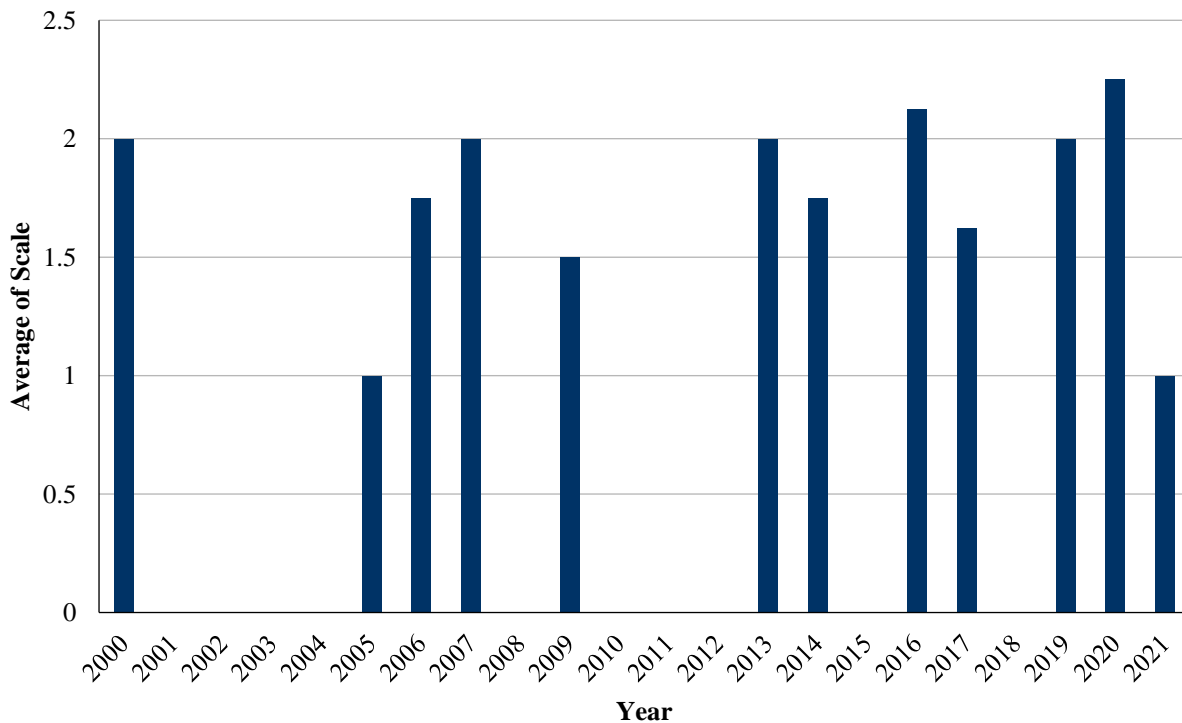


Figure 5: Average PTAC score of papers according to publication year

## Discussion

Despite multiple calls for change, particularly in the ASEE “Year on Diversity” in 2015 and literature focusing on examining how this influences research [15], many faculty still feel unequipped to tackle DEI within their institutions [16]. This claim is further supported in our work, which shows that despite many efforts to promote DEI, faculty beliefs about DEI reported in the literature have not changed noticeably with time. When examining why faculty felt this way, the faculty often cited needing an expert to guide them, a staff member focused on diversity to do the work for them, or more training about DEI. While faculty acknowledge a lack of DEI in their classrooms, they mainly recommend that more research be done on the subject.

For faculty at location 2 (the largest grouping location on the PTAC), the majority population feel that their agency is limited by the institutional policies and objectives that guide their teaching. Sallee [17] calls on Lawrence’s [18] framework model of institutional politics, which

reveals how individuals “shape and are shaped by institutions” [17, p. 372]. While this model reveals the agency of faculty and their ability to influence the institutional culture around them, the model also recognizes how faculty change in accordance with the institutional context they are in. If the policies of the institution do not support a faculty’s individual DEI efforts, the adoption of those efforts by other faculty and retention of those efforts by the starting faculty will most likely be low. Faculty at location 2 realize the responsibility they share to promote DEI due to their identities as educators, and most of these faculty have DEI goals that involve actionable change. This result shows that even with faculty’s full support for DEI efforts, they are limited by the institutions they are situated in. Therefore, faculty do not feel that they can enact changes toward DEI without institutional backing.

When examining why some faculty felt more equipped to discuss DEI in their classrooms, the key difference between faculty at location 2 and faculty at location 3 was the inclusion of policy and institutional backing for the faculty to promote change efforts in DEI. Hart [12] dissects three gendered institutional processes that negatively affected the career advancement for 25 women faculty in STEM. To alleviate these pressures on women faculty and dismantle the structures that build upon this gender discrimination, Hart calls for university-level policy change to make the tenure process more explicit for new faculty, interrupt exclusionary practices, apply re-gendering efforts, evenly distribute workloads between faculty and chairs, and modify work assignments for faculty returning from roles of caregiving. This paper exemplifies the calls for action that are necessary for DEI efforts to take hold in engineering programs and classrooms. With university-level policy change, faculty can play their role in fostering an engineering culture that is inclusive and equitable to a diverse array of individuals at all levels of the institution (students to administrators). Policy backing allows for faculty to make changes on the individual level toward DEI efforts.

When faculty felt more supported with institutional backing in these conversations, they were more willing to tackle the problems that hinder DEI in academic environments. Additionally, the results of our work showed that DEI can be promoted at any level from national to individual. Faculty can make change efforts individually in their own classrooms, and these efforts are important and deserving of recognition. Due to the scope of this literature review, we captured the change efforts at the department, engineering college, and university levels because those changes are more easily embedded into the culture and practices of all faculty at an institution rather than specific individuals. Therefore, we recommend a potential pathway to helping faculty progress from location 2 to location 3. This pathway involves efforts to change policy and procedures at a level higher than the classroom, which faculty can then more readily leverage in their classrooms.

Overall, this literature review revealed that most faculty acknowledge the importance of DEI and understand their responsibility to act, but they lack the knowledge, resources, or culture of care to enact those beliefs [16]. Most faculty do not know how to help or feel ill-equipped to make change efforts to execute or sustain DEI practices and policies. Future work involves fully mapping the literature onto the other branches of the literature tree. Additional future work includes investigating faculty’s role in action plans and initiatives for DEI policy change, which were out of the scope of this literature review. By addressing faculty’s role in these initiatives, we can support engineering faculty to engage in meaningful dialogue with all stakeholders and implement research-based strategies for improving DEI in their local academic institutions. The

collective impact of strategically including faculty in DEI efforts will further the national conversation about the importance of DEI to make lasting change in our educational system.

### **Summary**

In this study, we aimed to examine the state of engineering faculty beliefs regarding DEI in the United States. To address this idea, we performed a systematic literature review and a multi-pass, thematic analysis of the articles that fit our inclusion and exclusion criteria. Results showed that most faculty are aware of DEI topics and want to address them, but they do not know how with the authority and agency they have as faculty. The few examples where faculty took action to address perceived problems also exhibited backing and support from the institution. Future work includes examining DEI policy change and institutional practices that promote DEI and faculty's role in creating, supporting, and enacting these policies in all aspects of academia.

### **Acknowledgments**

Thank you to the many hands who played a role in producing this conference paper. Thank you to the PRiDE Research Group in engineering education at the University of Nevada, Reno. Without your constant support, guidance, and motivation to keep writing, this document would not be what it is. We are honored to be a part of this outstanding group of scholars.

This work is based on research supported by the National Science Foundation CAREER Grant Award under Grant No. EEC-2145884. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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## Appendix A

Table A-1: Articles used for systematic literature review of engineering faculty beliefs about DEI

Article #	Journal	Article title
1	CoNECD	An Engineering Faculty and...(Matters et al. 2021)
2	AERJ	Coloring the academic landscape...(Stanley 2006)
3	ASEE	Engineering faculty perceptions of...(Cross and Cutler 2017)
4	ASEE	Advisor perspectives on diversity...(Walden et al. 2016)
5	ASEE	Explaining faculty involvement in...(Kramer 2005)
6	ASEE	Action on diversity: A content...(Artiles et al. 2017)
7	ASEE	Examination of implicit gender...(Judson et al. 2017)
8	JEE	Undergraduate STEM Instructors' Teacher...(Blair et al. 2017)
9	JEE	Learning Together: A Collaborative...(Sochacka, Guyotte, and Walther 2016)
10	JEE	Exploring the White and...(Eastman, Miles, and Yerrick 2019)
11	JEE	Investigating the Teaching Concerns...(Turns et al. 2007)
12	JEE	Positionality Practices and Dimensions...(Secules et al. 2020)
13	FIE	Workplace Climate: Comparison of Science ...(Aldridge et al. 2019)
14	FIE	Expanding women in undergraduate...(Knight, Novoselich, and Trautvetter 2014)
15	FIE	Perceptions of treatment for...(Cruz et al. 2016)
16	JHE	Factors contributing to faculty...(Mayhew and Grunwald 2006)
17	JHE	Dissecting a Gendered Organization...(Hart 2016)
18	JHE	Is the Tenure Process Fair?...?(Lawrence, Celis, and Ott 2014)
19	JHE	Gender Norms and Institutional...(Sallee 2013)
20	JHE	Making Sense of Persistence...(Ferrare and Miller 2020)
21	JHE	Sexual Harassment in the...(Kelley and Parsons 2000)

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Article #	Journal	Article title
22	JHE	Attitudes and Advocacy: Understanding Faculty ...( <a href="#">Park and Denson 2009</a> )
23	JHE	Department Conditions and Practices...( <a href="#">O'Meara et al. 2019</a> )

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