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RESEARCH ARTICLE

How do ethics and diversity, equity, and inclusion relate in engineering? A systematic review

Justin L. Hess[1] | **Athena Lin**[1] | **Andrew Whitehead**[1] | **Andrew Katz**[2]

[1]School of Engineering Education, Purdue University, West Lafayette, Indiana, USA

[2]School of Engineering Education, Virginia Tech, Blacksburg, Virginia, USA

Correspondence
Justin L. Hess, School of Engineering Education, Purdue University, West Lafayette, IN, USA.
Email: jhess@purdue.edu

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Abstract

Background: This paper begins with the premise that ethics and diversity, equity, and inclusion (DEI) overlap in engineering. Yet, the topics of ethics and DEI often inhabit different scholarly spaces in engineering education, thus creating a divide between these topics in engineering education research, teaching, and practice.

Purpose: We investigate the research question, "How are ethics and DEI explicitly connected in peer-reviewed literature in engineering education and closely related fields?"

Design: We used systematic review procedures to synthesize intersections between ethics and DEI in engineering education scholarly literature. We extracted literature from engineering and engineering education databases and used thematic analysis to identify ethics/DEI connections.

Results: We identified three primary themes (each with three sub-themes): (1) lenses that serve to connect ethics and DEI (social, justice-oriented, professional), (2) roots that inform how ethics and DEI connect in engineering (individual demographics, disciplinary cultures, institutional cultures); and (3) engagement strategies for promoting ethics and DEI connections in engineering (affinity toward ethics/DEI content, understanding diverse stakeholders, working in diverse teams).

Conclusions: There is a critical mass of engineering education scholars explicitly exploring connections between ethics and DEI in engineering. Based on this review, potential benefits of integrating ethics and DEI in engineering include cultivating a socially just world and shifting engineering culture to be more inclusive and equitable, thus accounting for the needs and values of students and faculty from diverse backgrounds.

KEYWORDS

diversity, equity, ethics, inclusion, systematic review

Brief description of the topic: This paper reviews 36 articles to identify how engineering educators have connected ethics, diversity, equity, and inclusion in engineering and engineering education.

Prior conference proceeding on which this work builds: Hess, J. L., Whitehead, A., Jesiek, B. K., Katz, A., & Riley, D. (2021). WIP: Intersections between Diversity, Equity, and Inclusion (DEI) and ethics in engineering. Paper presented at the Frontiers in Education Annual Conference, Lincoln, NE. This work-in-progress paper included a summary of our search process and very preliminary themes. The themes from that study and this are largely distinct.

1 | INTRODUCTION AND BACKGROUND

This paper began with the premise that diversity, equity, and inclusion (DEI) are co-dependent and together are central to ethical engineering. When engineers fail to prioritize DEI, they cannot uphold the safety, health, and welfare of the public. Contrariwise, we posit that *un*ethical engineering is more likely to occur when engineers lack concern for diverse stakeholders, do not aim to ensure outcomes are equitable for all stakeholders, or fail to lift and respond to diverse stakeholders' voices.

We take the stance that diversity, equity, and inclusion each contribute uniquely but critically to the combinatorial phrase, DEI. We recognize that there are various ways of defining these terms. Here, we offer definitions provided by ABET in their criteria for accreditation. ABET (2021) defined diversity as "the range of human differences, encompassing the characteristics that make one individual or group different from another," equity as "the fair treatment, access, opportunity, and advancement for all people achieved by intentional focus on their disparate needs, conditions, and abilities," and inclusion as "the intentional proactive, and continuing efforts and practices in which all members respect, support, and value others." Equity is the newest addition to the DEI conception (e.g., see Bailee et al. [2011] on diversity and inclusion efforts in engineering education) and is often either "missing" or misunderstood when discussing DEI (Stringfellow, 2020). Equity differs from equality in that equality assumes "baseline parity" whereas equity accounts for structural issues that contributed to current unjust states (Rottmann & Reeve, 2020). Taken together, DEI aims to foster meaningful engagement with difference.

We take the stance that DEI is essential for ethical engineering. Diversity has been considered a core value of ethical engineers (Hamad et al., 2013) and can inform ethical decision making within teams (DeGrassi et al., 2012; Zoltowski et al., 2015). Individuals from minoritized populations may be more likely to approach ethics with a DEI mindset or DEI-related objectives (McGee et al., 2022). Equity is also a core aspect of ethical reasoning in engineering (Harris Jr. et al., 2019), although equity and ethics tend to "inhabit different spaces" in engineering education and there seems to be "equity silences" in engineering ethics (Rottmann & Reeve, 2020, p. 150). In addition to diversity and equity, a focus on inclusion requires that one consider who is (and is not) at the "decision-making table" (Riley & Lambrinidou, 2015). To act ethically, an engineer may need to identify ways to include vulnerable and disempowered individuals or groups in engineering decision-making processes. Without considering DEI connections such as these in engineering ethics education, we are likely to continue propagating a culture of disengagement in engineering (Cech, 2014).

The import of ethics and DEI connections is evident when we consider the distribution of harms when engineering technologies go awry. For example, when engineering failures occur, they often have detrimental impacts on diverse stakeholders and minoritized communities. Consider the Flint water crisis, where we learned of engineering firms that prioritized cost savings over equitable distribution of high-quality water to residents, which led to myriad negative health and environmental impacts (Sadler & Highsmith, 2016); or consider the BP Deepwater Horizon oil spill in the Gulf of Mexico, where we learned of questionable engineering decision-making processes that led to the loss of lives and catastrophic environmental damages (Polsky & Monsell, 2020). In both instances, the environmental harms emerging from these ethical lapses disproportionately harmed low-income and African American communities. We posit that ethical responses to these macro-ethical issues would have involved prioritizing and including voices from minoritized publics or communities.

Recently, many professional engineering organizations have recognized DEI as important to ethical engineering by codifying DEI or DEI-related sentiments (Pearson, 2019). For example, the NSPE (National Society of Professional Engineers, 2019) code of ethics indicates, "The services provided by engineers require honesty, impartiality, fairness, and *equity*, and must be dedicated to the protection of the public health, safety, and welfare" (emphasis added). The IEEE (2020) code of ethics describes discriminatory practices as unethical. Although some engineering codes of ethics (like IEEE) do not explicitly use the terms diversity, equity, or inclusion, ASCE has explicitly integrated equity and inclusion in the code of ethics for civil engineers (Hoke, 2021). Thus, for some engineering disciplines, becoming a professional engineer (and, thus, becoming an ethical engineer) requires developing a commitment to DEI.

Although ethics has long been a required ABET outcome for engineering programs, ABET only recently included DEI in their curriculum criteria. Yet, in the US national context, some legislation forbids the incorporation of DEI efforts or offices in colleges (Chronicle Staff, n.d.). ABET (2023) has noted that such laws are currently "restricting or prohibiting accrediting organizations from including DEI as part of the accreditation process." Despite these legislative barriers, ABET (2023) is piloting the new DEI criteria "in both the 2023–24 and the 2024–25 cycle" among volunteering institutions and programs. Despite the recent inclusion of DEI in ABET's curriculum criteria, ABET does not name intersections between ethics and DEI. Conversely, the Canadian Engineering Accreditation Board (CEAB) has infused a coupled learning objective of "Ethics and Equity" as a primary outcome for Canadian engineers (Rottmann & Reeve, 2020), therein suggesting a strong overlap between the two. Thus, approaches to connecting ethics and DEI may look or manifest differently across nations.

Through this work, we aim to contribute to ongoing conversations regarding ethics and DEI in engineering. We hope to bring clarity to existing approaches to connecting ethics and DEI by synthesizing scholarship in engineering education. We envision that this work will encourage additional dialogue across scholarly spaces and that it will enable engineering educators to cultivate more ethical, diverse, inclusive, and equitable engineering cultures.

2 | STUDY OVERVIEW

We reviewed scholarly literature in engineering education that connected ethics and DEI and sought to understand the nature of these connections. We address the research question, "How are ethics and DEI conceptualized and connected in peer-reviewed literature in engineering education and closely related fields?" We posited that there are important links between ethics and DEI that are largely hidden in contemporary engineering education discourses. Publications exist as an archive and can provide a historical view regarding the nature of and extent to which conversations have existed (and have not existed). Synthesizing such data will help bridge discourses across ethics and DEI scholarly spaces and generate paths to purposefully integrate ethics and DEI in engineering education research and practice.

3 | METHODS

We used systematic literature review procedures. For data collection, we adapted stepwise procedures from Borrego et al. (2014). For data analysis, we employed thematic analysis (Braun & Clarke, 2006) with an emphasis on inductive generation of conceptions and connections. We begin by sharing our positionality, which influences all aspects of our study.

3.1 | Positionality statement

We approached this research as scholars with greater expertise in engineering ethics than in DEI. Thus, our familiarity with engineering ethics likely shaped our data collection and analysis approaches to a greater degree than our familiarity with DEI literature in engineering. Although we identified primarily as scholars in engineering ethics, we did have professional experiences related to DEI that were more aligned to service and teaching than research. Though we felt DEI was central to our work and were familiar with literature in the DEI space, we had not published prior original research focused on DEI. Taken together, we entered this research investigation with awareness of literature in both spaces, including observations of existing overlaps between ethics/DEI in engineering, and the premise that there was a need for clarity regarding such overlaps. This motivation was omnipresent throughout our research journey.

3.2 | Data collection

Guided by Borrego et al. (2014), we employed six steps in data collection. While we present steps sequentially, the steps were iterative and informed non-adjacent steps.

3.2.1 | Step 1. Deciding to do a systematic review

We explored engineering education literature to find frameworks, research designs, and teaching approaches connecting ethics and DEI in engineering and engineering education. This decision was based on the division we observed between ethics and DEI scholarly spaces in this field despite many explicit connections.

3.2.2 | Step 2. Identifying scope and research questions

We addressed the research question, "How are ethics and DEI explicitly connected in peer-reviewed literature in engineering education and closely related fields?" We began this study with a focus on engineering, but we shifted to engineering education because of the education-focus of our data. We chose to include articles in education spaces like engineering either because of their explicit use of the term engineering or because of their ostensible connections to engineering (e.g., computing, engineering technology). Despite this inclusion, most articles focused on engineering education, and we emphasize engineering education throughout this paper.

We scoped our search parameters based on (1) engineering education focus; (2) explicit use of diversity, equity, or inclusion; and (3) explicit use of ethics or morality. In spring 2021, we searched three databases, each with slightly distinct strings: Education databases (ERIC or EBSCOhost) paired with "Engineer*" string in the Title; Engineering databases (Compendex, INSPEC) paired with "Educat* OR Teach* OR Training" search string in the Title; Computing database (ACM Digital) paired with "Education* OR Teach* OR Training" AND "Engineer*" string in the Abstract. In each search, we used two criteria:

- Explicit DEI Term—one of the following in the *abstract*: (1) Diverse OR Diversity; (2) Equit* (Equity, Equitable); or (3) Inclus* (Inclusion, Inclusive).
- Explicit Ethics Term—one of the following in the *abstract*: (1) Ethic* (Ethics, Ethical, Ethicality) or (2) Moral* (Morals, Morality).

Owing to the abundance of prospective data that we initially found (see Step 4) and conversations to develop shared understandings (see Step 6), we focused on articles that explicitly employed conceptions of and connections between ethics and DEI (see Step 5).

3.2.3 | Step 3. Defining inclusion and exclusion criteria

We first reviewed abstracts and then whole manuscripts. Inclusion criteria were (1) a concerted focus on engineering education or related fields (e.g., engineering technology education, computer science education, computing education); (2) a concerted focus on diversity, equity, or inclusion (i.e., articles must have had a concerted focus on at least one of these terms but not necessarily all three); (3) a concerted focus on ethics or morality; (4) a conceptualization of ethics; and (v) a conceptualization of at least one DEI term.

Based on these inclusion criteria, we employed several exclusion criteria (EC). We excluded articles in two rounds: (1) abstract screening and (2) manuscript appraisal.

During abstract screening, we employed five EC:

EC1: Non-peer-reviewed article;
EC2: Authored by an investigator on the NSF award supporting this project (this was added to minimize biasing the dataset toward the investigators' perspectives);
EC3: Focus not directly related to engineering education;
EC4: No concerted focus on DEI in the abstract;
EC5: No concerted focus on ethics or morality in the abstract.

We next appraised whole manuscripts with the following exclusion criteria:

EC6: Not directly related to engineering education;
EC7: No concerted focus on diversity, equity, or inclusion;
EC8: No concerted focus on ethics or morality;
EC9: No conception of diversity, equity, or inclusion *or* we cannot confidently infer one;
EC10: No conception of ethics or morality *or* we cannot confidently infer one;
EC11: Focus is on ethical or equitable teaching practices (i.e., the ethics of teaching).

3.2.4 | Step 4. Finding and cataloging sources

Figure 1 depicts our search process. One author first identified potential data through the procedures listed above. Next, at least two authors screened each abstract and appraised whole manuscripts by reviewing article content, identifying explicit uses of ethics and DEI, and documenting potential rationale to include or exclude the article. When two authors could not confidently discern an article's inclusion, those two authors consulted a third author.

3.2.5 | Step 5. Critique and appraisal

We conducted a two-step process to systematically assess the quality of each manuscript. First, we assessed the extent to which each article connected ethics and DEI. We identified 11 articles as "anchoring articles," or articles in which we perceived ethics and DEI connections to be a primary focus. We identified the remaining 25 articles as secondary articles. We used anchoring articles to develop an initial coding framework and secondary articles to develop confidence that codes constituted ethics and DEI connections (see Step 6).

Second, we addressed the question, "Can we reasonably infer how authors conceptualize ethics and DEI?" This step became a "check" for article inclusion centered on conceptions. Hess led the development of initial coding of conceptions and shared emergent conceptions and codes with Lin and Whitehead, who then reviewed and indicated agreement/disagreement. The Appendix summarizes ethics and DEI conceptions that we coded. We discovered that many articles included certain definitions or conceptions of phenomena but did not explicitly use the terms *ethics*, *diversity*, *equity*, or *inclusion* throughout the article. By documenting, discussing, and agreeing upon conceptions of ethics and DEI, each coder could then apply such conceptions to code ethics and DEI connections more confidently even when ethics or DEI terms were absent.

3.2.6 | Step 6. Qualitative analysis

Borrego et al. (2014) offered "synthesis" as the data analysis step, which includes three sub-steps: (1) mapping; (2) critique across studies; and (3) critique within studies.

Mapping overview

Borrego et al. (2014) described mapping as "organizing the studies and reporting certain characteristics" (p. 60). Mapping involved employing thematic analysis (Braun & Clarke, 2006) combined with analyzing discourses that connected ethics and DEI. We found that such discourses manifested in distinct ways, such as authors' motivations for connecting ethics and DEI; theoretical frameworks employed to connect ethics and DEI; learning outcomes that

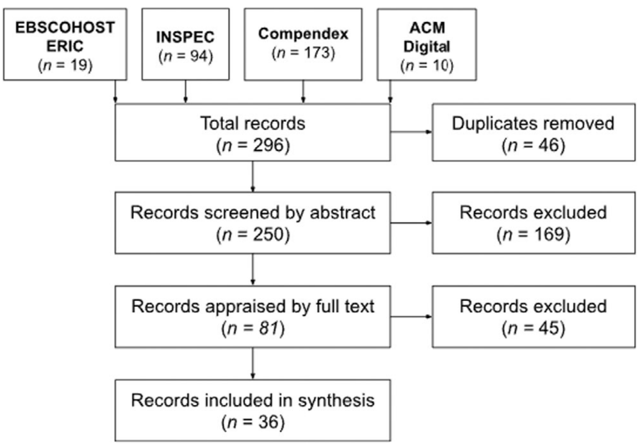

FIGURE 1 Data collection and exclusion procedures. *Source*: Adapted from Jesiek et al. (2018).

included ethics/DEI in combination; instructional strategies intended to help learners connect ethics and DEI; or results indicating how learners or research subjects connected ethics/DEI after participating in an intervention.

Our thematic analysis approach first involved immersion in the data. As described in Step 5, we identified 11 articles as anchoring articles (or anchors), which we used to develop an initial coding framework. Next, we engaged in (1) induction to generate new codes (and, later, themes) while reviewing anchoring articles, (2) deduction to apply codes to secondary articles, (3) narration of emergent themes, and (4) critique and appraisal of narration. We depict the analysis process in Figure 2, and summarize each step in more detail below. The Appendix includes a list of all articles, including themes associated with each article.

First, following the team's immersion in the data and team discussions and annotations of articles, Hess led initial inductive coding of anchoring articles, and then Lin and Whitehead reviewed the codes. The authors met to discuss agreements, disagreements, and suggestions.

Second, we deductively coded secondary articles using the coding framework as applied to anchoring articles. After peer coders reviewed assigned articles, all coders met to discuss discrepancies. A non-coder provided a perspective in instances where the two coders expressed disagreement or there was a need for a third interpretation of the data.

Third, based on the codes and team conversations, Hess developed an initial narration of themes and shared them with Lin, Whitehead, and Katz who reviewed and critiqued themes and revisited initial coding and annotations to help

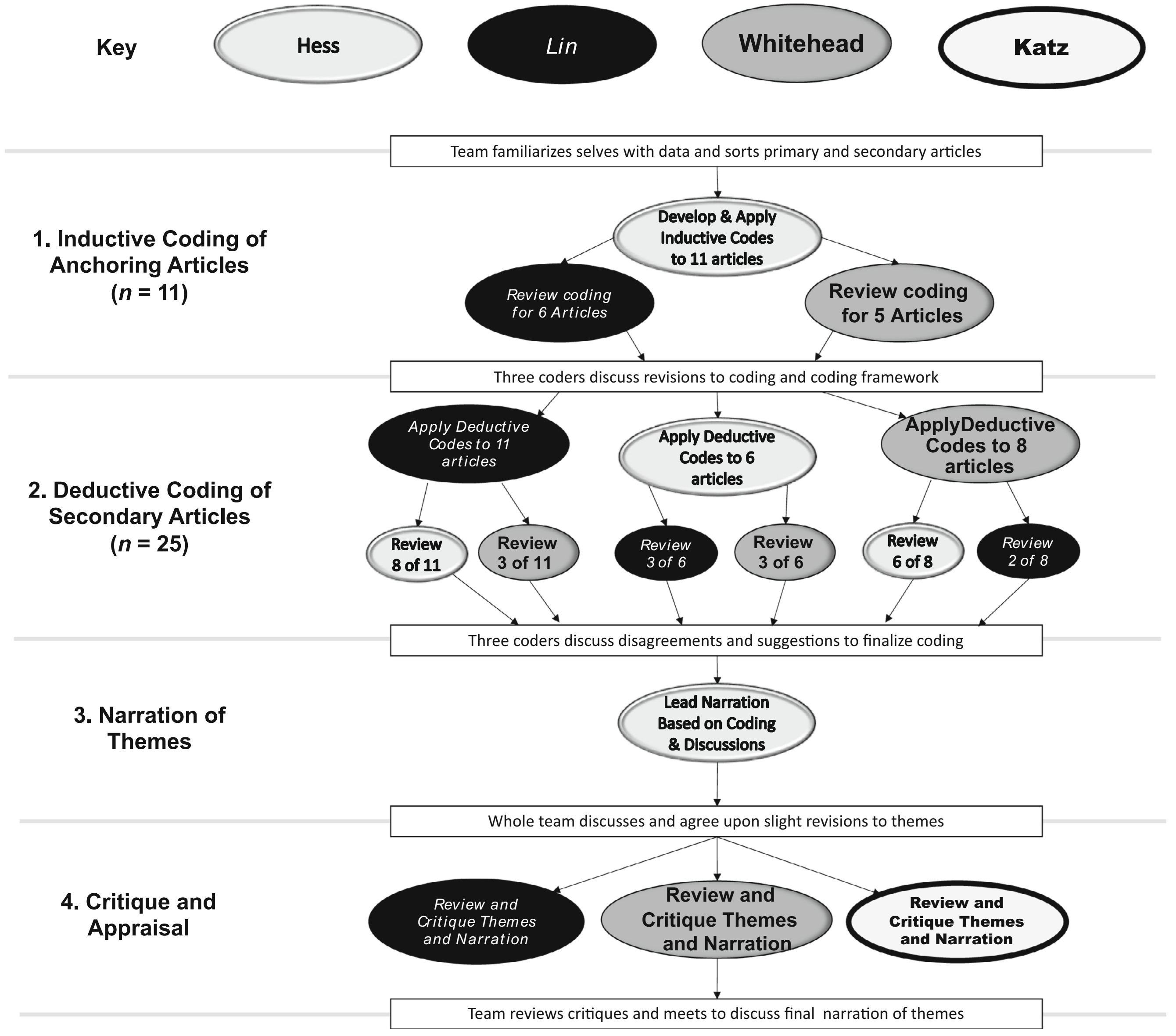

FIGURE 2 Thematic analysis process (formatting of circles represent different coders).

iterate on the themes. Katz, who had been involved in team meetings during the coding process, had not immersed himself in coding and thus provided a unique perspective to clarify the narration of themes. This process led to more coherence within themes and an additional check regarding alignment with the data. Finally, all authors reviewed, critiqued, and appraised the themes and developed a final narration.

Critique across studies

Critique across studies included reviewing coding frequencies. We identified the presence of codes associated with select themes across the dataset. This was an indicator of the pervasiveness of themes. All but one sub-theme were present in at least 25% of the articles.

Critique within studies

Borrego et al. (2014) described this step as "presenting the assessment of quality for each study" (p. 60). All papers were peer-reviewed but most articles were conference papers ($n = 25$), and the remainder were journal articles ($n = 11$). Eleven articles were published in 2020 or 2021; 13 were published between 2015 and 2019; six were published between 2010 and 2014; four were published between 2005 and 2009; and two were published between 1995 and 1999.

We checked the presence of sub-themes within individual articles and found that four articles included at least one sub-theme. Almost every article included codes associated with multiple sub-themes, thus suggesting that individual articles were represented by the themes.

3.3 | Validation considerations

We employed Walther et al.'s (2013) framework to promote research quality.

First, our data were largely from engineering education publication venues (rather than select engineering professional groups, engineering trade magazines, etc.). Rarely did the articles focus on or examine data from the workplace. We thus questioned whether the findings themselves would "withstand exposure to reality" (a key facet of pragmatic validation, see Walther et al., 2013, p. 640), namely the applicability of our data to the engineering workplace. As a result of this concern, early in the process, we focused our research question explicitly on engineering education (rather than engineering practice), which helped us to build confidence that we were constructing knowledge "within the relevant communication community" (a form of communicative validation, ibid, p. 640). As a result, we emphasize that the findings are applicable to engineering education contexts (i.e., instruction in classrooms, research on engineers). The applicability of results to engineering practice or industry contexts should be a focus of future work.

Second, we continuously asked whether our procedures and emergent data were sufficient to address our research question, which are key concerns associated with procedural validity (Walther et al., 2013). Early in analysis, we realized that *we* bring forth unique perceptions of ethics and DEI and these did not always align with authors' conceptualizations. Challenges included (1) grappling with many definitions (implicit or explicit) of ethics, diversity, equity, and inclusion, (2) understanding (and, then, prioritizing) how authors employed terms, and (3) identifying and comparing how authors used terms in similar (and dissimilar) ways. To help develop a foundation for understanding connections between ethics and DEI, we felt it was necessary to codify how authors conceived of ethics and DEI. We thus analyzed conceptions to clarify how ethics and DEI were conceived of within and across articles (see Step 5 for our approach and the Appendix for these results).

Finally, we sought to apply a collaborative interpretive coding process to data. We strove to ensure that we included all team members' perspectives by reviewing others' annotated rationales for coding, continuously discussing codes and annotations to develop shared understandings, ensuring agreement of coding across coders, and developing agreement on the narration of this work by all four authors. These strategies bolstered our process reliability (Walther et al., 2013) and ensured that each author's views were ethically represented (Sochacka et al., 2018).

4 | RESULTS

We generated three themes: (1) *Lenses* to connect ethics and DEI; (2) *Roots* that inform how ethics and DEI connect; and (3) *Engagement* strategies for prompting ways to connect ethics and DEI. Table 1 summarizes each theme and associated sub-themes.

TABLE 1 Overarching themes and associated codes.

Theme	Description	Sub-themes
Lenses	Lenses to connect ethics and DEI in engineering education	Social Justice-oriented Professional
Roots	Personal or historical factors that affect views or perceptions of ethics and DEI connections in engineering	Individual demographics Disciplinary cultures Institutional cultures
Engagements	Instructional strategies to promote ethics and DEI connections in engineering education via meaningful engagement with others	Affinity towards DEI content Understanding users or stakeholders Working in diverse teams

Lenses are akin to devices that enable one to view the world in different ways (imagine magnifying glasses, kaleidoscopes, or microscopes). *Roots*, then, represent the foundations on which individuals grow, develop, or form (imagine the roots and rhizomes of plants). Finally, *Engagements* represent strategics to cultivate or nurture *Roots* or prompt *Lenses*.

4.1 | Theme 1: Lenses for connecting ethics and DEI

Authors have used *Lenses* to connect ethics and DEI in engineering. A lens may represent a structure for, goal to, or outcome of engineering processes. Lenses may support one in making ethical decisions that account for DEI or enable one to act in ways that are inclusive and equitable and thereby lead to ethical outcomes.

This theme included three sub-themes: (1) social, (2) justice-oriented, and (3) professional. Each sub-theme was present in at least 10 articles (i.e., more than 25%). Authors offered other lenses to connect ethics and DEI in engineering, including macro-ethics and micro-ethics (Bielefeldt et al., 2018), inclusive innovation (Li et al., 2019), rights of persons (Tooley & Umphress, 2009), and other philosophical frameworks (Cheville & Heywood, 2016). Hence, the sub-themes we present here are not exhaustive of all *Lenses* for connecting ethics/DEI presented in the literature that we analyzed, nor are lenses mutually exclusive.

4.1.1 | Sub-Theme 1.1: Social

Authors often connected ethics and DEI in engineering by emphasizing social elements of engineering. This was the most common lens, which may be due to the omnipresence of social and ethical elements of engineering. As Huff and Martin (1995) argued, "Every ethical concern is located at a particular level of social analysis" (p. 76). The three most common social lenses were social issues, social responsibility, and social justice.

Social issues serve as a motivation for engineering work or informed course-learning goals or activities. Authors emphasized social issues associated with existing societal problems by prompting students to consider social implications of technologies (Berg & Lee, 2016; Bielefeldt et al., 2018; Bielefeldt et al., 2020; Li et al., 2019). Instructors embedded social issues in engineering curriculums and had students consider how diversity, equity, or inclusion factored into ethical decisions pertaining to users in society. Some authors argued that diversity considerations affect students' ethical approaches, especially with regard to social issues. Roberts (1995) noted that females and males [sic.] may approach ethical issues in distinct ways, wherein females often adopt a feminist and people-oriented approach. Tooley and Umphress (2009) argued that accounting for diverse perspectives was essential for post-conventional ethical reasoning. Other authors similarly called attention to the alignment between macro-ethics and social ethical issues (Li et al., 2019; Rottmann & Reeve, 2020).

Social responsibility prompts engineers or engineering educators to consider specific groups in their ethical decision making or behaviors, and authors often emphasized the import of focusing on specific user groups to realize equity. For example, Ludi et al. (2018) discussed social responsibility as an outcome of accessible design practices and its import when designing for users with disabilities. In alignment with Segal (2011), Naphan-Kingery et al. (2019) defined social responsibility as an individual disposition or a "prosocial individual perspective that contributes to improving the larger social arena" (p. 339). They focused on the views of social responsibility among majority versus minoritized student groups in engineering. In their view, a tendency to feel responsibility toward society, writ broadly, can help one to develop social empathy and, in turn, realize social justice in their work. They found that this disposition was stronger among students with direct experiences of social suffering (which tended to be minoritized students). Molina-Carmona et al. (2017) argued that social responsibility, defined as a "social commitment" that ensures "the social inclusion of any individual," was a critical aim of higher education *and* engineering design. Authors emphasized that social lenses generally informed each other and overlapped with other lenses which may not explicitly emphasize the "social." For example, Naphan-Kingery et al. (2019) framed social responsibility as a key aspect of another social lens—social empathy—which, in turn, was a key determinant of yet another social lens—social justice. Berg and Lee (2016) indicated that social responsibility and social justice align with other engineering ethics lenses, such as globalization and sustainability.

4.1.2 | Sub-Theme 1.2: Justice-Oriented

Justice was an oft-used lens to connect ethics and DEI in engineering. Some authors framed justice as an aim or an outcome of engineering practice or education (Naphan-Kingery et al., 2019; Rodrigues et al., 2014; Rottmann & Reeve, 2020; Wilson-Lopez & Minichiello, 2017). Like the social lens, authors denoted different ways to frame justice that influenced what aspects of ethics and DEI connected and how. For example, two authors described the import of striving for fairness in artificial intelligence (Lewis & Stoyanovich, 2021; Shen et al., 2021). Tharakan (2020) argued "from equity we get justice" and specified how different types of equity yield different types of justice. Tharakan (2020) argued that civil justice results from representational equity, environmental justice results from responses to environmental inequities, and resource justice results from social equity wherein communities have the power to control the flow of their resources (rather than some broader hegemonic power wielder). Tharakan further argued that different frames of justice lead engineers to engage with distinct types of questions regarding equity, and these distinct conceptions will lead to different ethical judgments. Similarly, Rottmann and Reeve (2020) articulated two distinct types of social justice.

Social justice was the most-oft described type of justice in our dataset. Bielefeldt et al. (2018) defined social justice as "promoting a just society by challenging injustice and valuing diversity" (p. 1). They indicated that social justice exists when all people experience "equitable treatment, support for their human rights, and a fair allocation of community resources" (p. 1). Rottmann and Reeve (2020) emphasized the alignment between equity and justice but offered two competing ways of conceptualizing social justice: (1) liberal and (2) critical. Liberal and critical social justice approaches vary, respectively, by an emphasis on objectivity versus subjectivity; a belief in meritocracy versus systemic oppression; a commitment to individual approaches to analysis versus societal approaches; and a focus on equality versus equity. A critical social justice perspective thus emphasizes the integral nature of equity for engineering ethics, whereas a liberal social justice perspective does not.

A few authors connected ethics and DEI by pairing DEI/ethics terminology. For example, Naphan-Kingery et al. (2019) described an "equity ethic" in terms of social justice (defined as disrupting systems of oppression). They argued that an equity ethic constitutes "a principled concern for social justice and for the well-being of people who are suffering from various inequalities" (p. 339). Although not emphasizing *social* justice, Li et al. (2019) discussed the framework of "inclusive innovation" and argued that the starting point for both engineering ethics and inclusive innovation are aligned based on a prioritization of fairness and justice.

4.1.3 | Sub-Theme 1.3: Professional

The *Professional* lens articulates ways by which being a professional engineer requires one to consider ethics and DEI connections. Authors identified specific professional values, responsibilities, or artifacts in engineering that connect ethics and DEI.

Codes of ethics encapsulate professional values and offer specific guidance for incorporating DEI into engineers' professional ethical practice. Articles extracted and unpacked different passages from codes and across multiple disciplines. Example codes included (1) IEEE's code of ethics, which requires engineers to "treat fairly all persons and to not engage in acts of discrimination" (Bielefeldt et al., 2018); (2) ASCE's 2017 code of ethics, which states that engineers "shall endeavor in good faith to include diverse perspectives, in the planning and performance of their professional service" (Bielefeldt et al., 2018); (3) ACM's 2018 code of ethics, which states, "Inequities between different groups of people may result from the use or misuse of information and technology," and wherein "failure to design for inclusiveness and accessibility may constitute unfair discrimination" (Ludi et al., 2018); and (4) NSPE's (2023) code of ethics, which states, "Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare" (Tooley & Umphress, 2009).

Authors interpreted how professional artifacts, including codes of ethics, hearken to other lenses, like *Social* and *Justice*, to connect ethics and DEI. Li et al. (2019) argued that most engineering codes of ethics emphasize the social elements of engineering practice and thus require engineers to think about professional codes in the context of "poverty groups" (p. 4). Tooley and Umphress (2009) indicated the NSPE's preamble explicitly states that equity is required for professional engineering practice. Ludi et al. (2018) argued that ACM's code of ethics emphasizes "inclusive thinking as a critical aspect of all design and development" (p. 717). Finally, Lambrinidou et al. (2014) described the import of continuously improving engineering ethics codes and professional norms in the spirit of social justice and encouraged professional engineers to incorporate the public voice to protect the public's health, safety, and welfare.

4.2 | Theme 2: Roots

This theme describes *Roots*, which inform how engineers define and connect ethics and DEI in engineering. *Roots* emphasize individual experiences or cultural histories and recognize that both inform one's views on ethics/DEI connections. The sub-themes name factors that inform how distinct *Lenses* resonate with engineering students, instructors, researchers, or practitioners.

We generated three sub-themes here: (1) individual demographics; (2) engineering cultures; and (3) institutional cultures. These sub-themes intersect and thus are neither discrete nor mutually exclusive. Taken together, articles indicated that institutional norms encapsulate and inform disciplinary values, which, in turn, can lead to distinct views on how an individual practitioner, student, or educator connects ethics and DEI in engineering.

4.2.1 | Sub-Theme 2.1: Individual demographics

This theme suggests that demographic factors influence views on or approaches to ethics and DEI in engineering or engineering education, including how one connects (or disconnects) ethics and DEI in their practice. Authors often used demographic variables to explore or understand variation in ways individuals from different backgrounds view ethics/DEI connections. Many authors argued or found that demographics are critical determinants of student engagement with ethics and DEI.

Several articles identified differences in individuals' ethical views or approaches based on demographic variables associated with race, ethnicity, gender, nationality, socioeconomic status, or disability status. Roberts (1995) observed gender differences in how men and women [sic.] prioritized distinct ethical values or frameworks in an ethics program. Specifically, women engineering students were more likely to incorporate a feminist and caring approach when compared to men. Through student interviews, Naphan-Kingery et al. (2019) found that majority students in engineering (i.e., White and Asian men) were less likely to experience an equity ethic when compared to minority members. Although majority members provided evidence of "high potential" for an equity ethic, they generally experienced social suffering indirectly. Conversely, minority members were more likely to experience overt or covert acts of racism and sexism and, in turn, were more likely to cultivate an equity ethic and prioritize social justice. Finally, one study noted that ways of understanding ethical reasoning tend to be based on Western and well-educated perspectives (Clancy & Manuel, 2019). These authors called for greater attention to how engineering students across the globe experience ethics in similar or distinct ways.

Although many studies focused on the demographics of engineering students, a few studies focused on engineering faculty. For example, Bielefeldt et al. (2018) compared faculty views and behaviors associated with teaching ethics by comparing national heritage, gender, and race. In a later study, Bielefeldt et al. (2020) explored how faculty members teach ethics based on demographic diversity. They found that women faculty members were more likely to embed reflection into their instruction of ethics and societal impacts. A few other articles shared empirical data collected with engineering faculty members, but many discussed their observations of how cultural practices and norms informed ethics/DEI connections (or lack thereof) within curriculum.

4.2.2 | Sub-Theme 2.2: Disciplinary cultures

This theme suggests that extant engineering cultural systems influence views on ethics and DEI connections in engineering. Authors described disciplinary cultures associated with engineering as a profession, engineering education, or other engineering sub-disciplines.

Many authors noted cultural barriers to connecting ethics and DEI within engineering education. Lambrinidou et al. (2014) and Cech (2010) both critiqued the tendency of engineering cultures to dichotomize the social and the technical, then prioritize the technical. Similarly, sociotechnical dualism and the de-prioritization of the *Social* in engineering were often cited in our data (e.g., Celik et al., 2020; Li et al., 2019; Rottmann & Reeve, 2020; Swartz et al., 2019).

Cheville and Heywood (2016) suggested that relative prioritizations and goals of engineering and engineering education are ongoing and omnipresent *tensions*. Reframed as tensions, diversity and ethics then are not *problems* for engineering educators to solve; rather, they are topics with "fundamental tensions" that engineering educators should discuss and debate. For example, they described the topic of "Diversity & Inclusiveness" as possessing a tension between "Inclusion" and "Professionalism," wherein they stated: "The need to be more inclusive can be in tension with the desire of programs to recruit and admit the 'most talented' students" (p. 7). Building from this, they argued that how programs define talent may influence diversification of engineering education and can serve as a barrier to inclusion.

Authors described how aspects of engineering culture, such as social-technical dualism, might inhibit diversification regardless of talent. For example, Roberts (1995) argued that the view of engineering as non-people-centered discourages women from pursuing engineering. Likewise, Tooley and Umphress (2009) noted that diversity was often missing in ethics instruction. They asked, "Would including diversity awareness as part of engineering ethics education result in a more inclusive culture in the engineering profession?"

Like Tooley and Umphress (2009), authors noted how DEI can (and, ostensibly, does) manifest in engineering ethics education. Bielefeldt et al. (2020) discussed norms of teaching ethics in engineering, wherein *microethics* (i.e., a focus on individuals or relationships) has been historically prominent when compared to *macroethics* (i.e., a focus on societal considerations). They argue that engineering codes of ethics generally focus on micro-ethics and professional codes; conversely, a focus on social justice may lend itself to macro-ethical concerns accompanied with a primary focus on equity and fairness. This consideration aligns with the argument that, historically, views of engineering ethics have not emphasized macro-ethics or equity (Rottmann & Reeve, 2020).

4.2.3 | Sub-Theme 2.3: Institutional cultures

While the prior theme focused on the culture of engineering, this theme suggests that the culture of institutions can influence individual and collective views on ethics/DEI connections in engineering. Institutional culture encompasses cultural values, norms, and related artifacts that signify who a group of people are or what they believe. Institutional cultures discussed by authors included institutions of higher education, engineering programs, and engineering workforce organizations.

A few authors collected empirical data to understand how institutional cultures influence individual views or approaches to connecting ethics and DEI in practice. For example, Feister et al. (2014) explored the impact of institutions of higher education on students' approaches to ethical reasoning. They identified how students from four distinct universities viewed ethical issues based on the Discourses of their respective institutional contexts.

While Feister et al. (2014) identified how different institutional cultures can influence individual's ethical approaches, Cech (2010) inferred aspects of engineering education culture by analyzing commonalities across student experiences from four institutions. Like Rottmann and Reeve (2020), these authors expressed that ethics and DEI connections tend to be counter-normative in engineering. They further postulated that the recurrence of institutional neglect has resulted in a disengagement of engineering and the *Social*.

Like Feister et al. (2014) and Cech (2010) found, Molina-Carmona et al. (2017) argued that core values of universities inform universities' obligation to student development, including the development of engineering students' social responsibility (i.e., Theme 1.1). Rottmann and Reeve (2020) shared how attending to norms and expectations pertaining to time and success can cultivate institutional cultures committed to ethics and DEI connections.

4.3 | Theme 3: Engagements

This theme describes modes of engagement to foster ethics and DEI connections in engineering. Engagement strategies may serve as instructional considerations to help students connect ethics and DEI in engineering or heuristics for instructors to promote the integration of DEI into students' ethical engineering processes.

We developed three sub-themes here: (1) affinity toward ethics/DEI content, (2) understanding diverse stakeholders, (3) and working in diverse teams. Authors often specified how engagement strategies may support the incorporation of *Lenses* for connecting ethics and DEI in engineering education or how *Roots* can introduce opportunities and barriers for introducing select sub-themes.

4.3.1 | Theme 3.1: Affinity toward ethics/DEI content

Authors recognized that *what* is taught regarding ethics and DEI connections or *how* it is taught may imbue cognitive dissonance, particularly when learners find it counter-intuitive or misaligned with their perceptions of engineering. Thus, learners may feel varying levels of engagement with curricular content, including positive engagement (i.e., affinity or vested interest), negative engagement (i.e., resistance), and non-engagement (i.e., ambivalence). Thus, content that focuses on ethics/DEI can resonate with some students, foster resistance among others, or simply generate no engagement.

Authors described instances where students exhibited positive feelings toward learning materials. Li et al. (2019) found that "engineering students studying in MIT's labs have consistently responded positively to global inclusive needs to design affordable and acceptable products and services for excluded or poor groups" (p. 11). Lawson and Keister (2020) similarly observed learner engagement and argued that the reality of ethics cases was the most positive aspect of learner engagement in their study. Wilson-Lopez and Minichiello (2017) discussed the import of locally relevant cases and shared, "When students read about and discuss the 'big picture' implications of technologies on their families and communities, they can become critical designers, consumers, and citizens who are able to more comprehensively evaluate the impact of proposed and current designs" (p. 13). Similarly, Bielefeldt et al. (2020) suggested that real-world cases are engaging when they are "real and poignant" (p. 11).

Some students may also resist or dis-engage from ethics/DEI content. As Bielefeldt et al. (2020) noted, "Ethics topics can be uncomfortable, and students may not always recognize the value in having their beliefs challenged" (p. 11). In this spirit, Moore (2020) discussed hypothetical resistance from students when content is taught by non-engineers. As they wrote, a *potential* student response to ethics instruction by non-engineers may be, "It's just the ethics instructors, not real work" (p. 422). While Moore described a possibility, Rottmann and Reeve (2020) vividly recount an instance of backlash from White male students during conversations regarding gender diversity. They provided strategies for instructors should they experience such student resistance or negative feelings when connecting ethics and DEI in their curriculums.

4.3.2 | Theme 3.2: Understanding diverse stakeholders

Authors depicted engagement strategies that prompted students to become aware of, understand, or effectively respond to diverse stakeholders during ethics learning or practice. Authors described two primary modalities of engaging stakeholders: (1) imaginative engagement through multimedia or related content or (2) actual interpersonal engagement.

First, authors discussed imaginative modes of engagement where students sought to understand stakeholder perspectives. Many authors discussed near or local users, including indigenous groups (Hadisantono et al., 2020), but many discussed global users and the need for students to consider the perspectives or impacts on stakeholders across the globe (Berg & Lee, 2016; Bielefeldt et al., 2018; Clancy & Manuel, 2019; Fu et al., 2018; Huff & Martin, 1995; Hughes et al., 2020; Wang & Buckeridge, 2016). Authors noted that global considerations may inhibit actual interactions with stakeholders whom engineering products impact, but encouraged connecting ethics and DEI by fostering empathy for stakeholders across the globe (Naphan-Kingery et al., 2019) or applying extant frameworks that are globally oriented (e.g., Sustainable Development Goals, see Tharakan, 2020).

Second, authors offered pedagogical strategies to facilitate interpersonal engagement between engineering students and user groups to bolster students' understanding of select user groups. While interpersonal engagement is also important to the following sub-theme, here, prospective users generally did not become team members. Rather, these interpersonal activities positioned engineers to think and act more inclusively while making engineering decisions in light of their enhanced user understanding. Authors leveraged extant pedagogical frameworks, such as inclusive thinking (Ludi et al., 2018) and inclusive innovation (Li et al., 2019), to help students understand and incorporate diverse users' perspectives in engineering processes. For example, Ludi et al. (2018) found that students who had "first-hand interaction with someone with a disability during the semester" expressed "greater sympathy" for "Disabled Persons" and considered accessibility to a greater extent in their design project when compared to students who did not experience such first-hand interactions (p. 722).

4.3.3 | Theme 3.3: Working in diverse teams

Diverse teaming or group experiences in engineering curriculums can improve learning experiences, team processes, or engineering outcomes associated with ethics and DEI. This theme describes how enhancing the diversity of an engineering team simultaneously enhances ethical outcomes of engineering decisions.

Authors argued that promoting diversity within a team can enhance approaches to ethical reasoning. Many authors offered theoretical or speculative lines of reasoning regarding the benefits of incorporating DEI into one's ethical processes (Bielefeldt et al., 2020; Feister et al., 2014; Hazzan & Lapidot, 2006; Kastenberg et al., 2006; Lantada, 2020; Silva et al., 2015; Tooley & Umphress, 2009), and several authors provided empirical support based on these speculations. For example, Berg and Lee (2016) shared student quotes from a course and found that one student felt there was a "need for inclusivity not only in the considerations factored into an engineering design but in the make-up of the design team itself" (p. 10).

Authors argued that including community members or users on a team was itself a primary characteristic of ethical engineering. For example, Lambrinidou et al. (2014) argued that engineers must not only listen to diverse stakeholder groups but also work alongside them to practice ethical engineering. Their research team modeled this behavior and included the "publics affected by engineering decisions" (p. 3) as members of their research team. Molina-Carmona et al. (2017) offered an action-research methodology wherein student teams collaborated with users with cerebral palsy. In this approach, these prospective users again served as team members. Specifically, students engaged in curricular design projects "in collaboration with associations of disabled users" (p. 182).

In sum, diversifying teams based on demographic factors (e.g., race, gender), disciplines, or roles (e.g., position within a community) can help encourage teams to make engineering decisions that have ethical results and outcomes.

5 | DISCUSSION

This study explored extant connections between ethics and DEI in engineering education. By synthesizing views from the engineering education community, we aimed to provide actionable modalities for connecting ethics and DEI in engineering education to guide future research and practice. We identified three primary themes: (1) *Lenses* for connecting ethics and DEI, (2) *Roots* that influence how engineers or engineering educators conceive of ethics/DEI connections, and (3) *Engagements* that foster ethics/DEI connections.

We approached this discussion by asking, "In what ways do the results offer *promising opportunities* for connecting ethics and DEI in engineering education?" We offer three take-aways: (1) *social justice* is a prominent lens for connecting ethics and DEI; (2) *individual and structural factors* influence ethics/DEI connections; and (3) scholars can apply extant *engagement strategies* to cultivate ethics/DEI in engineering programs.

5.1 | Social justice is a prominent lens for connecting ethics and DEI

Social justice arose as a prominent cross-cutting *Lens*. Rottmann and Reeve (2020) argued that social justice offers "one way to infuse equity issues into ethics education" (p. 151). Social justice prompts engineers to engage, empathize with, and care for the communities whom their decisions impact (Bielefeldt et al., 2020; Naphan-Kingery et al., 2019). Social justice might lead one to ask whether inputs into engineering models are sufficiently diverse, whether engineering procedures exclude minoritized groups, or whether there is an equitable distribution of the outcomes of engineered products.

Authors used social justice to design curricular *Engagements*, such as Lambrinidou et al. (2014) who employed social justice to consider challenges associated with technocentricism and Berg and Lee (2016) who argued that social justice can support liberal education by supporting students "to examine technical concepts more holistically" (p. 3).

Extant conversations regarding relationships between ethics and DEI are occurring in professional societies (Hoke, 2021; Pearson, 2019) to ensure that DEI becomes ethically normative in ethical engineering practice. ASEE (2020) has even incorporated social justice explicitly into their code of ethics for engineering educators. We encourage other professional societies to similarly consider integrating social justice or social justice-oriented sentiments into their codes of ethics. For example, societies might embody a social justice spirit in (re)designing extant codes of ethics by asking, "Historically, who has been at the table when professional artifacts have been created?" or, "Who should be at the table in the future?"

5.2 | Individual and structural factors influence ethics/DEI connections

Our findings indicate that the integration of ethics and DEI in engineering can be challenging because of cultural differences, be it differences across disciplines, organizations, or nations. For example, engineers have a "narrow" view regarding what does and does not constitute ethics (Lambrinidou et al., 2014), which (we conjecture) is a potential contributing factor to the culture of disengagement in engineering (Cech, 2014). Pawley (2019) argued that "engineering has profoundly moral consequences, but the stories we engineers tell ourselves about what we do mostly disregard this moral role" (p. 447). Pawley (2019) suggests we attend to systemic structural factors when we respond to moral issues. In our study, the *Roots* theme named such factors that influence views regarding ethics and DEI connections in engineering. Like Pawley, the *Roots* sub-themes suggest that internal individual factors (i.e., demographics) and socio-historical factors (i.e., discipline and institutional cultures) influence the stories engineers tell themselves about how ethics/DEI connect (or do not connect) in engineering.

Disciplinary cultures indicated that identifying connections between ethics/DEI in engineering involves asking questions about the culture of engineering, such as what it means to be an engineer and the purpose of engineering. Yet, as Pawley (2019) argued, we cannot address such purpose-oriented and morality questions through empirical analysis alone. Rather, like the tensions portrayed by Cheville and Heywood (2016), such questions require a collective conversation, asking critical questions and moving forward to shift engineering culture together. Pawley advocated for transparency and collective dialogue on moral values, including ways engineering educators ought to elevate DEI in their practice.

Apart from one's discipline, institutions of higher education have a key role in fostering dialogue and can have a strong influence on how students respond to ethical issues (Feister et al., 2014). Moreover, institutions are positioned to decide how and to what extent ethics and DEI will be co-implemented (Martin et al., 2021). Alas, Cech (2010) found persistent declines in ethical engagement across four institutions, thereby suggesting a culture of disengagement in engineering education programs (Cech, 2014). The *Engagement* theme offers strategies that can potentially help offset these declines by bridging ethics/DEI in engineering curriculums.

5.3 | Engagement strategies to cultivate ethics/DEI in engineering

The Engagement sub-themes offered strategies to introduce *Lenses* (e.g., social justice) or attend to *Roots* (e.g., sociocultural elements) in engineering curriculums. *Engagements* prompted students to consider or work alongside select users or stakeholders. To this end, authors employed and connected ethics/DEI through extant pedagogical frameworks, such as liberal education and service-learning (Berg & Lee, 2016), the ethics of technology and anthropology (Hughes et al., 2020), inclusive innovation (Li et al., 2019), and community-based participatory research (Lambrinidou et al., 2014). Such engagement strategies prompted engineers to consider the needs of users who they often neglect (Berg & Lee, 2016; Molina-Carmona et al., 2017).

While many *Engagements* encouraged user–student interaction, many involved attending to the needs or perspectives of users from select groups. Naphan-Kingery et al. (2019) theorized a direct link between a student's empathy for others' social suffering, that student's altruistic motivations, and their commitment to an equity ethic. Many authors encouraged students to consider users across the globe (Berg & Lee, 2016; Bielefeldt et al., 2018; Clancy & Manuel, 2019; Fu et al., 2018; Huff & Martin, 1995; Hughes et al., 2020; Wang & Buckeridge, 2016). Building from these works, we argue that promoting empathy for users is one way to encourage students to consider others who may be dissimilar or far-away (Hess et al., 2016).

Authors described (1) the import of promoting student engagement and (2) how student engagement may improve when instructors promote ethics/DEI connections in curriculum. However, some authors discussed instances where ethics/DEI connections may not resonate with students. Some students may resist engaging in ethics/DEI content because of the challenge and novelty of such discussions (e.g., see Rottmann & Reeve, 2020). In this sense, Hughes et al. (2020) noted that the problems engineers respond to are "complex, changing, unpredictable problems all over the world that will be understood differently in different places, according to local culture and value systems" (p. 239). They encouraged educators to embrace this complexity and argued that computing professionals (and, we infer, engineers) "will benefit greatly from substantial engagement with critiques from across the world and across campuses" (p. 244).

6 | LIMITATIONS AND FUTURE RESEARCH

This study presented a synthesis of existing connections by searching for ethics and DEI terms in the abstracts of engineering and engineering education publications. The data identified suggested that there is a critical mass of scholars in engineering education already connecting ethics and DEI. We identified three prominent *Lenses* in the data, but we do not presume that our analysis represents all views. Moreover, we recognize that there are likely many "implicit" connections in literature that we did not cover here. For example, rarely were "isms" (e.g., racism, classism, sexism) a focal point of articles, which we perceive to be both ethical and DEI issues. Our articles were largely (but not exclusively) US-centric. We did not exclude non-US articles, but we posit that other data collection processes would have yielded more non-US publications. Given this limitation, future work may seek to compare views on ethics/DEI between nations. One key aspect of such future work might question the comparability of DEI vocabulary in distinct national contexts (Luthra, 2022).

7 | CONCLUSION

There is a critical mass of engineering education scholars who have connected ethics and DEI in engineering. We identified three prominent themes to capture ethics/DEI connections: *Lenses* included frameworks for connecting ethics and DEI, *Roots* included factors that affect which *Lenses* manifest, and *Engagements* represented strategies for promoting *Lenses* or nurturing *Roots*. Benefits of integrating ethics and DEI include promoting a socially just world, but to ensure the widespread implementation of a social justice-oriented ethos requires ensuring that engineering culture is inclusive to and equitable for individuals from diverse backgrounds. We offered roots and engagement strategies that are critical to such change efforts. We hope the findings of this study will guide future investigations by providing ways and discourses that connect these phenomena and which others can build on in their work.

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ORCID

Justin L. Hess https://orcid.org/0000-0002-1210-9535
Athena Lin https://orcid.org/0000-0001-6563-6139
Andrew Katz https://orcid.org/0000-0002-3554-9015

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AUTHOR BIOGRAPHIES

Justin Hess is an Assistant Professor in the School of Engineering Education at Purdue University, Neil Armstrong Hall of Engineering, Room 1331, 701 W. Stadium Avenue, West Lafayette, IN 47907; jhess@purdue.edu.

Athena Lin is a PhD Student in the School of Engineering Education at Purdue University; aln@purdue.edu.

Andrew White is a recent Masters Recipient in the School of Engineering Education at Purdue University; andrewwhitehead415@gmail.com.

Andrew Katz is an Assistant Professor in the Department of Engineering Education at Virginia Tech, 354 Goodwin Hall (MC 0218), 635 Prices Fork Rd, Blacksburg, VA 24061; akatz4@vt.edu.

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APPENDIX

SUMMARY OF ARTICLES AND ASSOCIATED CODING

Lead author	Year	Publication type	Ethics conceptions	DEI conceptions	Lenses	Roots	Engagements
Berg	2016	Conference	Professional	Disciplinary "D"; "I" in higher education; "I" in the workplace	1.1	2.2	3.1; 3.2
Bielefeldt	2020	Conference	Professional	Demographic "D"	1.1; 1.2	2.1; 2.2; 2.3	3.2
Bielefeldt	2018	Journal	General; Professional; Topical	Demographic "D"; Experiential/Thought "D"; Global "D"; "E" involves Justice Concerns	1.1; 1.2; 1.3	2.1; 2.3	3.1; 3.3
Cech	2010	Conference	Personal; Professional	Demographic "D"		2.3	3.3
Celik	2020	Conference	Professional	Experiential/Thought "D"; Inclusive engineering thinking processes; "I" in higher education		2.2	3.2
Cheville	2016	Conference	Professional	Demographic "D"; "I" in higher education		2.2; 2.3	
Clancy	2019	Conference	Personal; Professional	Global "D"		2.1	3.2
Doyle	2010	Conference	General	Disciplinary "D"; Experiential/Thought "D"; Inclusive engineering thinking processes	1.1	2.2	3.2
Feister	2014	Conference	General	Disciplinary "D"; Experiential/Thought "D"		2.1	3.1
Fu	2018	Conference	Professional	Global "D"			3.2
Hadisantono	2020	Journal	Professional	Demographic "D"; Experiential/Thought "D"; Inclusive engineering thinking processes	1.3		3.2
Hasenberg	2005	Conference	General	Disciplinary "D"; Experiential/Thought "D"	1.1	2.2; 2.3	3.1
Hazzan	2006	Journal	General; Professional	Demographic "D"; Experiential/Thought "D"	1.1		3.1; 3.2
Huff	1995	Journal	General; Professional	Demographic "D"; Experiential/Thought "D"; Global "D"; Inclusive engineering thinking processes	1.1		3.2
Hughes	2020	Conference	General; Professional	Demographic "D"; Global "D"	1.3	2.1	3.2
Kastenberg	2006	Conference	General	Demographic "D"; Experiential/Thought "D"	1.1		3.1; 3.2

(Continues)

Lead author	Year	Publication type	Ethics conceptions	DEI conceptions	Lenses	Roots	Engagements
Lambrinidou	2014	Conference	Personal; Professional	Experiential/Thought "D"; "E" involves Justice Concerns; Inclusive engineering thinking processes		2.1; 2.2	3.2
Lantada	2020	Journal	Professional	Global "D"; "E" involves Accessibility Concerns			3.1; 3.2
Lawson	2020	Conference	Professional	Demographic "D"; Disciplinary "D"		2.1	3.1; 3.2; 3.3
Lewis	2021	Journal	General; Professional	Disciplinary "D"; Experiential/Thought "D"	1.1; 1.2; 1.3		
Li	2019	Conference	Professional; Topical	Experiential/Thought "D"; Global "D"; "E" involves Accessibility Concerns; Inclusive engineering thinking processes	1.1	2.1; 2.2	3.1; 3.2; 3.3
Ludi	2018	Conference	Professional	Demographic "D"; Experiential/Thought "D"; "E" involves Accessibility Concerns; Inclusive engineering thinking processes	1.1; 1.3	2.2	3.1; 3.2
Molina-Carmona	2017	Conference	Professional	Demographic "D"; Experiential/Thought "D"; Inclusive engineering thinking processes	1.1	2.1; 2.2; 2.3	3.2; 3.3
Moore	2020	Conference	General; Professional; Topical	Experiential/Thought "D"; "E" involves Justice Concerns; Inclusive engineering thinking processes		2.1; 2.2	3.3
Murrugarra	2014	Journal	Personal	Demographic "D"; Global "D"		2.1	3.1
Naphan-Kingery	2019	Journal	Topical	Demographic "D"; Experiential/Thought "D"; "E" involves Accessibility Concerns; "E" involves Justice Concerns; "I" in higher education	1.1; 1.2	2.1; 2.2	3.2
Roberts	1995	Conference	Professional	"I" in the workplace	1.1; 1.3	2.1; 2.2	3.3
Rodrigues	2014	Journal	General; Professional	Experiential/Thought "D"; Inclusive engineering thinking processes	1.2; 1.3	2.3	3.1; 3.2
Rottmann	2020	Journal	General; Professional; Topical	Demographic "D"; Experiential/Thought "D"; "E" involves Justice Concerns; "I" in higher education	1.1; 1.2	2.1; 2.2; 2.3	3.1; 3.3
Shen	2021	Conference	Professional	Experiential/Thought "D"			3.2

Lead author	Year	Publication type	Ethics conceptions	DEI conceptions	Lenses	Roots	Engagements
Silva	2015	Conference	General; Professional; Topical	Demographic "D"; Disciplinary "D"			3.1
Swartz	2019	Conference	Professional	Demographic "D"; Experiential/Thought "D"		2.2	
Tharakan	2020	Conference	Professional	"E" involves Justice Concerns	1.2		3.2
Tooley	2009	Conference	Professional	Demographic "D"; "E" involves Justice Concerns; "I" in the workplace	1.1; 1.3	2.1; 2.2	
Wang	2016	Conference	General; Professional	Disciplinary "D"; Experiential/Thought "D"; Global "D"; "E" involves Justice Concerns	1.1; 1.2; 1.3	2.1	3.2
Wilson-Lopez	2017	Journal	Professional	Demographic "D"; Inclusive engineering thinking processes	1.2	2.1	3.2; 3.3