The TRIPLE Change Framework: Merging Theories of Intersectional Power, Learning, and Change to Enable Just, Equitable, Diverse, and Inclusive Engineering Education

STUDIES IN ENGINEERING EDUCATION

THEORY

VIRGINIA TECH PUBLISHING

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ABSTRACT

Background: Despite many calls for change, and especially change aligned to diversity, equity, inclusion, and justice (DEIJ) goals, engineering continues to show disparities in the opportunities, experiences, and outcomes of women and people from groups historically marginalized in these fields. In response, institutions have traditionally used change frameworks to both understand and create reform at program, department, or college levels. However, when aiming at DEIJ goals, change frameworks alone do not lead to the desired transformations of systems.

Purpose: In this theoretical paper, we develop an integrated framework that draws from three theoretical domains to guide systemic, equity-focused transformation in engineering education. We argue knowledge from three domains—intersectional power, learning, and change—is necessary to account for and address the complexity of DEIJ change projects. This complexity requires a framework that sheds light on interrelated embodiments of power relations, guidance on how to change, including how and why people learn and engage in new practices.

Scope: To illustrate the need for and value of such integration, we examine how prior researchers have used theories of power, change, and learning. In doing so, we present a framework for how integration across these domains can occur. In the domain of change, we identified papers on diffusion of innovations and communities of practice. In learning, we identified papers on distributed practice and legitimate peripheral participation. We examined how these papers utilized critical theories of intersectional power, the third domain, in tandem with these theories. We also explored how the choice of a theory (within the domains) can help or hinder the attainment of systematic, equity-focused transformation.

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KEYWORDS:
higher education; organizational change; learning theory; intersectionality; power

TO CITE THIS ARTICLE:
Svihla, V., Davis, S. C., & Kellam, N. N. (2023). The TRIPLE Change Framework: Merging Theories of Intersectional Power, Learning, and Change to Enable Just, Equitable, Diverse, and Inclusive Engineering Education. *Studies in Engineering Education*, 4(2), 38–63. DOI: https://doi.org/10.21061/see.87

Discussion/Conclusion: We drew the three domains together to consider how these, when integrated in the Theories and Research on Intersectional Power, Learning, and Evolutionary Change (TRIPLE Change) Framework, provide a more comprehensive means to envision, guide, and characterize DEIJ change efforts. By integrating learning, change, and intersectional power theories, we increase the capacity of our analyses of systems and open new possibilities for creating more equitable and just systems.

DOI: 10.21061/see.87

BACKGROUND

In this theory paper, we illuminate how integrating theories of learning, change, and power creates a robust framework capable of meeting the complexity of change efforts in engineering education that aim to advance diversity, equity, inclusion, and justice (DEIJ). While the precise meanings of each of these terms may differ among scholars and projects, we broadly conceptualize DEIJ work as that which recognizes the functions and outcomes of inequitable systems of oppression and marginalization and the need to take a justice-oriented approach to counter these inequities, creating an inclusive culture that fosters diversity. The Theories and Research on Intersectional Power, Learning, and Evolutionary Change (TRIPLE Change) Framework presented herein can facilitate critically minded analyses of educational systems and guide the (re)design, implementation, and evaluation of policies and systemic change initiatives that improve the learning and lives of those historically marginalized in education and society.

We first situate our work broadly by considering change efforts in higher education, including those with DEIJ goals, and examine why these might differ from other change efforts. We then review recent history in engineering education to consider how our current approaches have been shaped and why the broader engineering education community both needs and resists DEIJ change efforts.

CHANGE EFFORTS IN HIGHER EDUCATION: SITUATING DEIJ INITIATIVES

Organizational change projects have been well-studied outside of higher education settings, resulting in models and theories that typically focus on a sequence of steps to take (Kezar, 2001; Kotter & Cohen, 2002). In business settings, such sequential, top-down approaches to change can be efficient and successful, in part because of the alignment between the change theories and the incentive systems at play. Even in higher education settings, change efforts that target, for instance, how business operations function or how to adopt new technologies (e.g., learning management systems, tenure and review file management systems) can be planned and accounted for with such theory (Sidorko, 2008; Wentworth et al., 2018). However, despite a history of using many theories to create change at different levels of the educational system (e.g., individual, department, university), the field lacks a comprehensive understanding of which approaches are most effective under particular circumstances or how to connect and leverage change projects within and across institutions (Amundsen & Wilson, 2012; Borrego & Henderson, 2014; Henderson et al., 2011; Kezar, 2001). Notably, efforts to change faculty teaching, such as adopting active learning and efforts to change departmental policies, such as what counts in tenure and promotion decisions, are more challenging than changes to business operations and technology adoption (Klempin & Karp, 2018).

While progress has been made in adapting theory for such change efforts (Kang et al., 2022; Quan et al., 2019; Quardokus Fisher & Henderson, 2018), few have focused on DEIJ goals. We argue, and studies seem to bear out, that DEIJ-focused change differs from other kinds of change efforts, as evidenced by limited progress in meeting repeated calls for broadened participation and equity (NASEM, 2016; NAS et al., 2011; NSF, 2021). When the overarching goal of organizational change is to foster diversity, equity, inclusion, and, ultimately, justice for people from historically marginalized and excluded communities, organizational change strategies must transform the structures, cultures, policies, practices, and norms that have long guided organizations, producing "inequality regimes" (Acker, 2006, p. 441). While convincing faculty to adopt a new educational

technology or pedagogical practice is difficult, DEIJ-focused change efforts are far more complex, requiring attention to and transformation of the ways in which underlying systems distribute power and privilege through structural and cultural aspects of an organization (Armstrong & Jovanovic, 2015; Posselt, 2020). These changes require attention to power and privilege because they challenge longstanding beliefs, norms, and baseline assumptions (Diggs et al., 2009; Ely & Thomas, 2020; Falci & Watanabe, 2020; Stewart, 2020).

EPISTEMOLOGIES AND HOW THEY INFLUENCE OUR INSTITUTIONAL CHANGE EFFORTS

Advancing DEIJ through organizational change requires contending with power, privilege, and systems of oppression that have shaped institutions of higher education for centuries (Gusa, 2010; Stewart, 2020). The critical epistemologies that guide this perspective are less understood, trusted, and valued within a community that favors objectivist ways of knowing. Positivist epistemologies, common in engineering education, tend to value outcomes that are measurable and statistically driven, and thus not always compatible with DEIJ aims (Bredo, 2012; Crotty, 1998). We consider these issues specifically within the context of postsecondary engineering departments, where deeply embedded assumptions in both engineering and university cultures have promoted focus on learning and change, but not on intersectional power (Staller, 2013). These assumptions reveal epistemologies guiding what counts as knowledge (e.g., Beddoes, 2014), and which may contribute to some of our failed attempts at advancing DEIJ through organizational change.

While conversations about epistemology have become more common among qualitative engineering education researchers (e.g., Cross, 2020a; Kellam & Jennings, 2021; Secules et al., 2018), these conversations are not common among disciplinary engineering faculty who may operate with a positivist epistemology. Guided by a positivist stance, such faculty value empirically derived, "objective" explanations about the phenomena they study. This stance may be productive in both laboratory and industry settings when characterizing, for instance, the physical conditions under which a device will no longer operate safely. This positivist stance likely informed earlier failed change efforts built on assumptions that increasing assessment and engineering education research would lead to widespread changes in engineering education classrooms. To this day, this positivist stance also informs many diversity efforts with seemingly objective "standards of merit" that may be hidden under the auspices of "rigorous" research (Riley, 2017, p. 249).

When applied to teaching and learning, however, positivism does not lead to improvement in diversity and inclusion, but instead tends to promote a uniform, homogenous approach to instruction and to place blame on students (Biesta, 2007). Though this is not our stance, those who follow this positivistic logic may believe that just as a composite material may contain a fault tied to its manufacture, so may a student possess misconceptions and deficits tied to their "natural" potential, their own efforts to learn in past courses, or their teachers' abilities to cover content appropriately. This last aspect, however, is a leverage point for professional development, as faculty may accept new pedagogical practices, like active learning (Macaluso et al., 2020), especially when the preponderance of evidence demonstrates its efficacy (Freeman et al., 2014). Such changes, while guided by theories of learning and change, need not fundamentally alter faculty's epistemologies, and thus, may not be as effective in leading to institutional change that advances DEIJ.

HISTORICAL CONTEXTS OF DEIJ-FOCUSED CHANGE IN ENGINEERING EDUCATION

We consider history within postsecondary engineering education, where there have been many pushes towards innovations in teaching linked to theories of learning and change; considering this history provides context for understanding challenges of DEIJ-focused change efforts. In 1989, the National Science Foundation (NSF) funded six coalitions that resulted in widespread changes to first-year engineering courses but did not realize NSF's goals of increasing the number of degrees awarded to women and underrepresented minorities (Coward et al., 2000). Instead, the coalitions

focused on attracting women and minorities into engineering programs and had difficulties in assessing the numbers of women and minorities in the engineering coalitions. This focus on the numbers of diverse students and number of students entering into an engineering program, demonstrates a more positivistic approach to dealing with issues of diversity and inclusion, one that involves primarily counting students and graduates.

In the early days of the new discipline of engineering education research ("The research agenda for the new discipline of engineering education," 2006), there was an understanding that higher quality assessment of educational innovations would drive broader adoption by engineering faculty (Borrego, 2007; Foertsch et al., 1997), leading to a push for more research in engineering education (Fortenberry, 2006; Jamieson & Lohmann, 2009; "The research agenda for the new discipline of engineering education," 2006; Streveler & Smith, 2006). Diversity and inclusiveness were included in the research agenda with a focus on characterizing and measuring diversity, alongside demonstrating how diversity of engineers would impact engineering solutions and society. However, this increase in assessment and engineering education research did not lead to the expected changes in teaching (Finelli et al., 2014; Jamieson & Lohmann, 2012; National Research Council, 2012). This transition from a focus solely on diversity to a focus on inclusiveness of programs demonstrates a movement beyond more positivistic approaches. However, the primary focus on assessment still suggests a more positivistic approach to understanding DEIJ issues.

In 2000, as the field continued to shift to more assessment and engineering education research, the field began relying more on learning theories, evidenced initially in citations to *How People Learn* (Bransford et al., 2000; Felder & Brent, 2003; Prince, 2004). In *How People Learn*, the discussion around diversity and inclusion was focused on cultural mismatches between home and school cultures and how these mismatches can impact student learning. This focus on cultures demonstrates a movement from focusing on individuals within the system to concerns around systems that produce inequities, thus suggesting a movement beyond positivistic epistemologies.

In 2014, NSF announced the Revolutionizing Engineering Departments (RED) program, which required teams to use change theory to guide educational innovations and cultural change projects (NSF, 2014). The RED program specifically calls for proposals that foster inclusive cultures and that increase participation and engagement of students for groups underrepresented in engineering. To support such work, NSF required teams to include a social scientist with expertise in change theory and the ability to monitor change processes (NSF, 2014).

More recently, the pandemic and social movements, including Black Lives Matter, Stop Asian Hate, and Abortion Rights, have brought increased attention to widespread and historically rooted inequities in our society that privilege white people and especially white men. Alongside these social movements, engineering education researchers have begun to push for critical and anti-racist approaches (Cross, 2020b; Holly Jr, 2020; Long III, 2020) to make meaningful changes to the way that our engineering education system operates and to empower people who are marginalized and oppressed in engineering.

Over this history, we note changes in the ways DEIJ goals have been brought into both NSF programs and our work. In the Coalitions, one of the goals was to increase "both the quality of engineering education and the number of degrees awarded in engineering, including those to women and underrepresented minorities" (Coward et al., 2000, p. iii); here, the focus on quality and quantity aligns to a positivist epistemology, placing diversity as a secondary goal.

In the 2014 RED program solicitation, diversity was described as a "stubborn long-standing issue" (NSF, 2014, p. 1), situating the lack of diversity as a recognized problem, yet still treated as rather monolithic, representing a post-positivist stance. The 2019 RED program solicitation included a focus on quantity, linked to capitalism and suggestive of a positivist stance: "percentages of persons from underrepresented groups entering into – and remaining in – the practice of engineering are still unacceptably low, impacting the future health of the national workforce" (NSF, 2019, p. 4). However, this solicitation also included statements suggesting a more critical stance: "Among the common challenges facing engineering departments are … how to create cultures of inclusion that are welcoming to students and faculty of all types" (NSF, 2019, p. 4). Further, the goal of

RED has an activist tone that is certainly more aligned with critical epistemology: "The goal of the RED program is to catalyze revolutionary, not incrementally reformist, changes to the education of the next generation of engineers. Revolutionary means radically, suddenly, or completely new; producing fundamental, structural change; or going outside of or beyond existing norms and principles" (NSF, 2019, p. 4). This critical vision does not permeate the rest of the solicitation, suggesting misalignment between the vision and possible ways of achieving that vision. This is also reflected in a recent literature review that found that despite the increased use of critical theory to frame papers, many such papers still took a deficit stance (Mejia et al., 2018). While authors have used theories of power to characterize or issue critique about persistent inequities in engineering (Falci & Watanabe, 2020; Ross et al., 2017), these accounts offer little insight into *how* to make change.

CALL FOR CHANGES TO OUR EPISTEMOLOGICAL PERSPECTIVES

To address this problem, Dillard argues that we must change our epistemological perspectives to become both accountable and responsible to the people we study (Dillard, 2000). Critical epistemologies may enable faculty to begin to understand and dismantle systems of oppression and elevate voices that are traditionally marginalized (Crenshaw et al., 1995; Cross, 2020a; Delgado & Stefancic, 2017; Dillard, 2000; Gotanda, 1991) in order to truly begin to transform engineering education. By adopting more critical epistemologies, such as endarkened feminist epistemology (Dillard, 2000), faculty can begin to challenge the enmeshed positivist epistemologies of our community that continue to reproduce white supremacy and colonial ideologies in engineering education (Beddoes, 2014; Eastman et al., 2019; Kellam & Jennings, 2021; Wilder, 2013; Winfield, 2007). Endarkened feminist epistemology was developed out of experiences and voices of African American women (Dillard, 2000, p. 662); it

> articulate[s] how reality is known when based in the historical roots of Black feminist thought, embodying a distinguishable difference in cultural standpoint, located in the intersection/overlap of the culturally constructed socialization of race, gender, and other identities and the historical and contemporary contexts of oppressions and resistance for African-American women.

This endarkened feminist epistemology encourages us to consider research as a responsibility, rather than a recipe to follow. A shift to this type of epistemology helps researchers reflect on and challenge their research practices (Cross, 2020a). For example, Pawley (2019) used a critical epistemological approach by elevating minoritized students' voices to develop an argument for institutional change that would create an environment that considers students as assets. This shifts the onus of responsibility for change from individual students to structures and institutions.

PURPOSE

Guided by endarkened feminist epistemology (Dillard, 2000), we argue that knowledge from three domains—change, learning, and intersectional power—is necessary to account for and address the complexity of DEIJ change projects in engineering education. Here, we use a formal definition of *complexity* as indicating that there are many variables and factors, and that these are interrelated (Jonassen, 2000). The complexity of power relations is a key barrier to change in engineering departments, yet power is often ignored in organizational change efforts. Shifting power relations is difficult not only because those who are in positions of power benefit from their power, but also because structures, cultures, policies, and practices that shape power relations reinforce one another, sometimes in ways that are difficult to notice (Collins & Bilge, 2020).

This complexity requires a framework that sheds light on interrelated embodiments of power relations, paired with guidance on how to change, including how and why people learn and engage in new practices. As such, we consider theories of learning and change and how they might be integrated with an intersectional framework for power. Alone, each theory uncovers insights about particular phenomena, while leaving other insights unexplored (Maxwell, 2013). The

TRIPLE Change Framework presented in this paper integrates learning, change, and intersectional power theories, and by doing so increases the capacity of our analyses of systems and opens new possibilities for making them more equitable and just.

The purpose of this paper is to integrate these three theoretical perspectives as a means to plan, guide, and evaluate change work that accounts for and dismantles oppressive power structures in research and practice. In this paper we are modeling this integration through example theories that align with the TRIPLE change framework. In this paper we are not advocating for these specific theories, rather we are encouraging people involved in institutional change to consider theories of power, learning, and change in their institutional change efforts and how the choices of these specific theories might impact their institutional change efforts. Whether DEIJ-focused change is isolated, individual work (e.g., a single faculty member transforming their course) or organizational (e.g., an entire engineering department or school changing policies and practices), the TRIPLE Change Framework can support redesign work by anticipating or revealing inequities, identifying sites of action, and providing clarity about indicators of progress. Merging theories on intersectional power, organizational change, and learning provides a means to interrogate root causes, discover levers for making change, and implement reform in a systems-focused and equitable way.

THEORETICAL FRAMEWORK

In this paper, we argue for a more complex treatment of theory for DEIJ-focused change projects that integrates theories of intersectional power, learning, and change. We are not advocating for particular frameworks for power, learning, or change. To illustrate how the TRIPLE Change framework can enhance DEIJ work, we select specific theories of power, learning, and change.

In this paper, we selected an intersectional theory of power (Collins & Bilge, 2020), which we refer to as intersectional power, for its capacity to examine not just interpersonal dynamics, but also the ways in which structures, norms, and culture shape individual, organizational and societal experiences and development. While critical theories (e.g., Critical Race Theory; LatCrit, DisCrit; Indigenous Critical Theory) contend with systems of power and oppression, and would therefore be complementary with the TRIPLE Change approach, we focused on a theory that draws on intersectionality, a concept that underlies most critical theories and helps us understand how people's multiple social identities gain meaning in the context of intersecting systems of oppression. Additionally, we focus on Collins and Bilge's (2020) theory of intersectional power because it incorporates practical tools (described below) for examining how power relations inform both individuals and organizations.

To consider how variants within each domain might (mis)align, we include several contrasting theories within the domains of change and learning to illustrate how the TRIPLE Change framework is essential to DEIJ efforts. For change theories, we selected diffusion of innovations (DoI, Rogers, 2003) and communities of practice (CoP, Wenger, 1998; Wenger et al., 2002) based on their popularity and evidence that engineering education researchers, including teams in the NSF RED program, cite these in their accounts of change (Berger et al., 2018; Davis, Chen, et al., 2021; Herman et al., 2016; Sheppard et al., 2018). For learning theories, we selected distributed practice (also referred to as the spacing effect, Cepeda et al., 2006; Dempster, 1988) and legitimate peripheral practice (LPP, Lave & Wenger, 1991). Both are well-studied, enduring accounts of the acquisition of knowledge and skills over time and have been used in engineering programs (Mestre et al., 2018; Roldan et al., 2018). LPP and CoP were also selected for their compatibility; LPP defines learning as "changing participation and identity transformation in a community of practice" (Wenger, 1998, p. 11), which provides an entry point for Wenger's elaboration of CoP as a social theory of learning. When learning is conceptualized in terms of participation, individuals' engagement in actions and interactions have the potential to shape the social structures in which they take place, thus linking learning and organizational change.

We focus on theories of learning rather than theories of teaching or pedagogical approaches because, while there are many theories of teaching that have been developed with attention

to power and inequities (e.g., culturally relevant pedagogy), these were typically developed with expertise and attention to what teachers or faculty should do, rather than accounting for the more fundamental processes of learning. And while we can infer corollaries for how learning happens in the depictions of what teachers should do, we note two issues for our aims. First is the fact that many such theories also link to learning styles, an explanation that has repeatedly failed to be evidenced (Kane & Boan, 2005; Pashler et al., 2008; Rogowsky et al., 2020; Stahl, 1999). Second, and importantly, is that theories of teaching depend on the presence of an instructor directing or facilitating the students. The kinds of learning that need to be accounted for in DEIJ change projects often happen between peers, or at least without a clear, consistent instructor.

In what follows, we contrast individual-centered (DoI) versus organizational change theory (CoP) and contrast a cognitivist (distributed practice) versus a socio-constructivist theory of learning (LPP), considering how each theory complements and coheres with a theory of intersectional power. We describe each theory in more detail in our analysis. While we focus our analysis in this paper on these specific theories, our argument is for the inclusion of theories that address intersectional power, learning, and change as we embark on DEIJ-focused change projects. The particular theories chosen for a particular DEIJ change project may vary depending on its specific context. These theories should be chosen carefully, including attending to the situated historical context of the theory's origins and purpose (Philip & Sengupta, 2021; Secules & Mejia, 2021).

LITERATURE SELECTION

To illuminate the current state of scholarship that combines two or more of these theories and support interpretations from these comparisons, we identified studies through a multistep process (Figure 1). First, we identified highly cited papers related to each theory: DoI (Rogers, 2003); CoP

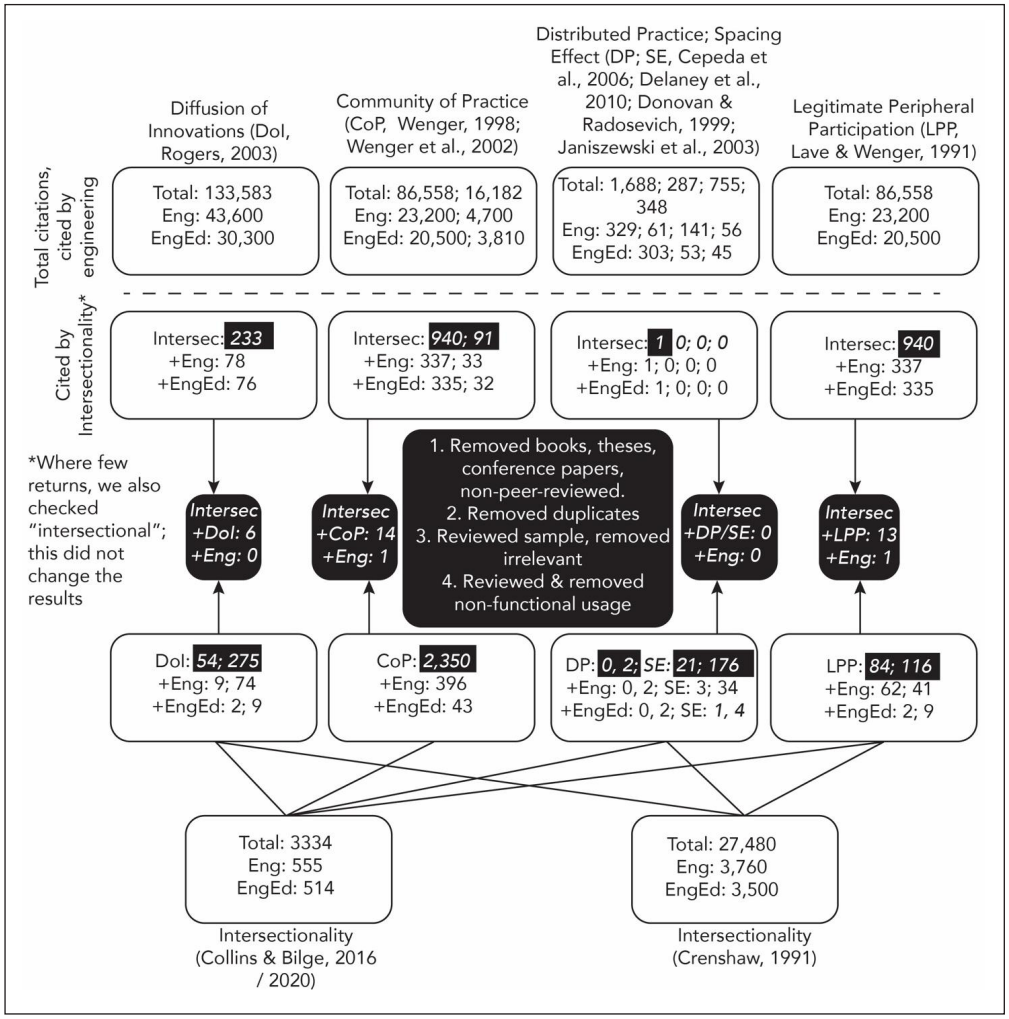

Figure 1 Overview of Searches and Search Results.

(Wenger, 1998; Wenger et al., 2002); distributed practice/the spacing effect (Cepeda et al., 2006; Delaney et al., 2010; Donovan & Radosevich, 1999; Janiszewski et al., 2003); and LPP (Lave & Wenger, 1991). Using Google Scholar, we searched the articles citing these papers for the term intersectionality. We then added "engineering" and "engineering education" as search terms.

Next, we used Google Scholar to identify papers citing Collins and Bilge (2020). We searched these papers for terms related to the other theories, each as a separate search: diffusion of innovations; community of practice, communities of practice, "distributed practice," spacing effect, and legitimate peripheral participation. Only for distributed practice did we need to include quotation marks, after reviewing initial results and finding no relevant papers in the first 100 citations. When our search turned up fewer than 100 results, we conducted the same approach using the original formulation of intersectionality (Crenshaw, 1989). We then also added "engineering" and "engineering education" as search terms.

We reviewed all the results across these searches. We excluded results that were not published in a peer-reviewed venue (e.g., non-peer reviewed conference papers), that were restricted to commentary (e.g., introduction to a special issue, book reviews), or that were not available in English.

LITERATURE ANALYSIS

We downloaded and more carefully reviewed the remaining results, excluding those that did not functionally use both theories. For instance, some papers included the term "intersectional" in an author bio or used terms "community" and "practice," but not in reference to CoP. Several papers equated CoP to any community and did not articulate how the community fit typical CoP definitions. Likewise, some papers mentioned intersectionality to indicate that participants were diverse, but did not make any analytic use of intersectionality, such as considering how these diverse individuals were "positioned within mutually constitutive sociohistorical systems and structures of inequality" (Harris & Patton, 2019, p. 363). We omitted 13 papers that cited Lave and Wenger (1991) or LPP, but that did not make functional use of these ideas. Specifically, this included papers that named LPP or CoP in a list of relevant theories, but did not investigate learning/change, or did so using other theories. Also omitted were studies that used LPP to describe participants/setting as comprising experts and novices or that offered implications for such settings, but did not frame the paper or interpret data using LPP. Notably, these papers also used intersectionality exclusively at the interpersonal, individual level.

For the remaining results, we analyzed the papers (6 DoI, 14 CoP, 13 LPP, one of which also reported on change) through repeated readings, using a grounded approach to characterize whether it was used to frame the study purpose and whether it was used analytically. For intersectionality, we additionally sought evidence for its use at the individual/interpersonal level, or referencing culture, structure, policy, power, and norms, by searching for these terms. We then grouped the papers with similar approaches to consider how these theories have previously functioned in tandem.

REFLEXIVITY STATEMENT

We, the authors of this paper, met each other and began collaborating through engagement on RED teams. Our collaboration began as we were involved in change projects with varying DEIJ goals, including asset orientation and a focus on diversity at University of New Mexico, fostering a more inclusive culture for those marginalized in engineering at Oregon State University, and focusing on faculty as a way to foster a more inclusive culture at Arizona State University. We found common concerns in the progress teams were making towards revolutionary change. In exploring these issues, we also recognized ways leadership teams were not inclusive and embodying DEIJ goals themselves. We did not initially consider intersectional power as an important framework for our institutional change efforts. Through our cross-site work, and especially by seeking out more knowledgeable mentors, we came to recognize how important power and privilege are in understanding the progress of each change team. In our shared EAGER project, we framed our

work around intersectional power explicitly. With this shift in our focus, we learned about power and intersectional power together and through facilitating community workshops (Davis, Kellam, et al., 2021; Kellam, Svihla, & Davis, 2020; Kellam et al., 2021; Kellam, Svihla, Pawley, et al., 2020).

We are white women at different career stages, which provides us with some perspective on power dynamics within such teams, but this perspective is limited because, as white people, we have benefitted from white supremacy (Hamad, 2020). In recognizing this limitation, we intentionally foregrounded literature by Black scholars as we developed the theoretical argument presented in this paper (e.g., endarkened feminist epistemology (Dillard, 2000) and intersectionality (Collins & Bilge, 2020; Crenshaw, 1989, 1991). We recognize that what seemed novel to us (the idea that we need to consider power and privilege in institutional change efforts) may be unsurprising to our Black, Indigenous, and Latine/x colleagues who have experienced ways in which racism is laced throughout engineering and higher education systems. Individually and collectively, we have reflexively worked to understand how racism is embedded in engineering and higher education systems and ways that we can move towards an epistemology and research practice that is anti-racist in nature. We do have much more to learn, but are committed to continuing to learn, especially through the stories, experiences, and research of our colleagues and students.

RESULTS: DEVELOPMENT OF THE TRIPLE CHANGE FRAMEWORK

In the following section, we detail the selected theory of intersectional power. We then describe each theory of change or learning on its own, share ways it has been used with intersectional power or in aid of DEIJ aims and, based on this, consider its potential role in work that deliberately merges these three domains into the TRIPLE Change Framework.

INTERSECTIONAL POWER RELATIONS

In presenting the TRIPLE Change framework, we posit that the theory of intersectional power provides a strong model for how theories of power could be used. Frustratingly, many scholars whose work is entangled with or even fundamentally about power never provide a clear definition of power, instead detailing what it is not, treating it as a philosophy too broad to be defined, or defining only terms that surround it (Dore, 2009; Foucault, 1979; Roscigno, 2011); this definitional avoidance is true even for works naming this issue (Núñez, 2014). We can understand the challenges in defining power by considering how much simple definitions omit; for instance, classical definitions of power as "capacity to influence" or "having control" (Roscigno, 2011; Weber, 1946) suggest a binary relation—controller/controlled—perhaps independent of context, and bring to mind visions of someone adjusting a volume knob or convincing someone to buy something they don't need. Rather than treating power as one group exercising domination over another, we take a more nuanced and complex stance on power, acknowledging that power is distributed across relations (Foucault, 1978). We conceptualize power as a complex, situated, distributed system of influence that, despite its dynamism, tends to sustain inequities (Gore, 2003; Young, 2011).

During the 1960s and 1970s, when social movements were working to address structural inequity for racially minoritized groups, women of color—particularly Black women—began to articulate their own positionalities and experiences within these social movements that otherwise centered men's agendas (Collins & Bilge, 2020). Black women and other women of color introduced statements and publications that complicated understandings of structural inequity by articulating the compounded nature of oppression faced by people with multiple, intersecting oppressed social identities (e.g., Anzaldúa, 1987; Anzaldúa & Moraga, 1981; The Combahee River Collective, 1997). Later, Crenshaw (1989, 1991), a legal scholar, introduced the concept of intersectionality within higher education. An intersectional approach facilitates "social structural analysis of inequality, in particular, the organization and institutional manifestations of power hierarchies and their effects on individuals and groups" (Collins, 2009, p. ix), and is therefore particularly helpful for scholars and practitioners interested in fostering DEIJ-oriented organizational change.

To operationalize how a system can be both dynamic and durable, we rely on a framework of intersectional power that presents a set of four lenses, making power relations explicit, contextualized, and therefore, available to be worked on (Collins & Bilge, 2020): (1) from a structural lens, policies and policy-like practices affect individuals differently based on their social and role identities; (2) from a cultural lens, ideas and culture organize power, often obscuring those with privilege from noticing bias; (3) from a disciplinary lens, people train and coerce each other to behave in certain ways to sustain norms; and (4) from an interpersonal lens, an individual's social (e.g., gender, ethnicity) and role (career, position, voluntary memberships) identities can shape how they experience bias. This set of lenses highlights that power is fundamentally intersectional, meaning that no single category provides enough information to understand how one experiences oppression; rather "people's lives and identities are generally shaped by many factors in diverse and mutually influencing ways" (Collins & Bilge, 2020, p. 226). The complexity of power—meaning, the ways these lenses interconnect—can be brought into consideration through this framework. This approach to power recognizes impacts of systems as jointly deliberate and diffuse/constitutive (Dore, 2009). Indeed, scholars emphasize that intersectionality is a "way of thinking about the problem of sameness and difference and its relation to power" and attends to "categories not as distinct but as always permeated by other categories, fluid and changing, always in the process of creating and being created by dynamics of power" (Cho et al., 2013, p. 795). This characterization of intersectionality suggests a dynamic, situated account of power that emphasizes the interrelationships among multiple systems of oppression (Harris & Patton, 2019).

Intersectionality has been used in three primary ways in scholarship: to account for differences in contexts and outcomes; as a site of debate about its extensibility and comprehensiveness as a theory; and as guidance for change-making efforts (Cho et al., 2013). Intersectionality has been an effective tool for explicating the consequences of inequities, and to a lesser extent, making power relations "visible and available for analysis," an approach that provides a foundation for making change by laying bare the ways in which inequity is institutionalized (Rodriguez et al., 2016, p. 202). Far less progress, however, has been made in advancing DEIJ change using intersectionality (Bonilla-Silva, 2013; Cho et al., 2013). Scholars have accounted for this by noting that much of the work on intersectionality has been focused at the interpersonal level, rather than taking aim at structures (Cho et al., 2013; Harris & Patton, 2019; Núñez, 2014). And indeed, while much attention has been placed at the interpersonal level (Nichols & Stahl, 2019), we argue that intersectionality on its own is ill-equipped to deliver DEIJ changes, though it is instrumental in shaping and evaluating such change. More specifically, theories of power are useful in revealing how power is distributed, laying bare existing inequities, and even in envisioning more just systems. Yet such theories are inadequate on their own in shaping a path from current contexts to more equitable futures. This is because such work also involves learning and change, mechanisms not accounted for as *processes* in theories of power. In this way, we could think of theories of power as a specialized camera, capable of taking pictures of existing and possible power relations and configurations that promote or hinder access to and participation in engineering. But we need other tools to navigate and way find, to ford the rivers and cross the chasms encountered on the journey. For this, we need theories of change and theories of learning that complement theories of intersectional power.

INDIVIDUAL CHANGE THEORY: DIFFUSION OF INNOVATIONS

DoI, a widely used and well-known theory of change in engineering education illustrates potential challenges and opportunities of integrating change theories with intersectional power. DoI (Rogers, 2003), categorizes individuals as "innovators," "early adopters," "early majority," "late majority," and "laggards" based on their willingness to adopt a new idea, practice, or technology. This perspective has been used in engineering education to examine faculty change (Borrego et al., 2010; Finelli & Froyd, 2019; Pimmel et al., 2013) and is the model of change most frequently assumed by funding agencies, national organizations, and major initiatives (Kezar et al., 2015). Originally developed to account for technology adoption, innovators and early adopters are characterized as risk tolerant, high social status, and as having sufficient resources to back their

risk-taking (Rogers, 2003). In the context of pedagogical innovations, scholars have described innovators as risk takers who are open to experimenting with a pedagogical innovation and who use their wealth of teaching experience to inform their experiments (Sinclair & Aho, 2018). These characteristics suggest interpersonal and disciplinary power dynamics are integral in DoI; when an individual instructor makes changes that go against department norms, they may face pushback from students and administrators and this pushback may be more consequential if they are not tenured.

Some researchers have used DoI in tandem with intersectional power to identify or critique inequities. Dewachter et al. (2018) explored how water policy diffused in a rural Ugandan village across intersectional power dynamics at the interpersonal level (i.e., gender and education). They identified separate channels of DoI, noting that women with low educational attainment—the primary water fetchers—were most removed from the policy makers. Similarly, Del Savio et al. (2019) noted the role of structural power in DoI, characterizing ways nations set policies that limit or expand the spread of knowledge, human resources, and technologies across borders, and also the ways these policies sustain inequities. These studies highlight how bringing intersectional power and DoI together can serve critical purposes. While DoI and intersectional power may be a poor match for fostering DEIJ-related organizational change, together these frameworks may be employed to reveal inequities.

Few studies have brought together DoI with intersectional power. Rather than simply suggesting a lack of overlap of disciplines, we perceive a potential incompatibility between the two theories, depending on how they are used. In some cases, DoI is referenced as a means to spread DEIJ approaches, but the volitional nature of this change theory has inequitable access baked-in, making it a questionable strategy, for instance, to promote equitable access to health information and treatments (Hull et al., 2020), to access internet-based health supports (Turnbull et al., 2020), and to spread a social justice stance by relying on influential leaders in the context of education programs like Outward Bound (Warner et al., 2020). These approaches ignore the implications of DoI—specifically, that a strategy of engaging only a few powerful members to spread ideas will be unlikely to result in change beyond the people and programs already interested in making changes. Indeed, this is borne out by critical analysis of an inequitable electronic medical records system, where scholars noted that designers justified their inequitable decisions using DoI, citing, for instance, that the early adopter market was a sufficiently large market, permitting them to ignore other stakeholders and their needs (Goedhart et al., 2021).

Part of the incompatibility of DoI for DEIJ projects is related to how DoI accounts for change at the individual level, rather than across an organization (Borrego & Henderson, 2014). Such individual change models fail to account for the complex and intersecting systems-related factors that can impact an individual's decision to adopt a new pedagogy (Austin, 2011; Fairweather, 2008). Given the concerns that intersectional analysis has attended too exclusively to interpersonal factors, and insufficiently on structural factors, we argue that a systems-focused *organizational* change theory may better elucidate promising sites for action and critical barriers to change (Cho et al., 2013; Núñez, 2014).

ORGANIZATIONAL CHANGE THEORY: COMMUNITY OF PRACTICE

While DoI accounts for how changes move across individuals, an organizational change theory accounts for how the organization as a whole develops or learns new practices and cultures in teleological/top-down approaches, emergent/grassroots approaches, or using a mix of these (Borrego & Henderson, 2014; Kezar, 2001). Given the autonomy faculty possess in higher education, we focus on a primarily grassroots theory: CoP (Wenger, 1998; Wenger & Snyder, 2000). Sometimes inaccurately equated with any community, CoPs are specific forms, in that they involve "mutual engagement"—meaning members negotiate and contend with issues together—to form shared goals and a shared sense of purpose (referred to as "joint enterprise") and develop practices, ideas, norms, and tools ("shared repertoire") responsive to the goals (Wenger, 1998). To understand how CoPs can bring about organizational change, we draw on later conceptualizations of CoP that

clarify how mutual engagement, joint enterprise, and shared repertoires illuminate development and maturation in a CoP (Li et al., 2009; Wenger et al., 2002). Specifically, Wenger et al. (2002) offered guiding principles that illustrate how CoP is a change theory: "1. Design for evolution. 2. Open a dialogue between inside and outside perspectives. 3. Invite different levels of participation. 4. Develop both public and private community spaces. 5. Focus on value. 6. Combine familiarity and excitement. 7. Create a rhythm for the community" (p. 51). Even within CoPs following these principles, some have aims of stewardship rather than innovation or change. Analysis of engagement in such efforts highlights the importance of collective, long-term engagement, as it takes time to form shared values and practices and use these to make complex change happen (Gehrke & Kezar, 2017).

In our review, five papers called for or had implications for bringing together CoP and intersectional power (Adams et al., 2011; Esnard et al., 2017; Miller et al., 2019; Reinholz et al., 2021; Strong et al., 2021). This included a paper about Caribbean academics forming and using a CoP as a support system as they navigated early career challenges, concluding that intersectionality would be a valuable addition to their CoP (Esnard et al., 2017). In a review of STEM higher education change, Reinholz et al. (2021) note that CoP was used in 26 articles, but intersectionality was used in just one, suggesting value in merging these. Strong et al. (2021) framed the field of engineering education research as a CoP and described how intersectional identities of gender and career status impinged on individuals' sense of legitimacy. These papers highlight an interest in bringing these theories together.

Three papers equated CoP to a generic community. For instance, women with differing social and role identities all experienced bias in physics that led them to feel isolated, despite opportunities to "be members of a community of practice" (Avraamidou, 2021, p. 10). Somewhat similarly, CoP is sometimes used to signify a niche carved out of an exclusionary field for a minoritized group to convene, share, and offer support (Isler et al., 2021), such as supporting identity and belonging (Fracchiolla et al., 2020).

Two studies take a primarily interpersonal lens on intersectionality and argue for CoP as itself a need—in some cases linked to DEIJ issues—but not as a *mechanism* for change. Specifically, such papers do not articulate key aspects that differentiate them as CoPs, and while they use the term CoP, some do not cite research on CoPs. For instance, Goodley et al. (2020) use intersectionality to advance ideas of critical disability studies that center experiences of disabled and Black people, and propose a transdisciplinary CoP as means to bridge theory-practice gaps. Similarly, López (2016) proposed that an intersectionality-focused CoP could be a way to address intersectional race-gender and race-class gaps in graduation and attainment, but it did not share specific change strategies that a CoP might use.

Additionally, scholars have considered CoPs as sites for learning about intersectionality. Walsh et al. (2020) treated a sustainability course as a CoP in which students came to recognize the course foci through the lens of intersectionality. Likewise, Wallin-Ruschman et al. (2020) described a course on intersectionality in which they equated the class to a "CoP for critical action" (p. 23); they proposed incorporating another change theory to address their concerns that students would not persist in critical actions after the course concluded. Although these studies mention CoP, they do not cite any studies that use CoP for change-making. In proposing to use another change theory, it seems clear that Wallin-Ruschman et al. (2020) did not recognize CoP as a change theory. They also offered no plan for forming or maintaining such CoPs. These examples demonstrate interest in bringing these theories together, but not in the ways Wenger et al. (2002) imagined.

Few papers report on intentionally forming and cultivating CoPs in ways that contend with intersectional power to achieve DEIJ change. In one example, Haeger et al. (2021) formed a CoP to support faculty to redesign undergraduate courses to include research experiences. This was done to overcome structural, cultural, and disciplinary barriers that excluded minoritized students from other research experiences. In this way, a CoP can serve a functional role in addressing DEIJ goals.

Scholars have also examined power relations *within* CoPs. For instance, Crowley et al. (2018) characterized differences in identity and participation within an artisan Irish cheese making CoP in terms of how various members benefited from the CoP. They noted the importance of intersectional power in understanding the clearly inequitable access to information within the CoP. In this way, an intersectional approach can also expand and improve data collection and analysis efforts that define and track change by broadening methodological strategies to better understand and serve people with multiple marginalized identities.

Collectively, these papers show interest in bringing these theories together, but also highlight two potential misalignments when using CoP with DEIJ aims. First is the typically volitional nature of CoPs, which are formed by those with shared interests and investments (Wenger et al., 2002). As such, DEIJ-focused CoPs may not have the membership needed to bring about structural changes in particular. Indeed, this may be why some of these studies looked internally or focused on the CoP as a countermeasure, treating symptoms of inequities while leaving structures and disciplinary power intact. The second possible misalignment is the potential to retain focus at the interpersonal level, or, to focus almost exclusively on the structures within the CoP (Fracchiolla et al., 2020). Yet, the few examples of CoP that focus primarily, for instance, on changing faculty practice show that attending to structural issues plays a critical role in DEIJ change efforts (Haeger et al., 2021). In order to mitigate the tendency to focus on the interpersonal level when cultivating CoPs, teams should consider intersectional power across the "domain of knowledge, which defines a set of issues; a community of people who care about this domain; and the shared practice that they are developing to be effective in their domain" (Wenger et al., 2002, p. 27).

An intersectional approach can inform organizational change efforts by highlighting the importance of local context and illuminating the complexity of identity characteristics and their interrelationships (Armstrong & Jovanovic, 2015). For instance, if the issue in question is broadening participation and expanding enrollments of engineering students from marginalized communities, there are two sets of people who might be easily engaged: those passionate about DEIJ work and those concerned about enrollments and budgets. Both groups matter because the latter tend to bring structural power and the former are likelier to have expertise about the kinds of shared practices needed. However, such a CoP would likely include faculty members from marginalized communities and administrators, who are more likely to be white and/or men given inequities in retention and promotion in higher education (Terosky et al., 2014), and would therefore have to contend with power dynamics related to rank/position, as well as social identity. Such power dynamics, situated within the larger context of a long history of institutionalized structural and cultural biases and inequities in higher education (Cabrera et al., 2017; Gusa, 2010), would shape whether and how participants of such a CoP could come together to create shared values and co-construct an agenda that meets their goals.

There is also a danger of the CoP promoting exclusivity, or constructing insiders and outsiders within the community. Wenger (1998) distinguishes between *peripherality*, where some degree of non-participation is either a choice or related to being a novice with a trajectory aimed at full participation, and *marginality*, where a participant's engagement is restricted in a way that prevents full participation. Attending to intersectional power relations deepens our understanding of CoP as an approach to organizational change, as well as how the experiences—including of marginalization—of CoP members affect both individuals and the change process.

These examples also clarify the importance of learning and development, including learning about existing inequitable situations, learning to critique structures, cultures, and disciplinary relations that produce and sustain inequities, learning new norms and changing beliefs, and understanding the impacts of these in terms of their capacity to reach more just futures. With this in mind, we argue that theories of learning are also needed to provide a mechanism for this growth.

COGNITIVE THEORIES OF LEARNING

We contend that learning should play a key role in DEIJ change efforts, as faculty, staff, and students may need to develop new practices and norms, including those related to teaching and

assessment, and also to shift beliefs about student potential. We consider the role a particular cognitive learning theory—distributed practice—might play in this process. Distributed practice theory is a cognitive account, in that studies have aimed to identify generalizable and universal features of learning and memory—so universal in fact that even bumblebees do it (Toda et al., 2009). This theory suggests that spacing out study sessions or exposure to ideas over time leads to more durable learning (Cepeda et al., 2006; Dempster, 1989). Our search turned up no papers that made functional use of constructs related to intersectional power and distributed practice. This may be in part because such theories of learning are treated as generalizable, and therefore the scholars who work with such notions may expect little variability by context or across individuals, making DEIJ considerations appear less salient. Indeed, even searches for equity within the literature on distributed practice suggest it is treated as a de facto solution that should be used to achieve equitable outcomes, such as in middle school mathematics classrooms (Woodward & Brown, 2006). This does not mean such a theory could not play a role in DEIJ change efforts, though we raise a concern about why it could be inadequate.

While distributed practice studies have primarily focused on conceptual learning, research suggests that spacing out study sessions can allow learners to inductively build up categorical knowledge (Kornell et al., 2010) as well as practices (Moulton et al., 2006). Thus, we could propose repeatedly exposing engineering faculty to ideas about equitable and inclusive teaching and power dynamics and inequities in engineering departments as a means to build their knowledge inductively about these issues. However, we would also need to counter the repeated exposure to deficit beliefs and the abundant traditional teaching approaches that seem familiar and dependable. Without a compelling counter, the preponderance of experiences accepting inequitable outcomes as beyond one's control would be predicted to sustain deficit beliefs. This is not to say that all cognitive theories of learning are subject to the same issues, but we would argue that they do fail to adequately account for the growth needed when contending with shifting prevailing assumptions, norms, and practices—like shifting from teacher-controlled, content-centered to learner-centered pedagogy—within a *particular* context.

SOCIOCULTURAL THEORIES OF LEARNING

DEIJ change that takes intersectional power seriously needs to account for structures, practices, and norms within a specific context. To address learning needs within such situated, complex environments, we turn to sociocultural learning theory because it shares assumptions about the importance of local context, history, and the identities of participants. We draw heavily on the learning sciences for its treatment of learning as contextual and situated, and its theorization of learning as a process entangled with other developmental processes, such as identity formation and interest development. However, while other fields of education research have long considered power dynamics, those in the learning sciences have taken up equity and power in their work only relatively recently. In some of these efforts, there are clear equity goals (e.g., Jurow & Shea, 2015) and research methods center justice (e.g., Gutiérrez & Jurow, 2016). Recently, Philip and Sengupta (2021) drew attention to the historical and contextual roots of theories of learning, in turn, noting power dynamics endemic to these theories; for instance, behaviorism was a offered as a critique against eugenics, cognitivism as a response to war, and sociocultural theories as a reaction to Western individualism.

Yet, few learning scientists have brought a specific theory of power into their work, an approach that stands to "illuminate dimensions of learning that both embody and help to bring about transformative possibilities by including structural critiques of systems of power as a necessary component within processes of partnering and learning" (Bang & Vossoughi, 2016, p. 175). And while analytic attention has increasingly been paid to power—for instance, considering how embodied movements become resources when "power dynamics threatened to position someone on the outside of meaningful participation" (Vossoughi et al., 2020, p. 201)—few such studies make reference to a theory of power, or they do so in ways that are not comprehensive (e.g., by bringing attention to power in a literature review, but not in data collection methods) (Philip et al., 2018).

To address this, learning scientists proposed building on sociocultural theories of learning like LPP, where the emphasis on situatedness and relationships provides access to considerations of intersectional power because these theories already bring "attention to the conditions in which people's processes of learning unfold, and [consider] how these processes vary by kinds of experience and ways of knowing" (Esmonde & Booker, 2016, p. 163). By bringing insights from critical race theory, queer theory, and decolonization approaches into theory like LPP, critical sociocultural learning theories are an invitation to those who study and design learning for justice (Esmonde & Booker, 2016). As a highly influential account of learning, LPP (Lave & Wenger, 1991) articulates learning as a developmental and situated process, whereby newcomers are gradually apprenticed into more central roles, initially mastering simpler yet authentic tasks. Such apprenticeship provides authentic feedback and opportunities for revision, reflection, and growth towards meaningful knowledge and practices. Indeed, it is the situated nature of LPP that suggests a need to contend with intersectional power (Philip & Gupta, 2020).

We found two studies that cited LPP as a means to sustain an existing community, such as building the capacity of volunteers to contribute to archiving (DeVito et al., 2021), or training lab members (Cooper et al., 2019). In such studies, LPP is concisely invoked as a mechanism for organizational maintenance, but not used to explain how learning happens. These papers gave short shrift to intersectionality, either mentioning it in describing diverse participants (Cooper et al., 2019) or as a future focus (DeVito et al., 2021).

Six papers functionally linked LPP and intersectionality, but not necessarily in ways that detail learning processes or mechanisms. Such papers made functional use of intersectionality at the individual level, sometimes also referencing structures that produced or sustained inequities, but treated LPP as context or as a briefly used lens. For instance, while analytically, Waitoller and Kozleski (2015) primarily used intersectionality at the individual level, they noted structures, such as assessment policy, that created inequities. They invoked LPP to critique the narrowed scope of assessment, referencing the complex and situated classroom activities missed in many school assessment policies. In a study of community organizing to promote anti-racist and intersectional education, LPP was used to describe how individuals transferred experiences from other activities into their organizing, thereby shifting into a more central role while enhancing the community's capacity (Pham & Philip, 2021); in this example, LPP provides insight into a member's role, but not in their learning. A study of disabled girls of color used LPP to situate the learning environment as complex and multifaceted, and used intersectionality to examine which resources these students were denied access to (Miller, 2020). Liccardo (2018) and Liccardo and Bradbury (2017) detailed how inequitable membership in LPP can sustain inequities, specifically, how Black women are prevented from moving from peripheral to central roles in STEM. In one of the few examples set in engineering, Roldan et al. (2018) critiqued LPP as not scalable to address the challenges of broadening participation, especially considering the intersectional barriers women of color face.

Four papers integrated LPP with intersectionality to account for learning and shifts from peripheral to more accomplished roles. For instance, in a multiple case study of Latinx students learning calculus, students evolved in how they positioned themselves in relation to mathematics and how and with whom they worked over time; this highlighted connections between their learning and intersectional experiences, including their increasing capacity to counter deficit narratives (Oppland-Cordell, 2014). Similarly, Esmonde et al. (2009) investigated ways students' intersectional identities shaped their participation and learning in a mathematics classroom. Takeuchi (2021) described learning as a process of shifting from peripheral to central roles, but functionally used agency and intersectional identity to account for learning as a power-laden process. And Rodriguez et al. (2019) brought these theories together similarly to foreground the importance of recognition for Latinas in STEM. In examples such as these where the theories are clearly integrated, the roles of other constructs, like agency and identity, are salient in both theories.

INTEGRATING INTERSECTIONAL POWER, COP, & LPP AND ITS IMPLICATIONS

Through careful integration of power, change, and learning theories in the TRIPLE Change framework our analysis uncovered ways that DEIJ efforts can be enhanced in institutional change

efforts. In this section we discuss the importance of the synthesis of these three types of theories and provide some guidelines for practice.

We found only one study that considered intersectional power, change, and learning in tandem. This merging of frameworks illuminated how community health workers navigated intersecting power dynamics—as women in a patriarchal culture, as professionals working in households, and as comparatively low-skilled workers sharing their findings with doctors (Kumar et al., 2020). These women experienced marginality in various ways, yet their roles strengthened their sense of identity, and they used social media to share knowledge with one another, forming a learning community. This example highlights that by treating the work of those who are marginalized as *learners* in a CoP, rather than as conveyers of information, these theories of learning and change mutually reinforce one another in consequential ways. Although other studies that used LPP also mentioned CoP, most did not do so in reference to organizational change. We consider how an integrated approach might further DEIJ goals, and we share implications.

DISCUSSION

While research on intersectional power has provided abundant evidence that it is a sophisticated and useful tool for characterizing power as dynamic and distributed, and that it is extensible to many contexts, the goal of using it to plan and make DEIJ change largely remains unmet (Bonilla-Silva, 2013; Cho et al., 2013). An explanation for why this is may lie with other research-to-practice chasms. We argue that the remedy comes in the form of merging such theory with theory on learning and change. In particular, as scholars turn attention to structural, cultural, and disciplinary power, intersectionality serves as a critical tool for characterizing institutionalized inequities (Rodriguez et al., 2016, p. 202) as well as for planning DEIJ changes and anticipating potential reproductions of inequities. However, actually carrying out such work relies on the capacity to bridge the theory-practice gap. Research and theory salient to navigating this gap may come from fields like learning sciences and organizational change, as well as from improvement science, team science, leadership studies, and human resource development. One implication for both scholars and academic change teams of this insight is the need for interdisciplinary collaborative teams, as few scholars have expertise across these fields. However, based on our review, such teams cannot simply include members as representatives of these theoretical frames. They must bring their expertise together in ways that are consequential for their work together as a change team that learns and commits to DEIJ aims.

Given the myriad and sometimes subtle ways discrimination impacts participation in higher education (Dowd & Bensimon, 2015) and STEM education in particular (McGee, 2020), and the long history of white norms, practices, and policies guiding institutions of higher education (Cabrera et al., 2017; Gusa, 2010), change efforts aimed at creating more equitable and inclusive experiences and outcomes for those historically marginalized require coordinated, structural transformation at multiple levels (Posselt, 2020). Mono-theoretic approaches, in the context of DEIJ change efforts, may promote oversimplified understandings of the complexity of these efforts. Instead, integrating these theories suggests a need for multi-level, multi-strategy change efforts—as opposed to the commonplace practice in higher education of focusing on single change strategies (Borrego & Henderson, 2014; Henderson et al., 2011). In turn, this suggests an implication for both research and practice: we need to design, implement, and evaluate more ambitious, interdisciplinary change efforts that are informed by theories of learning, change, and intersectional power and incorporate the voices and perspectives of those marginalized within and by the system (the TRIPLE Change Framework; Figure 2). Such coordinated work depends on equity-minded leaders who value and are dedicated to the hard work required to make transformational change (Dowd & Bensimon, 2015).

While we argue that various theories of learning, change, and intersectional power might be productively integrated, we also caution that individualistic accounts of change could reinforce a noted trend in intersectionality work. Specifically, DoI could reinforce the tendency to focus on interpersonal relations at the expense of structural power (Cho et al., 2013; Núñez, 2014).

DOI: 10.21061/see.87

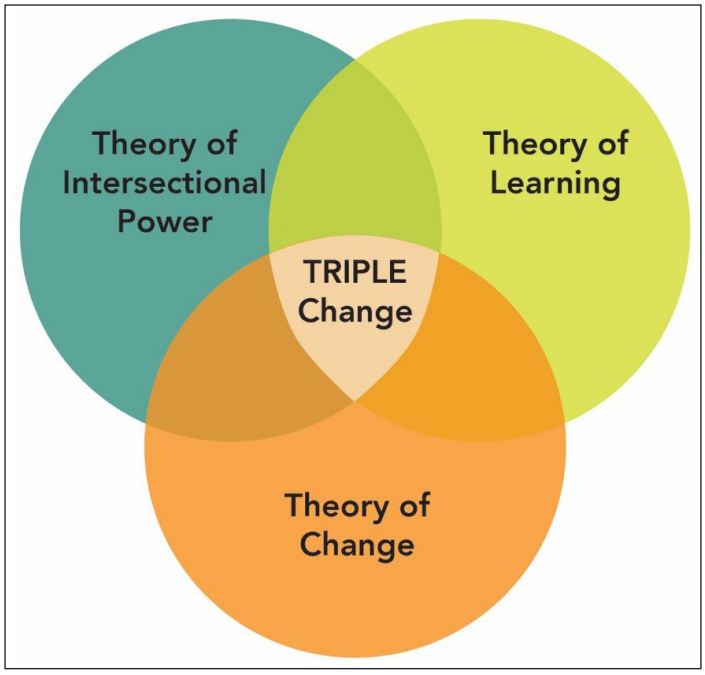

Figure 2 The Theories and Research on Intersectional Power, Learning, and Evolutionary Change (TRIPLE Change) Framework.

Instead, we advocate for layering theories of organizational change that are capable of acting on structures, cultures, and disciplinary norms. While we focused on CoP, other approaches could be used. For example, Dowd and Bensimon (2015) integrated cultural-historical activity theory and critical race theory to develop action research tools to support universities in advancing racial equity in educational outcomes. Similarly, cognitive theories of learning that focus on individual progress—and often in ways that seek to factor out issues of intersectional power by treating learning as a neutral process—are ill-equipped to explain the complexity of learning needs and processes present in engineering change efforts. Even LPP, a sociocultural learning theory, risks reproducing inequities through limiting movement of marginalized members from peripheral to central roles.

Thus, change projects that target equity in engineering education but that do not center power are unlikely to result in more than superficial understanding and change. Integrating critical theories of power into theories of learning and systems-oriented theories of change can facilitate structural and cultural change. Intersectional power provides an analytic framework that deepens our understanding of learning and change and better enables us to enact and empower change that has the potential to improve the learning and lives of students, faculty, and other stakeholders in engineering education.

Although we find hope in the integration of these theories for making DEIJ change, we also offer caution. Engineering faculty tend to have positivist epistemologies (Staller, 2013), which will continue to present challenges to embracing critical theoretical frameworks of power and intersectionality. This epistemological tension may become more apparent as we, as a community, commit to changing engineering education systems to embody DEIJ principles, making structural, disciplinary, and cultural changes in the process (Collins & Bilge, 2020). We therefore advocate not only drawing upon an integrated set of theoretical frameworks, but doing so from a critical stance. We, as a community, may be able to catalyze the shift to critical stances by creating more opportunities for diverse, interdisciplinary collaborations where epistemological diversity is present and contended with, including an endarkened feminist epistemology (Dillard, 2000). Such collaborations can, for instance, provide opportunities to recast a change project that aims to modernize the scope and sequence of content in a program of study as one that aims to create an inclusive environment for students minoritized in engineering. By bringing together theories of organizational change, learning, and intersectional power—supported by adept teams with expertise in these areas—even the superficially neutral scope-and-sequence can be effortfully reworked into provocative territory for DEIJ change.

CONCLUSIONS

In this theory paper, we proposed that DEIJ change work lies at the nexus of intersectional power, organizational change, and learning. Using only one or even two theoretical frameworks to plan, guide, or interpret DEIJ change efforts in engineering education limits our resulting understanding. Our literature review found evidence that scholars have explored intersectional power in tandem with theories of change or theories of learning. We noted an incompatibility between DoI and DEIJ efforts because of the volitional nature of DoI. We found support for using change theories that focus on organizations as systems, such as CoP, yet also caution that CoPs may be used in ways that offer solace to members from marginalized communities but otherwise make no structural or disciplinary changes. Further, CoPs that do not adequately contend with intersectional power run the risk of reproducing inequities. Integrating learning theory can play a critical role by considering what and how members of engineering education change teams can learn about DEIJ issues and their own epistemologies. Our review found no instances of distributed practice, a prominent and well-cited cognitive learning theory, used in tandem with intersectional power, but our review turned up many examples of LPP, a sociocultural learning theory used in this manner. When LPP is used to consider *how* learning occurs in power-laden spaces, other factors, like identity and agency come into focus as tools, and notably, are also salient for change work. Thus, the TRIPLE Change Framework, which integrates perspectives on sociocultural learning, systems change, and intersectional power, can be a means to move beyond descriptive accounts and into action. Achieving this vision in engineering departments will require committed, collaborative effort from scholars across multiple fields.

FUNDING INFORMATION

This material is based upon work supported by the National Science Foundation under multiple grants in EEC 1914578, 1915484, 1913128, and in DUE/EDU 2236374 and 2236163. 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.

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

All authors contributed to conceptualization, analysis, and writing. Svihla created the figures.

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TO CITE THIS ARTICLE:
Svihla, V., Davis, S. C., & Kellam, N. N. (2023). The TRIPLE Change Framework: Merging Theories of Intersectional Power, Learning, and Change to Enable Just, Equitable, Diverse, and Inclusive Engineering Education. *Studies in Engineering Education*, 4(2), 38–63. DOI: https://doi.org/10.21061/see.87

Submitted: 01 November 2021
Accepted: 05 July 2023
Published: 11 September 2023