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Inclusive Excellence in Practice: Integrating Equitable, Consequential Learning and an Inclusive Climate in Higher Education Classrooms and Institutions

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Abstract

In education, initiatives aimed at improving diversity, equity, inclusivity, and justice (DEIJ) are often conceptualized and implemented separately from those addressing students' and faculty's learning — and the reverse is also true. In this theoretical paper with an empirical illustration, we present a holistic framework based on our experience with a comprehensive change initiative. The I^2 Framework posits that DEIJ and learning goals need to be addressed simultaneously and at multiple, intersecting organizational levels. Through a systems approach, I^2 integrates change activity across two dimensions: one representing goals of reform (DEIJ and improved learning) and another representing levels of organizational change (classroom and department/organization). I^2 integrates the work of creating equitable, consequential learning opportunities in the classroom and the work of creating an inclusive climate at the departmental/organizational level, emphasizing their inherent relatedness. We provide an empirical example based on design-based implementation research and related mixed methods analyses of a multi-year change project in an engineering department at a large, public university in the United States. The example highlights a need to shift the nature of this work, how we do this work, and the environment and culture within which we do this work at both the classroom level and the department level. The example also illustrates ways that elements of the change initiative intersected with existing institutional practices, leading some innovations to succeed and others to be resisted. The I^2 Framework provides guidance to practitioners, policymakers, and leaders working towards equitable, consequential learning at the classroom level and an inclusive climate at departmental and institutional levels.

Keywords: higher education; inclusive excellence; equity; learning; organizational change

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1. Introduction

In education, initiatives that address improving diversity, equity, inclusivity, and justice (DEIJ) too often are conceptualized and implemented separately from those addressing improved learning opportunities and experiences (Bauman et al., 2005; Milem et al., 2005; Williams et al., 2005). Likewise, most research on improving learning focuses on changing classroom activity, without sufficient consideration of departmental or organizational contexts, policies, and practices, or faculty members' learning, development, and experiences (Maass et al., 2019). In this paper, we argue that fostering DEIJ and improving learning opportunities are mutually constitutive and synergistic and should be addressed using a systemic, multilevel approach that considers classroom, department, and organizational contexts. DEIJ should be central to research and practice on instructional innovation aimed at students' learning, and students' and faculty's learning, development, and experiences should be central to efforts to improve DEIJ in departmental and institutional cultures.

In support of this argument, we present the I^2 Framework, termed I^2 because it *integrates* organizational change efforts within and across *two* dimensions: one representing *goals of reform* (DEIJ and improved learning) and another representing *levels of organizational change* (classroom and department/organization). I^2 integrates equitable, consequential learning opportunities in the classroom and an inclusive climate at the departmental/organizational level, emphasizing their inherent relatedness. Our systems approach to organizational change accounts for the interconnected social, cultural, and organizational processes that shape reform efforts (Engeström, 2001; Greeno & Engeström, 2014; Holland, 2010), and treats the educational institution as a complex system, seeking to develop a strategy compatible with that system (Henderson et al., 2011). We draw upon Cultural-Historical Activity Theory (CHAT; Engeström, 2001) in considering organizations as *activity systems*, in which different groups of people, structures, rules, norms, and behaviors serve to maintain or change the status quo. Using CHAT and sociocultural views of learning and identity, we illustrate the I^2 framework through an empirical case, describing the design and implementation of our own reform project aimed at improving learning and DEIJ at classroom and departmental levels within a multidisciplinary engineering department in a large, public, research-intensive university in the United States.

There is increased global attention to broadening access and supporting student learning and retention in higher education (Blackie et al., 2016; Direito et al., 2021; Mejia & Martin, 2023; Pineda & Mishra, 2023; Siri et al., 2022), despite variation in how programs and countries across the world conceptualize and prioritize both equity-centered efforts and pedagogical change. The I^2 framework provides a context-sensitive tool for designing, implementing, and evaluating multi-level systems change that addresses both learning and DEIJ goals. In the literature review in the following section, we describe the need for this framework. Next, we provide the framework's theoretical underpinnings and describe the I^2 framework itself. Finally, we operationalize the framework with an empirical illustration from our own change project.

2. Literature review

To contextualize the I^2 framework, this section summarizes prior research, first on students' opportunities to learn and meaningfully engage with disciplinary knowledge and practices in classrooms, and then on departmental and campus climate. Next, we advocate for an integrated, multilevel model to incorporate learning and DEIJ goals by reviewing how inclusive excellence has been addressed in higher education.

There is increasing attention across the globe in diversifying higher education and expanding access and success for students from historically marginalized communities in higher education, though how diversity is conceptualized and supported varies by context (Langholz, 2014; Mejia & Martin,

2023; Pineda & Mishra, 2023). Rationales for increasing diversity include economic advancement, social justice, equity, and internationalization (Pineda & Mishra, 2022). There are also regional variations in the aspects of diversity (e.g., gender, race/ethnicity, cultural diversity, and inclusion) prioritized (Pineda & Mishra, 2022). Even within Europe, there is variation in the ways that ideas about diversity, equity, and inclusion are conceptualized and implemented (Direito et al., 2021; Pineda & Mishra, 2023).

In higher education reform in the United States, Europe, and beyond, research, organizational policies and practices, and funding opportunities often foreground either DEIJ goals *or* student learning goals. Some efforts to improve access, experiences, and outcomes for minoritized and underserved groups have focused on recruitment, institutional climate, and reducing harm through policy change and faculty development (e.g., Bensimon et al., 2019; European Commission/ECEA/Eurydice, 2022; Milem et al., 2005; Rankin & Reason, 2008). Efforts to improve learning outcomes for all students have primarily focused on increasing the use of active learning and associated research-based instructional practices (Christie & de Graff, 2017; Lima et al., 2017; Lombardi et al., 2021; Prince, 2004; Raver & Maydosz, 2010). These goals—advancing DEIJ in higher education and creating more effective learning opportunities for students—are both necessary to improve the experiences of students and faculty in higher education. Moreover, students' classroom learning and the inclusivity of the departmental and institutional climate in which they learn are connected, but often researched separately or with only vague associations.

2.1 Classroom learning

Much research in education, including in STEM, has connected pedagogical practices and instructional innovations with student learning (Christersson et al., 2019; National Research Council, 2012). In general, calls for reform support a shift from teacher-centered to student-centered classroom learning (Barr & Tagg, 1995), commonly conceptualized in terms of active learning pedagogies (Freeman et al., 2014; Lima et al., 2017; Lombardi et al., 2021). Rather than a transmission model of traditional lecture-based instruction, active learning "requires students to do meaningful learning activities and think about what they are doing" (Prince, 2004, p. 223). For example, in the flipped classroom approach, students read the textbook or watch lectures outside of class and work together during class, often on the same homework problems as the corresponding traditional lecture course (Bishop & Verleger, 2013).

When equity issues arise in active learning interventions, some researchers have looked to characterize the quality of instruction without considering how instruction positions students in relation to their social and professional identities. For example, Theobald et al. (2020) relate the intensity of active learning—the percentage of class time students are engaged in active learning—to the performance of minoritized students, showing high intensity approaches lead to more equitable achievement outcomes. However, this work is framed in terms of the achievement gaps minoritized students need to overcome rather than restructuring classroom activities in ways where these students' own experiences and perspectives are assets in doing the work. Similarly, others frame inequitable participation patterns as an issue of individual students' confidence or motivation (Brown et al., 2015; Kurth et al., 2002). Instructors may then aim to change individual behavior through psychological or emotional interventions such as values affirmation interventions (Hulleman et al., 2017; Jordt et al., 2017), while ignoring structural reasons for uneven participation.

In contrast, we advocate for a sociocultural framework to create equitable learning opportunities that account for how the activity socially positions the learners. For example, in cases where problems have single correct answers, groups often coalesce around a high-status student whom the others rely on to direct the work (Cohen & Lotan, 1997; Horn, 2012). High status in small group work is often conferred by membership in the dominant social identity group, facility with the language of instruction, quick responses, and social strategies including ignoring or shutting down attempts by lower-status students to participate (Horn, 2012; Kurth et al., 2002). In contrast, problems structured to allow for

multiple approaches or that have more than one acceptable answer can encourage multiple perspectives and more equitable participation (Nolen et al., 2024), yet this type of work is uncommon in U.S. university-level STEM courses.

2.2 Campus and departmental climate

Oppressive social structures and relations within institutions are produced and reproduced through actions, interactions, practices, and policies at classroom, department, and institutional levels. The ruling relations (Smith, 1999), or everyday norms, assumptions, and social interactions that structure higher education have historically been created by and for White men and create and perpetuate systems of oppression and privilege (Direito et al., 2021; O'Meara et al., 2018; Pawley, 2019). These inform classroom, department, and broader campus climates through norms, attitudes, social interactions, and behaviors (O'Meara et al., 2018; Rankin & Reason, 2008). For example, in a study by Rankin and Reason (2005), students of color experienced racial harassment at higher rates than White students and female students reported higher rates of gender harassment. The negative experiences of students from historically marginalized groups, including harassment, bias, and microaggressions, may be amplified in STEM fields (Rolin, 2008), which have historically centered the experiences of people who identify as White, male, and heterosexual (Direito et al., 2021; Pawley, 2019; Rincón & George-Jackson, 2016; Secules, 2019; Slaton, 2010). In engineering, researchers have described this phenomenon as the "chilly climate" (Hall & Sandler, 1982; Sandler et al., 1996; Walton et al., 2015) or "climate of intimidation" (Palmer et al., 2011). Perceptions of unwelcoming and inequitable campus climates, feelings of isolation, and negative experiences with bias, harassment, and microaggressions have a detrimental impact on the learning experiences, sense of belonging, disciplinary identification, and persistence of students from historically marginalized communities (Beasley & Fischer, 2012; Chang et al., 2014; Hausmann et al., 2007; Hurtado et al., 1998; Marra et al., 2012; Ong et al., 2011, 2018; Pawley, 2019; Rankin & Reason, 2005; Seymour & Hewitt, 1997; Tonso, 2007; Yosso et al., 2009).

Faculty in higher education also experience the effects of non-inclusive campus and department climates and inequitable policies, practices, and norms that perpetuate systems of oppression (Garvey & Rankin, 2018; Harris, 2020; Hart, 2016). Women and faculty of color remain underrepresented, despite attempts to diversify university faculty (Blackburn, 2017; Siri et al., 2022; Turner et al., 2008; U.S. Department of Education, 2018). Women and faculty of color face inequities in hiring, retention, and promotion (Blackburn, 2017; White-Lewis, 2020). While employed, these faculty also report more negative experiences, including marginalization, injustice, scholarly isolation, tokenism, social exclusion, lack of belonging, and epistemic exclusion (Diggs et al., 2009; Minnotte & Pederson, 2021; Settles et al., 2019, 2022; Tippeconnic Fox, 2005; Turner et al., 2008; Zambrana et al., 2017).

Research examining students' views of their institutions' climate (e.g., diversity, equity, discrimination, support, safety) has highlighted important aspects of campus environments that correlate with positive outcomes for diverse students (e.g., Museus, 2014; Museus et al., 2017). However, this approach lacks consideration of how practices, policies, and experiences at the institutional level interact with those at course and department levels. Hurtado and colleagues' (2012, 2013) model for diverse learning environments more explicitly draws attention to the multiple contexts that influence institutions of higher education and student outcomes, linking student educational outcomes with "the mesolevel dynamics of teaching and learning (inclusive of cocurricular environments) within institutions, and also with these larger macrolevel constraints and processes" (Hurtado et al., 2012, p. 49). This work provides an important multicontextual vision of diverse learning environments that highlights "the interaction of systems and reciprocal influences that constrain or lead to an institution's role in producing social transformation or the reproduction of inequality" (Hurtado et al., 2012, p. 103).

Departmental climates are a "microcosm of the larger institution" (Rincon & George-Jackson, 2016, p. 743), and unwelcoming campus climates permeate the departments down to classroom interactions (Hurtado et al., 2012, 2013). Whether it happens within a classroom or departmental

context, when relationships and interactions reflect and reproduce the systems of sexism, racism, classism, heterosexism, ableism, and ageism in the larger society and institutions of higher education, students and faculty experience the climate as unwelcoming and their learning, sense of belonging, and persistence suffer. Therefore, organizational change efforts with learning and DEIJ goals must consider and address the ways that students and faculty experience campus climate at both classroom and department levels, as well as how to design interventions that attend to the multidimensional nature of climate and its effects on students and faculty.

2.3 Inclusive excellence

While there is variation across the globe, both DEIJ and student learning receive international attention, though usually through separate efforts (Beddoes et al., 2018; Blackie et al., 2016; Direito et al., 2021; Walden et al., 2020). Equity and inclusion are core to the European Union's vision for a European Education Area (European Commission/ECEA/Eurydice, 2022) as the European Union works on the "twin challenge of equity and excellence" (European Commission, 2024, p. 5). In addition, gender equality is a European Research Area priority, including consideration of intersections between gender and other aspects of identity, such as ethnicity, disability, and sexual orientation (European Commission, 2021; Palmén et al., 2020). Recently in U.S. higher education there have been attempts to connect DEIJ with student learning, often adopting the language of "inclusive excellence" found in three Association for American Colleges and Universities (AAC&U) reports (Bauman et al., 2005; Milem et al., 2005; Williams et al., 2005). The AAC&U reports highlight structural barriers to student success, including the preponderance of isolated efforts on campus and the disconnect between DEIJ and educational excellence. As Milem and colleagues (2005) state, "education leaders routinely work on diversity initiatives within one committee on campus and work on strengthening the quality of the educational experience within another. This disconnect serves students—and all of education—poorly" (p. vii). Calls to foster inclusive excellence have spanned many fields, including nursing education (Bleich et al., 2015), kinesiology (Mahar et al., 2021), and teacher education (Everett & Grey, 2016). Some have highlighted the need to incorporate ideas about inclusive excellence into faculty development (Bryson et al., 2020; Forde & Carpenter, 2020) and into the classroom (Considne et al., 2017; Salazar et al., 2010).

The AAC&U reports simultaneously address inclusion and excellence; however, they lack specific guidance connecting the classroom and department levels, and thus do not adequately address the ways in which students and faculty experience everyday life within their institutions. Students and faculty who hold a variety of marginalized and nondominant identities do not artificially separate what happens in the classroom, in the department, and at their institution. As a student walks through a day in their academic life, they may go to a class where they are talked over and their ideas are co-opted by others with more dominant social identities, followed by an advising appointment where they learn that two of the classes they need for their major meet at times when they are scheduled to work at their financially-necessary job, followed by an office hour where the professor remarks on how "well spoken" they are in a way that feels racialized, followed by a class where they are the only student from their ethnic community and no examples or texts connect with their lived experiences. These everyday experiences operate within overarching structural, cultural, disciplinary, and interpersonal power dynamics that affect but transcend relational, classroom, departmental, and institutional levels (Collins & Bilge, 2020). Within a student's (or faculty member's) holistic academic experience, not only are their experiences of learning and inclusion interconnected, but these experiences are affected by what is happening at the micro-interaction, classroom, department, and institutional levels.

The AAC&U inclusive excellence framework focuses primarily on the institutional level and is aimed at high-level academic leaders. Of the three initial reports, implications for classroom environments are mentioned only by Milem and colleagues (2005), and only briefly. They argue that "active learning pedagogies provide opportunities for students from different backgrounds to engage with each other around the content of courses—a form of interaction that is restricted in a lecture-based

environment. These interactions have a direct impact on climate by breaking down stereotypes and facilitating more nuanced out-of-class interactions" (p. 25). The authors also mention the importance of increasing faculty compositional diversity and integrating diverse perspectives in the curriculum. While this report offers some guideposts, it lacks a rich description of *how* to integrate learning and inclusion at the classroom level, and doesn't address the contextual connections between the classroom, department, and institution.

The need for an integrated multilevel model can be seen in the trajectory of funding priorities. For example, the *Engaged Student Learning* track of the U.S. National Science Foundation's (NSF) Improving Undergraduate STEM Education (IUSE) initiative (NSF, n.d.a) focuses mainly on the classroom level while another NSF program, ADVANCE: Organizational Change for Gender Equity in STEM Academic Professions (ADVANCE), operates at the institutional level (NSF, n.d.b). Recently, opportunities like the NSF's Revolutionizing Engineering & Computer Science Departments (RED) program (NSF, n.d.c) and the Howard Hughes Medical Institute's Inclusive Excellence programs (HHMI, n.d.a; n.d.b), have left room for connections between classroom and departmental and institutional cultures and practices. However, few grantees have framed their change projects to address the connections between learning and DEIJ in ways that cross the boundaries between classrooms and department cultures. Based on our analysis of their public abstracts, only four of the 24 RED projects explicitly address connections both between learning and DEIJ and also between classroom and departmental levels. The majority foreground some but not all aspects of the I^2 framework. For example, if DEIJ is considered at all, the underlying logic is frequently that making the curriculum more oriented to current technical challenges will attract diverse students. The focus of these programs is often on learning at the classroom level through curriculum change without addressing learning at the department level (e.g., how faculty will learn to make curricular and pedagogical changes in line with the project's goals), and concerns about DEIJ are secondary.

The development of institutional models of assessments (e.g., climate surveys, focus groups) is an important step in assessing the current climate at particular institutions, establishing which inputs are correlated with desired outputs (i.e., student outcomes), and providing a vision for campus environments that support diverse students to thrive. However, such causal models, which suggest linear cause and effect relations, do not suffice when dealing with the complexity inherent in advancing DEIJ and learning goals (Hurtado, 2012, 2013). Instead, we take a socioculturally-grounded systems approach to capture the complexities of learning, identity, and the multidimensional, interconnected contexts within which these develop. Additionally, survey research leaves open the question of *how* institutions and programs within them might make changes that advance the positive outcomes associated with more equitable campus climates (Hurtado et al., 2008). By taking an activity systems approach and using design-based implementation research (DBIR; Penuel et al., 2011; Sabelli & Dede; 2013) to iteratively inform the development, implementation, and evaluation a comprehensive departmental reform using the I^2 Framework, our research project seeks to contribute to the field's understanding of the connectedness of DEIJ and learning, as well as the processes, tools, and practices that advance both DEIJ and learning for students and faculty.

The I^2 Framework provides guidance for programs, institutions, and funding agencies that are trying to take a systemic, holistic approach to advancing inclusive excellence in practice while also addressing the interconnections between DEIJ and learning goals. Next, we describe the sociocultural approach that forms the spine of the I^2 framework.

3. Theoretical framework

Here, we outline the activity systems perspective underlying the I^2 Framework, taking a sociocultural or situative approach to learning and identity (Holland et al., 1998; Tonso, 2007; Turner

& Nolen, 2015; Wenger, 1998). This approach views learning and identity as socially constructed within and across particular contexts. In an engineering classroom, for example, learning processes (interactions with peers and instructors, problem-solving activities, etc.) and outcomes (getting a "correct" answer, high scores on tests, knowing how to approach a difficult problem) position students in particular ways (e.g., as more or less able, as desirable group members, as hard to work with, as someone with good ideas, etc.). At the same time, those social identities can open or close off opportunities to learn, including regulating access to materials, having one's ideas taken seriously or ignored, being trusted to figure things out or told to follow directions.

Much research in higher education considers individuals or groups to be influenced by their contexts (e.g., Cabrera et al., 1999; Espinosa, 2011; Hurtado et al., 1998; Museus et al., 2017). Changing a department or classroom environment to be more inclusive, for example, would be expected to affect student engagement. In a situative view, individuals and their contexts are not seen as separate entities but as cultural-historical activity systems (Engeström, 1987, 2001). Individuals are *part of* their social contexts; learning and identity construction occur within and across those contexts, and the contexts themselves are changed through the activity of the individuals within them through social practice.

In CHAT, individual and group motives and actions mutually influence each other and evolve over time as groups pursue a shared object (Engeström, 2001; Miettinen, 2005). The *object* of activity refers to the "ultimate reason" behind collective activity (Kaptelinin, 2005, p. 5). Individual and collective needs and motives, shaped by the available cultural resources and tools, are negotiated through collective activity (Engeström, 2001; Miettinen, 2005; Stetsenko, 2005). Classroom, departmental, and institutional environments are transformed through changes in the practices of the people in them, including changes in policies, social structures, norms, values, and goals. Multiple voices and perspectives within the activity system lead to "contradictions" or "historically accumulating structural tensions" (Engeström, 2001, p. 137) within the system as it evolves over time (Engeström, 1987, 2001). Joint work to resolve these contradictions towards shared goals has the potential to lead to organizational learning through "collaborative envisioning and a deliberate collective change effort" (Engeström, 2001, p. 137).

A situative approach includes consideration of the ongoing cultural histories of people and organizations, including systems of power and oppression (Collins & Bilge, 2020; Slaton, 2010). For example, engineering has a cultural history of participation and status largely limited to White men, leading to structures, practices, and values that reflect those participants (Pawley, 2019; Riley et al., 2014; Secules, 2019; Slaton, 2010). As participation broadens, shifts in departmental culture are negotiated. Systems of rank and tenure resist change from newcomers, concentrating power in the hands of those (historically, White males) with more seniority. A change in the system, say an institutional policy change to increase diversity through hiring, may only slowly lead to changes in culture. A more diverse group of junior faculty likely brings different histories and values, but must still initially work within the existing structures, producing in ways historically valued by their departments and institutions. Bringing those divergent histories to participation in existing practices may lead to changes in those practices and values for both the newer faculty and their departments, but movement toward departmental change is likely to face resistance from those with power gained through established means. Newer faculty with less power may be positioned in ways that limit their influence on the department. Those pushing for change may be marginalized or even removed. At the same time, newcomers of senior rank (externally hired administrators, for example) may exert more influence because of their status within the larger institutional system.

Similarly, a situative perspective proposes that changes in the classroom require changes on the part of instructors and students who bring their histories with them. Instructors may wish to make their classrooms more just and inclusive, but their instructional practices (e.g., assigning problems with single correct answers or standard approaches), gained through their own participation in traditional classrooms, may work against this goal. If changes are made (e.g., to complex problems encouraging multiple possible approaches), students who have been successful in traditional classrooms may bring inappropriate strategies or re-create status hierarchies that marginalize divergent approaches.

Finally, classrooms are located within departments, part of the same systems of higher education. Departmental norms and policies may support or work against changes to instructional practice. To the extent that innovative instructional practice is more widespread among junior faculty and non-tenure-track instructors, marginalization and conflicting value systems mitigate against investing time and energy in instructional change. Structures that open opportunities for faculty collaboration or provide time and other resources for instructional innovation, on the other hand, can support changes to instruction that lead to a more welcoming climate for students as well as faculty.

4. The I^2 Framework

In this section, we describe how the I^2 Framework integrates equitable, consequential learning in the classroom with the development of an inclusive climate. To do this, we use the situative approach to learning and identity, as well as an understanding of organizations as multi-voiced activity systems described above, to describe our systems-oriented framework for institutions of higher education to meet learning and DEIJ goals through improvement efforts. The I^2 Framework *integrates* learning and equity goals across *two* dimensions: by fostering equitable, consequential learning in the classroom, and by connecting classroom and department/organization levels through the development of an inclusive climate (see Figure 1). Although this framework is general enough to be used across disciplines, given the context of this study, we draw on work in STEM education to illustrate how it works.

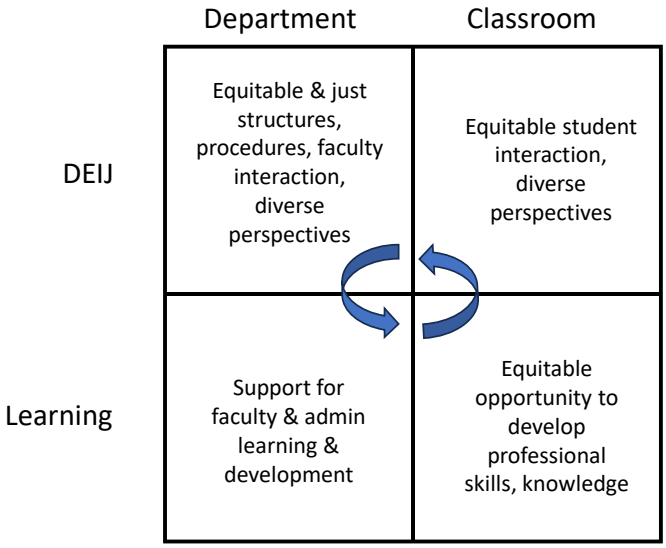

Figure 1: *The I^2 Framework integrates goals of change (DEIJ and learning) and levels of organizational change (department and classroom)*

4.1. Dimension 1: Equitable, consequential work in the classroom

Equitable, consequential work aims to engage students in more authentic disciplinary practices, and through these practices facilitate the development of students' disciplinary identification and ability to work within and contribute to equitable and inclusive professional teams (Collins et al., 1991; Engle, 2012; Engle & Conant, 2002; Hall & Jurow, 2015). Work is "consequential" when it addresses authentic problems. It is "equitable" when it creates meaningful opportunities for all learners to access and engage in valued practices (Hall & Jurow, 2015). With Susan Jurow and colleagues (2016), we argue that consequential work and equitable social practices are mutually constitutive. Shifting from instruction as

usual to equitable, consequential work entails a change in both the nature of the problems and the social practices of students.

For example, problem-based learning (PBL) and model eliciting activities (MEA) are pedagogies that follow the principles of equitable, consequential work and have been adapted by engineering educators. These pedagogies place students in small teams (e.g., 3-5 students) with real-world client or manufacturing-driven problems. To respond, students need to construct and organize knowledge, consider alternatives, engage in analysis, inquiry, and design, and critique their own reasoning and that of others (Barron & Darling-Hammond, 2008). Such pedagogies situate students' learning activities and sense-making at least partially within the world of engineering practice (e.g., solving a relatively messy, open-ended problem with real-world constraints) rather than solely in the context of disconnected classroom practices (e.g., lectures, exams, solving decontextualized equations), thus promoting conceptual understanding rather than procedural learning (Lesh et al., 2000).

In addition to supporting students' disciplinary knowledge and skills, these situated pedagogies resist the ideology of depoliticization, which frames "non-technical" concerns as irrelevant to "real" engineering work, devalues social competencies relative to technical competencies, and frames social structures as just by default (Alpay et al., 2008; Cech, 2014). Learning environments that place students in realistic contexts have increased participation of women and students of color in science and engineering (Arastoopour et al., 2014; Basu & Calabrese Barton, 2007). Such authentic contexts support professional discussion and reflection on the political, social, and ethical dimensions of science and technology, toward a vision of just engineering practice. It is insufficient, however, to merely place students in groups, even when tasks are presented as realistic engineering work. The nature of the tasks, including the extent to which diverse perspectives are framed as essential to the group's success and supported through task design, is critical (Nolen et al., 2024). Equally important, instructional facilitation must align with and support equitable participation.

To develop professionally, students need to not only learn about engineering concepts and calculations, but also to participate in engineering practices and to see themselves as belonging to the engineering community (Gilbuena et al., 2015; Herrenkohl & Mertl, 2010; Stevens et al., 2008). Pedagogies that situate learning in authentic contexts provide opportunities to reason about key subject matter ideas, participate in the discourses of the discipline, and solve authentic problems (Windschitl & Calabrese Barton, 2016). They help students learn knowledge and practices that have meaning and are valued in a professional context, supporting students' integration into a professional community of practice (Lave & Wenger, 1991). Identification with engineering is associated with improved student learning, academic success, and persistence (Rodriguez et al., 2018).

Windschitl and Calabrese Barton (2016) argue for a framework that integrates rigor and equity, wherein "rigor is codetermined by standards of performance particular to a task, the quality of support offered by the teacher, and the intellectual activity engaged in by learners... In broad strokes, equity in classroom instruction means providing opportunities for all students to learn challenging ideas, to participate in the characteristic activities of the discipline, and to be valued as important and fully human members of the science [and engineering] learning community" (p. 1101). This integrated conceptualization of rigor and equity in science communities focuses on teaching practices, but not on the broader socio-historical power structures that lead to and perpetuate inequity. In the next section, we describe how the I^2 framework connects equitable, consequential learning with the creation of an inclusive culture.

4.2. Dimension 2: Connecting classroom and department/organization levels through inclusive climate

We define inclusive climate as an environment that values and advances justice, equity, diversity, inclusion, student learning and development, and departmental/organizational community. Our framework connects the inclusion and learning of students and department members (e.g., faculty

and staff) at two levels: the classroom level and department level. At a classroom level, an inclusive climate brings explicit focus to issues of justice, equity, diversity, and inclusion to curriculum and instruction through equitable, consequential learning. For example, an inclusive climate attends to equitable access to learning opportunities that help all students—particularly those traditionally marginalized in engineering and society—to develop a sense of belonging and disciplinary identification. It does so through the development and implementation of complex, open-ended problems, activities, and assignments that benefit from the collaborative attention of multiple individuals with diverse identities and experiences. In addition, an inclusive classroom climate requires equitable and just interpersonal practices, including supportive relationships with faculty and peers, appropriate facilitation of group work, and an absence of (and appropriate acknowledgement and response to, when present) harassment, bias, and microaggressions. An inclusive classroom climate also attends to just and equitable student outcomes through the development and implementation of equitable grading policies that value and promote consequential learning; explicit valuation of inclusive teamwork skills, distributed expertise, and social and political responsibility; and ensuring that all students (again, especially those from marginalized communities) gain the knowledge, skills, and dispositions valued by the discipline and disciplinary community.

At a department/organization level, an inclusive climate attends to issues of access, experiences, and outcomes by bringing explicit focus to issues of justice, equity, diversity, and inclusion to departmental policies, practices, and norms. For students, this includes access to and ongoing support for equitable, consequential learning opportunities as well as equitable departmental student outcomes (for example, retention, graduation, and graduate employment). Students should leave with the knowledge, skills, and dispositions valued by their discipline or field and that contribute to a just global society. This includes the knowledge and skills to disrupt inequitable and unjust norms and practices within workplaces and the field. Achieving these goals requires equitable practices for entry and continuation in the major or program; additional resources and supports for students from marginalized groups; equitable access to co-curricular opportunities, including internships, labs, and research experiences; and equitable access to the classes needed for the program.

For faculty, an inclusive climate embraces equitable policies and practices, beginning with more equitable access to graduate school, mentoring opportunities, and faculty hiring processes (Liera, 2020; Posselt, 2020; White-Lewis, 2020). An inclusive climate also facilitates equitable, consequential learning opportunities for faculty, including high quality mentoring and professional development opportunities for women and faculty of color (Kachchaf et al., 2015; O'Meara et al., 2017; O'Meara & Terosky, 2010). In an inclusive and just climate, students and faculty experience equitable and just interpersonal interactions and practices with peers, academic leaders, and other stakeholders.

In the following sections, we describe a study that provides an empirical example of the I^2 Framework in action, revealing both the promise and challenge of an approach that integrates learning and DEIJ goals across classroom and department/organizational levels.

5. Context and Methodology

We illustrate the I^2 framework using an empirical example from a multi-year organizational and instructional change project in a multidisciplinary engineering department at a large, research-focused public university in the United States. As co-designers and researchers on this project, we began with the foundational framing that this initiative would be a collaborative partnership among faculty, students, change advocates, administrators, staff, and researchers to improve DEIJ and learning. The empirical example highlights a need to shift the nature of the work of students, faculty, administrators, staff, and researchers; how we (the change community) do the work; and the environment and culture within which we do the work at both the classroom level and the departmental/organizational level. We

(the authors) emphasize how work at the departmental/organizational level is needed to disrupt ingrained social practice as small groups work collaboratively in the classroom. Finally, we discuss implementation challenges and implications for integrating DEIJ and learning opportunities through research and practice.

The twin objects of the project were to create: (1) a culture where everyone in the departmental community feels a sense of being valued and belonging, and (2) a learning environment in which students and faculty meaningfully relate learning activities and experiences to each other and to professional practice (Koretsky et al., 2018). We (the authors) were part of the change team and related change effort. Using a design-based implementation research (DBIR) approach (Penuel et al., 2011; Sabelli & Dede; 2013) and our evolving sociocultural theoretical framework, we pursued these objects simultaneously, collecting and analyzing data that was used to inform the ongoing change efforts (Davis et al., 2023; Koretsky et al., 2018; Lutz et al., 2019; Michor et al., 2019; Nolen et al., 2024). These iterative analyses informed change strategies, which included professional development for faculty, changes to curricula and instructional practices, and changes to the reward structure to support faculty working to advance learning and DEIJ goals. The I^2 Framework was developed through this iterative, collaborative change process.

For purposes of illustration, in this paper we describe the case of one instructional innovation (Studio 2.0) that spanned the department's core classes. The change project built on a previous departmental reform that aimed to promote active learning by shifting core engineering courses to a new studio structure (Koretsky, 2015; Koretsky et al., 2018). Here, large undergraduate lecture courses (100-350 students) were complemented by smaller group "studio" sessions with approximately 24 students where graduate student teaching assistants (GTAs) facilitated undergraduate students' collaborative work on engineering problems (mainly in groups of three). In the original innovation, known as Studio 1.0, students largely worked on sequestered, conceptually oriented worksheet-type problems typical of many reform STEM classrooms (Finkelstein & Pollock, 2005; Koretsky, 2015; Koretsky et al., 2018). The Studio 2.0 reform aimed to engage students in more equitable, consequential work that would help them develop valued professional knowledge, skills, attitudes, and behaviors.

The data that underlie this analysis were collected over five years and include faculty and administrator interviews; a student survey about perceptions of learning; an annual student climate survey; student focus groups; observations at departmental meetings and workshops; classroom observations and video recording; and artifacts from classrooms, the department, and the institution. This was a large project on multiple levels, with iterative data collection and analysis informing the change process throughout the project following our DBIR methodology. We draw on several previously published analyses of particular aspects of the study (e.g., Davis et al., 2023; Koretsky et al., 2018; Nolen et al., 2024), supplemented by more recent analyses of additional faculty interviews and observational and documentary evidence to create a more holistic picture of how this framework both derived from and informed the ongoing departmental reform.

These analyses illuminated the ways in which creating and sustaining change in DEIJ-centered problem-based learning at the classroom level necessitated the development of new pedagogical practices and supports for these changes at the departmental level. In the following sections, we illustrate the I^2 Framework using this empirical example, describing how the Studio 2.0 reform worked to shift, at both the classroom and department level, (1) the nature of the work, (2) the ways in which faculty engaged in the work, and (3) the environment and culture within which the work was accomplished.

6. The I^2 Framework in action: An empirical example

6.1. Change at the classroom level

6.1.1. Shifting the nature of the work

At the classroom level, the Studio 2.0 project aimed to better engage students in disciplinary practice, changing the nature of students' work, as well the practices of instructors. The primary aims of the department's shift to Studio 2.0 were to engage students in more authentic engineering problems better suited to small groups and to facilitate students' development of the practices and identities of social justice-minded engineers able to work within equitable and inclusive teams (Koretsky et al., 2018). Studio 2.0 problems were changed, distinguishing them from Studio 1.0 problems as follows: they were situated in the world of engineering professional practice (i.e., contextualized problems within specific engineering workplaces rather than abstract and decontextualized problems); they were often open-ended, having multiple possible solution paths (rather than instructor-prompted sequential steps to get to "the right answer"), and required more collaboration (e.g., asking students to collaboratively make design recommendations).

We encouraged changes in assessment within studios to make concrete a shift in the object of activity. Assessment shifted from a focus on individual summative assessment (e.g., a worksheet graded for completion and accuracy) to group formative assessment emphasizing learning, collaboration, and progress on the task (e.g., students' collaborative engagement in and progress on substantive, realistic problems). This shift in assessment further supported students' developing disciplinary identities and their understanding of how engineering knowledge and concepts might be usable and used within professional practice. By shifting the object of the activity and nature of related assessments, studio work helped students (and instructors) shift from "school world" to "engineering world" and thus positioned students as developing engineers (Koretsky et al., 2018; Nolen et al., 2024).

Through video analysis of small groups, we have identified two distinct forms of engagement. In "school world" mode, learning activity is seen for its transaction value (to "get the points" or "satisfy the instructor.") In contrast, when engaging in "engineering world" (or, alternately, a "real" world aligned with a different discipline or profession), the object of a team's activity is to apply disciplinary concepts and practices to create, design, analyze, and optimize processes (or other correspondingly disciplinary-valid ways). The premise here is that the ways of thinking and knowing in engineering world better align with the activity students will undertake in professional practice. By eliciting engineering world engagement, the work that we ask students to do will more likely result in adaptable, flexible, and transferable knowledge and skills.

Correspondingly, engagement in school world and engineering world depends on different social arrangements. In school world, groups approach the task as if it is best tackled from a single perspective or a "divide and conquer" approach wherein students divide tasks and therefore have little engagement as a group, reinforcing existing social hierarchies and privileging dominant interaction styles. In engineering world, students appear open to alternate perspectives and strategies, are willing to listen to and question each other in pursuit of an initial approach, and are flexible enough to change tactics when necessary. Group members need to develop and employ the social skills that foster participation by all, including those with social identities that otherwise can be marginalized in engineering school.

Engaging students in disciplinary practice in this way has the potential to fundamentally address issues of broad dissatisfaction with schooling and inequitable participation and opportunity to learn. Because the wide array of engineering practices offers numerous avenues for legitimate engagement of learners, learning environments that engage students in engineering practice can support access by a more diverse set of learners. Through subsequent participation in such activities, learning in engineering and identity development in engineering become linked and inseparable. To become successful engineers, students must learn to engage productively with diverse stakeholders, multiple perspectives,

and others with different funds of knowledge (González et al., 2005). Coursework, such as Studio 2.0 problems, that positions students on inclusive teams as engineers doing consequential work helps students identify equity and social justice as central aspects of engineering itself. This perspective aligns with broader notions of academic rigor discussed above (Windschitl & Calabrese Barton, 2016).

This type of inclusive, collaborative work must be supported by instructional practices within an environment of social caring (Appleby et al., 2021). Thus, changing the nature of the students' work also requires changes to *how we*—all stakeholders in higher education systems, and particularly instructors—*do the work of education*.

6.1.2. Shifting how we do the work

Instructors needed to develop new pedagogical practices, changing the nature of their work to support student learning and new, more equitable forms of engagement (Murtonen et al., 2022). In our project, changing the characteristics of classroom activity to be more equitable and consequential required more from instructors than simply adopting the kind of research-based instructional practices (e.g., active learning; use of complex problems) that receive so much attention in higher education (Freeman et al., 2014; Lombardi et al., 2021), including in the inclusive excellence literature (Milem et al., 2005). Though adopting research-based instructional practices likely requires professional development (Murtonen et al., 2022), creating classroom activities that are more open-ended, contextualized, and situated in "engineering world" (or a different disciplinary "real world") is a more complex endeavor that involves shifts in an instructor's knowledge of how people learn and their identity as an instructor.

For example, complex, discipline-relevant problems require more collaboration among students with differing lived experiences, cultural backgrounds, epistemologies, knowledge, and skills. When Studio 2.0 problems required multiple perspectives, instructors had new responsibilities to disrupt longstanding participation patterns. Students have spent years in traditional "school world" activities that reward having the "smartest," fastest, most high-status students take the lead in group work and discussions. To help students truly benefit from complex problems in the discipline, instructors needed to also help them value multiple perspectives and develop inclusive collaboration skills (Cohen & Lotan, 1997; Horn, 2012; Nolen et al., 2024). Changes in assessment practice were important in highlighting changes in the value framework for classroom activity.

Productive, inclusive teamwork involves equitable participation patterns, group-wide engagement, collaborative thinking and co-construction, and the use and production of shared work objects or representations (Horn, 2012; Windschitl & Calabrese Barton, 2016; Kang et al, 2016). Furthermore, it requires that instructors start to value productive friction, where the dilemmas and discrepancies that a team might face can lead to new ideas. Such "glorious confusion" is the necessary precursor to deeper learning as well as immersion in engineering (or another disciplinary) world (Horn, 2012; Michor et al., 2019). Just as the work becomes more complex and open-ended for students, so it becomes more complex and open-ended for instructors. These shifts in instructional practices required department-level support, as discussed in section 6.2.

6.1.3. Shifting the environment and culture within which we do the work

Changing both the nature of the work and instructors' pedagogical approaches also necessitated changes to classroom and department structures, policies, practices, values, and cultures—particularly given that advancing equity and justice was embedded within these goals and practices. At the classroom level, this shift required a rethinking of what counts as work and how to measure progress (for both instructors and students); a shift in values towards equity, justice, and realistic disciplinary practice; an acknowledgement of the assets and resources diverse students bring to the classroom (González et al., 2005); and respect for the whole individual. Previous research has found that environments where students feel cared for by peers and instructors support learning and the development of disciplinary practices (Appleby et al., 2021). Classrooms needed to become spaces where students felt welcome and that they belonged.

Within our own program, we developed and implemented an annual undergraduate survey to help understand the departmental climate, including attention to classroom learning and learning environments. Peer relations and microaggressions predicted students' identification with engineering. Students' open-ended responses also highlighted the importance of peer relations for their sense of belonging in the classroom and the department (Davis et al., 2023). It follows that creating classroom environments where peers interact inclusively and recognize the assets diverse students bring may increase students' disciplinary identification. Climate survey results were reported to department faculty and integrated into professional development opportunities, an example of change at the department level, discussed next.

6.2. Change at the Department Level

Over the course of the project, our change team initiated a series of department-based supports to facilitate changes at the classroom level in the nature of the work of engineering education, how we do the work, and the environment and culture within which we do the work. While the department and classroom levels are presented separately for clarity, they are mutually supportive and interdependent.

6.2.1. Studio 2.0 classroom supports

Department-level supports were necessary to help faculty successfully create and implement the kinds of complex, contextualized, collaborative problems that shift the nature of the activity and create more equitable participation patterns within classrooms. For example, changing the nature of the work required reorganization of the course and program structure to accommodate Studio 2.0 problems and activities. For each studio course, the program added smaller sections of about 24 students that met in between lectures to facilitate small group collaborative activities. To further support this major reorganization of the program curriculum, members of the change team worked with the registrar and the University Space Committee to secure two dedicated classrooms for Studio 2.0. Classrooms were adjacent to enable instructors to visit two studios within a single class period. Space within classrooms was reconfigured to support small group collaboration (e.g., installing movable tables that could support shared work and be rearranged as needed). Graduate Teaching Assistants (GTAs) supported these studio sections. Further, the department adopted a new Undergraduate Learning Assistant (LA) program modeled after the program from the Colorado Learning Assistant Alliance (Gray et al., 2016). LAs provided additional "near peer" support for students' learning in studios (Koretsky et al., 2018). Importantly, professional development programs were implemented for both GTAs and LAs where they learned pedagogical principles and social practices to support equitable, consequential learning.

6.2.2. A departmental faculty community of practice

The change team established a Studio 2.0 Community of Practice (CoP) to support the development of new pedagogical practices, values, and norms that would allow faculty to implement changes to the nature of classroom activity to facilitate equitable, consequential learning. The CoP was designed to help departmental faculty develop shared values and goals for the studio model. Several studio course instructors met regularly for a term and created a set of Instructional Design Principles for Studio 2.0, informed by the learning and DEIJ goals of the overall change project as well as program objectives. Participating faculty collectively determined the specific instructional principles that should guide curricular and pedagogical decision making and implementation. These design principles, shown in Table 1, were based on three overarching propositions: (1) there are multiple ways to contribute productively to a team, (2) engineering problems have multiple solution paths, and (3) engineers need to make progress despite incomplete knowledge of the problem.

Table 1

Instructional design principles for Studio 2.0 identified by instructors during the CoP

Design Principle	**Example**
Group-Worthy Problems	As much as possible, make problems challenging enough so that multiple perspectives become valued. Include some problems that have multiple solution paths.
Practice First	Learn principles by doing
Cooperative Learning	Facilitate inclusive interactions and 'situated' learning
Looping	Revisiting concepts within a course and between courses in the program
Revisit Context	Weave the same context into studios for multiple courses… [to] further develop previously learned knowledge and skills
Assessment	Emphasis should be placed on the process of making progress and less emphasis on getting the answer
Formatting for Cognitive Load	Align studio delivery so it is as similar as possible between sections
Manageable Change	Take baby steps in transitioning from Studio 1.0 to 2.0

The CoP also created a set of proposed "Components of Disciplinary Knowledge" to inform the design and implementation of program curriculum. The Components emphasized the broader set of competencies needed in professional practice (Treveylen, 2014); for example, they included *open-ended design, computational tools, communication and writing, hands-on experience,* and *inclusive teamwork*. In this way, DEIJ goals were supported by explicitly recognizing the distributed assets and experiences that are needed for engineering work. The department's Curriculum Committee then discussed and iterated upon the proposal. Finally, faculty voted to adopt the Components at a faculty meeting, reifying departmental goals related to learning and DEIJ. Together, the Instructional Design Principles and Components of Disciplinary Knowledge created by the CoP constituted an agreed-upon framework to guide faculty members as they shifted the nature of their course activities.

6.2.3. Professional Development Opportunities

To further support faculty members' ability to design and implement equitable, consequential Studio 2.0 problems, the change team created a week-long Studio 2.0 workshop held the summer following the Studio 2.0 CoP. Faculty learned more about the education research that supported the Instructional Design Principles and Components of Disciplinary Knowledge and had opportunities to (re)design a studio activity for a course they taught in line with this framework. Participants received feedback during this design process from peers in the workshop, as well as a learning scientist and a faculty member from the university's education department specializing in collaborative learning. The workshop emphasized the relationship between problem-based learning and DEIJ through attention to inclusive teaming practices, different forms of collaborative engagement, shifting assessment strategies, and valuing students' diverse funds of knowledge.

Two institutional resources helped department faculty more fully appreciate the connections between equitable, consequential learning and DEIJ. The university annually offered two 60-hour summer workshops about understanding and applying knowledge of systems of oppression to professional practice: the ADVANCE workshop, focusing on equity-minded leadership, and the Difference, Power, and Discrimination (DPD) Academy, which focused on developing more inclusive and equitable curricular and instructional practices. Seventeen faculty members in the department, including several who participated in the Studio 2.0 CoP and summer workshop, went through either the ADVANCE or DPD workshops, in many cases with financial support from the change project.

Three departmental faculty members and a change team researcher (the first author) went through the DPD Academy together with the goal of learning how to support more inclusive and equitable teamwork in their courses and department. They then created, along with two more faculty members and a postdoctoral researcher, an ongoing Inclusive Teaming Professional Learning Community (PLC). Members of the Inclusive Teaming PLC met regularly and designed curricular content, pedagogies, and assessment tools and metrics for inclusive, socially just teaming practices. PLC members tried these new tools and approaches in their own classes, evaluated results individually and as a group, and used their experiences to iteratively improve these tools and practices (Lutz et al., 2019).

6.2.4. Department-level policy changes

To implement these changes to the nature of the work and how the work is done, faculty needed recognition for new forms of work, including time and effort on professional development and course development. Several strategies were developed to shift the departmental environment and culture to support new forms of activity aimed at equitable, consequential learning.

6.2.4.1. Position descriptions

One strategy allowed faculty to modify and tailor their position descriptions to align with their professional activity. The goal was to appropriately reward faculty who engaged in transformative work by revising the reward structure of the department. At the university level, annual review of faculty is based on individualized position descriptions (PDs). Our change team worked with faculty and the department head to allow faculty to customize their PDs to better match their current and desired activities, including involvement in department reform activities as well as other DEIJ-focused work. We worked with administrators to emphasize the value of PDs as a tool to help interested faculty pursue DEIJ and teaching-related interests and be appropriately rewarded for those contributions to the department and the institution. We imagined that the individualized PDs might carry weight during annual reviews and help faculty get appropriate credit for their curricular transformation work, including adapting their courses guided by the Studio 2.0 framework.

6.2.4.2. Alternating leads model

Change team members, in collaboration with the Curriculum Committee, developed a new departmental teaching structure. The Alternating Leads co-teaching model was designed to support faculty members to develop and improve innovative course activities and delivery. In this model, faculty pairs share a course assignment, with one focused on course delivery and the other on curricular development and integration of key skills and approaches that are interwoven throughout the program curriculum as articulated through the Components of Disciplinary Knowledge (e.g., working in teams, writing, using computational tools). This model had several goals: to institutionalize and support continuous curricular and pedagogical innovation; to give faculty time and credit for ongoing course development; and to have the instructors model to students collaborative and inclusive practices through their work with each other. In practice, Alternating Leads also provided a new support structure for more inclusive and meaningful interactions among students and between students and instructors. Individual pairs had the autonomy to determine more specifically how they would share roles and responsibilities for course development and delivery, but both instructors were expected to attend class regularly.

6.2.4.3. Teaching 10s

To have more regular, visible opportunities for faculty members to reflect on, discuss, and learn more about effective curricular and pedagogical practices, the department instituted a "Teaching 10"—ten minutes of teaching-focused time at the start of each faculty meeting. During each Teaching 10, a lead facilitator would focus on a specific topic, discussing education research related to the topic and/or how they approached the topic in their own classes. Discussion among the whole faculty followed. Sometimes a provocative statement was simply provided (e.g., "most exams students take are too long") followed by 10 minutes of discussion.

6.2.5. Providing multiple entry points for stakeholders

Shifts were required in both classroom and departmental environments to generate the kinds of systemic changes that would advance both learning and DEIJ. The suite of activities described above worked together to support new and more equitable forms of collaborative engagement for students and instructors. Importantly, it addressed a significant challenge of systemic change: engaging a majority of stakeholders, who have different interests, expertise, and perspectives (Davis, 2023; Kezar, 2018). This suite of change activities provided multiple entry points for faculty, staff, and administrators, and required that both members of our change team and department leadership embrace the essential linkages between DEIJ and learning. While specific activities within the approach might foreground DEIJ or learning, attending them in an integrated way enhanced the potential to positively impact both goals.

Though there is extra work involved in coordinating multiple efforts, including negotiating among different perspectives, there is also value in creating time and space for people with different perspectives and motives to engage in joint work to determine a shared vision and work towards it (Davis, 2023; Wenger, 1998). In our project, different people engaged in different change activities (e.g., ADVANCE and DPD workshops, the Studio 2.0 COP and summer workshop, Alternating Leads, and the Inclusive Teaming PLC). Though some department members participated in several of these activities, most were actively engaged in only one or two. Activities were designed to be synergistic, such that participation in any activity helped advance learning and DEIJ goals. The multiple entry points provided by this multilayer framework made room for people with different motivations and interests to learn and engage with change efforts.

6.3. Implementation challenges and successes

Creating systemic and sustainable change in higher education is notoriously difficult, and frequently fails (Curry, 1992; Kezar, 2018; Rowley & Sherman, 2001). One challenge of this work in higher education is the need for collaboration among faculty, staff, and administrators to support both individual and organizational learning (Allen, 2004; Banta, 1996; Banta & Palomba, 2015; Davis, 2023; Kezar, 2018; Maki, 2010; Mentkowski & Loacker, 2002). Collaboration and distributed engagement are at odds with longstanding traditions of autonomy and academic freedom and run counter to a reward structure that incentivizes individual achievement over collective growth (Goodlad et al., 1990; Hamilton, 2002; Kezar, 2018; Olivas, 1993). Collective goals (in CHAT terms, objects) such as creating more equitable, consequential learning experiences, environments, and outcomes within an academic program, require the engagement of many, if not all, stakeholders. For example, if only some faculty, staff, and administrators participate in learning and incorporating more inclusive practices, there may be countervailing policies and practices at work in the department that undermine the reform effort. For example, students may still be subject to culturally offensive comments from nonparticipating faculty or feel frustrated or undermined by advising policies that do not take their lived experiences into account, especially if their advisors have not been engaged in the change effort. The net effect of less-than-full participation may well be that students do not experience a more broadly inclusive climate despite a department's significant investment and efforts.

The higher education environment creates many challenges for creating a truly collaborative endeavor that engages most, if not all, stakeholders and also attends to interactions among multiple aspects of the system, such as instructional practices and interactions, curricular development, assessment practices, norms related to engagement within group work, learning opportunities for faculty, and incentives and rewards for faculty to change their practices (Davis, 2023). In CHAT terms, this kind of collaborative work creates a contradiction between the traditional division of labor in higher education (e.g., one instructor in charge of one class; a committee created to make recommendations for admissions criteria, which an administrator then has decision-making authority to implement or not) and what must be collective efforts reflecting common values in order to reach a shared object. This tension between the division of labor and the object proved salient in our own change project; working collectively to create and advance a shared vision was a challenging task. We provide three illustrative examples next.

6.3.1. Alternating Leads

The Alternating Leads model encountered fundamental tensions with the existing division of labor, rules, tools, and values that made this innovation significantly harder to garner support for and sustain than other change efforts. The rules, policies, and norms of the institution reflected those in higher education, notably that promotion and tenure guidelines were designed to support a single-instructor model. The historic practice in this department—following that of the institution—was to assign individual faculty to teach specific courses. Each instructor was given significant leeway about how to teach their assigned course and was evaluated based on students' and peers' perceptions of their effectiveness as sole instructor. Both administrators and students lacked experience evaluating co-instructors, particularly where one instructor served the more visible role, leading class lectures, while the other instructor worked more in the background, developing course content and activities and working with small groups in studio.

Preexisting norms within the department (and the larger institution within which it operated) valued teaching lecture-style classes over facilitating small group work, putting the instructors working on course redesign at a perceived disadvantage. We found in interviews that both faculty and administrators held the belief that the institution valued studio development and implementation less than lecturing. Junior faculty—worried about implications for tenure and promotion—felt pressure to be the "lead" instructor (implementing the lectures). Thus, in several classes using the Alternating Leads model, junior tenure-track faculty led the lecture section and non-tenure-track instructors focused on studio course development and implementation, and the leads did not alternate, reproducing unjust status hierarchies in the institution.

From an administrative perspective, the Alternating Leads model also created perceived challenges with course coverage across the program (another division of labor issue). Ultimately, the Alternating Leads model clashed with too many pre-existing norms, policies, and values at department, college, and university levels, and the administrative support it received was insufficient to allow the model to survive. In our assessment, further changes within the system would have been required for full implementation of the Alternating Leads model: updated teaching evaluation tools, protocols, and values; updated promotion and tenure guidelines that valued the work of studio development and implementation; and other solutions for course coverage. While there is still some co-teaching happening in the department, the implementation of the Alternating Leads model fell short of the scale envisioned.

6.3.2. Learning Assistant program

In contrast, the LA program has been significantly more successful than Alternating Leads at garnering the administrative and policy support necessary to reach its stated goals. Prior to Studio 2.0, the department often used undergraduate students to support instruction, especially for grading. With Studio 2.0, undergraduate LAs shifted from grading support to helping facilitate small group collaborative learning. Though the implementation of the LA program increased costs for undergraduate

instructional support, this program represented a minor shift (from the administrative perspective) and expansion of existing practices rather than a departure from them. Instructors, particularly those least comfortable with the new emphasis on small group problem-based learning, appreciated additional facilitation support. Administrators found additional financial support when needed to support the program. Undergraduate students willingly attended additional training that helped them develop new skills. Unlike the Alternating Leads program, the LA program did not conflict with existing norms, policies, and practices, and thus was taken up more readily by faculty and administrators.

6.3.3. Timescale and funding tensions

Another consideration for complex change projects, especially those working to change culture, is the timescale of implementation. The LA program could be accomplished within a shorter period of time and within the timescale of the grant because it worked within existing structures and norms at both the departmental and institutional levels. Initiatives like Alternating Leads that challenge existing structures, policies, cultures, and norms require a longer timescale for change to take hold, which also means they are more likely to face the additional challenge of leadership turnover. This does not mean that these more transformative projects should not be undertaken, but rather that change teams should design a change trajectory that accounts for the types of interventions they need to meet their goals and for inevitable pushback against any fundamental challenge to the status quo.

Thus, interventions that can be accomplished in shorter periods of time and within existing structures can be a starting point that can help gain traction, build a foundation, and provide interim successes on a longer-term trajectory of institutional and culture change (Reay et al., 2006; Termeer & Dewulf, 2019). This conclusion suggests the need for longer-term grant opportunities from funders, given the significant amount of time it takes for multilevel systemic change that involves transformation of existing structures, policies, practices, and norms, and values. Short of funders providing longer-term support for cultural and institutional change, change teams will need to plan to secure multiple grants sequentially to provide resources for longer-term change goals.

7. Conclusion and Implications

For nearly 20 years in the United States and beyond, increasing attention has been paid to supporting DEIJ in higher education, as well as improving students' learning (Bauman et al., 2005; Blackie et al., 2016; European Commission/ECEA/Eurydice, 2022; Langholz, 2014; Mejia & Martin, 2023; Milem et al., 2005; Pineda & Mishra, 2023; Williams et al., 2005). At the same time, scholars have increasingly emphasized the integration of learning and identity (Agarwal & Sengupta-Irving, 2019; Rahm & Moore, 2016), including in higher education, where students are often learning to become particular kinds of professional people (Davis et al., 2023; Gilbuena et al, 2015; Horn et al., 2008; Turner & Nolen, 2015). In addition to learning concepts and principles, university students are learning particular social practices as part of their emerging professional identities. Understanding the integrated nature of learning and identity provides a way to approach organizational change that can advance both learning and DEIJ goals.

The I^2 Framework presented herein integrates equity and learning goals at classroom and department/institution levels. By integrating efforts to advance learning with efforts to advance DEIJ, I^2 provides a model for a systemic, multilevel approach to inclusive excellence through the development of equitable, consequential learning opportunities and an inclusive climate at classroom and departmental levels. We argue that one cannot think about the environment where learning occurs (whether it be student or faculty/administrator learning) as separate from what is being learned and how (e.g., the learning activities and social relationships within which those activities are carried out).

I^2 prompts us to rethink our conceptions of learning and "student success," moving beyond conversations about persistence and graduation metrics to attend to the interdependent nature of learning and identity. Organizational change guided by I^2 facilitates these interwoven learning and identity-forming processes through changes to the nature of the work of education, how we accomplish the work, and the environment and culture within which we do the work. I^2 accounts for instructors' co-constitutive learning and identity formation processes as well, and how those can be supported at the classroom and departmental/institutional levels.

Without integration, activities aimed at DEIJ goals may fall short on learning goals, and vice versa. For example, we can teach faculty about the ways in which systems of oppression operate and how to become more equitable in their interactions, but if the work students do in their classes is oriented towards a single, canonical answer, students will likely arrange themselves in standard, inequitable ways. In our change initiative, instructors who had taken a 60-hour DEIJ training needed further support, through the Studio 2.0 summer workshop or the inclusive teaming PLC, to understand how designing more complex, open-ended problems for students to work collaboratively could help them pursue DEIJ in practice. When we change the nature of the work so that it is open-ended, complex, and challenging, group members' diverse competencies and funds of knowledge become resources for one another. Thus, opportunities to engage in just social practice in the context of equitable, consequential work position historically marginalized students as engineers, by both peers and faculty, contributing to a sense of belonging and identification with the discipline as well as their learning (Adams, 2001; Davis et al., 2023; Rogelberg & Rumery, 1996).

Such pedagogical shifts towards equitable, consequential learning require attention to departmental (and institutional) policies, practices, and tools. In our own program, this transition required changing the structure of core classes to include smaller-group "studio" sections to support what students learned in lecture each week. Within these studios, students engaged in the kind of situated pedagogies described above, facilitated by GTAs and undergraduate LAs overseen by course instructors. Changing the structure of classes alone was not enough. Faculty, GTAs, and LAs needed support and training to understand and be able to implement situated, cooperative, and inclusive pedagogical practices. Other changes to practices, such as increased co-teaching, also supported such pedagogical shifts, but ran into challenges where they conflicted with more ingrained institutional policies, such as instructor evaluation and tenure and promotion policies, that proved harder to change.

I^2 also addresses the role of intersectional power dynamics (Collins & Bilge, 2020; Svihla et al., 2023). Workplaces reflect and perpetuate systems of oppression in the greater society, producing through organizational policies and practices "inequality regimes" that marginalize and devalue certain stakeholders based on their social identities or professional positionality (Acker, 2006). Organizational change aimed at DEIJ goals therefore requires deliberate attention to the ways in which structural and cultural practices within an organization distribute power and privilege (Acker, 2006; Armstrong & Jovanovic, 2015; Svihla et al., 2022). Equitable, consequential learning requires changes to occur and persist at multiple levels, from the classroom to the department to the institution and beyond—for example, the larger sociopolitical environment, including national and global political forces (Dahlberg et al., 2021; De Clercq et al., 2021). For example, teaching workload models or tenure and promotion policies can lead faculty to feel pressure to spend less time on teaching or not try new pedagogical approaches because of competing expectations. These policies will impact faculty's experiences within their department and their approach to teaching- and research-related workplace practices, impacting students' learning and experiences in the classroom.

Systems-oriented change in primary and secondary schools and in higher education is difficult work and prone to failure (Kezar, 2018; Sarason, 1990). Those attempting to address both DEIJ and learning goals in an integrated way, and through an approach that addresses both classroom and departmental levels, are likely to face challenges that pull them back towards the status quo. Goals, values, policies, and practices originating from a change initiative may meet resistance when they disrupt policies and practices central to an institution's existing practice, as we saw with the attempted implementation of the Alternating Leads co-teaching model. Furthermore, though we did not focus on

the larger sociopolitical environment, forces such as the Black Lives Matter movement and political resistance to critical race theory in education matter in shaping policies and pressures within institutions, departments, and classrooms (Dahlberg et al., 2021; De Clercq et al., 2021).

Though the I^2 Framework was crafted through analysis of a major change effort at only one institution, I^2 provides a model for others to think about how to design such change and how it might play out in their unique context. For example, in the review of RED abstracts discussed above and in a cross-site study of RED programs (Davis et al., 2024; Svihla et al., 2023), most programs foregrounded learning *or* DEIJ, rather than incorporating these goals in a meaningful way at both classroom and departmental levels. Notably, I^2 asks change agents to consider DEIJ and learning as part of the same phenomenon rather than separate, parallel goals. This linkage has implications for change efforts both within and beyond engineering, and also within and beyond higher education. Though primary and secondary school systems have unique cultures and challenges (Sarason, 1990), schools could also benefit from taking a systems-oriented, multilevel approach that holistically integrates learning and DEIJ goals in classrooms and the larger school community. Despite regional variation in conceptualizations and foci of DEIJ and learning efforts, these issues have increasing relevance internationally, suggesting utility of this framework within and beyond the United States (Blackie et al., 2016; Direito et al., 2021; European Commission/ECEA/Eurydice, 2022; Mejia & Martin, 2023; Pineda & Mishra, 2023; Walden et al., 2020). I^2 prompts users to consider the ways in which the nature of the work, how the work is accomplished, and its environment are all connected and should be approached in an integrated way. This multidimensional framework for equitable, consequential learning guides those trying to change education environments to be more just and equitable, and to concurrently further consequential learning for all, by designing and implementing changes to the policies, practices, and values that guide classroom, department, and institutional levels.

Keypoints

- In education, initiatives that address improving diversity, equity, inclusion, and justice (DEIJ) too often are conceptualized and implemented separately from those addressing improved learning. Likewise, research on classroom reform is often pursued without consideration of departmental or organizational contexts, policies, and practices, or teachers'/faculty members' learning, development, and experiences.
- DEIJ and improving learning opportunities are mutually constitutive and synergistic and should be addressed using a systemic, multilevel approach that considers classroom, department, and organizational contexts.
- We present the I^2 Framework, termed I^2 for *integration* within and across *two* dimensions: one representing *goals of reform* (DEIJ and improved learning) and another representing *levels of organizational change* (classroom and department/organization). I^2 integrates equitable, consequential learning opportunities in the classroom and an inclusive climate at the departmental/organizational level, emphasizing their inherent relatedness.
- We illustrate I^2 with an empirical example from a systemic change initiative in a multi-program engineering department at a public university in the United States. The example highlights a need to shift the nature of the work of education, how we (the change community) do that work, and the environment and culture within which we do the work at both the classroom level and the department/organization level.

- Our experience with a systemic change project highlighted the difficulty of change initiatives that challenge existing structures, policies, cultures, and norms at departmental and/or organizational levels. This does not mean that these more transformative projects should not be undertaken, but rather that change teams should design a change trajectory that accounts for the types of interventions they need to meet their goals and for inevitable pushback against any fundamental challenge to the status quo.

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