



Reconstructing PhD Admissions Through Organizational Learning

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Abstract

The goal of this study was to assess the outcomes of a grant-funded intervention designed to provide comprehensive training and support for holistic admissions in 26 STEM PhD programs at five California research universities. This pilot intervention combined a flexible, research-based model of holistic review, training for faculty involved with admissions, and informal coaching in how to critically analyze and redesign their admissions processes. Using a theoretical framework centered on organizational learning as a mechanism of equity-minded change, we assessed evidence of learning in two ways: 1) adoption of admissions practices that align with a new paradigm, and 2) changes in the racial and gender composition of applicants, admits, and enrollees. Drawing on administrative and survey data from participating programs, we find evidence suggestive of positive, sustained changes in both adoption of new admissions practices and racial diversity. This indicates that systemic, scaffolded approaches may promote more equitable processes and outcomes in the graduate and professional education context.

Keywords: graduate education, STEM, equity, admissions, organizational learning

Typical admissions processes in undergraduate, graduate, and professional education have undermined racial/ethnic diversity and perpetuated inequalities (Posselt, 2016; Rosinger et al., 2021), contributing to stratification in the labor market and society. Reforms often focus on making single changes in admissions processes, such as removing or altering standardized testing requirements. Research to date offers mixed evidence regarding the effectiveness of this single policy change, which is often enacted with varying motivations of increased diversity and selectivity (Belasco et al., 2015; Bennett, 2022; Rosinger et al., 2022).

Growing evidence suggests larger, systemic changes to admissions practice are needed to promote equitable outcomes. At the undergraduate level, examining applicants' achievements in their school and community context can increase access (Bastedo et al., 2022; Bastedo et al., 2018; Mabel et al., 2022). However, holistic admissions differs substantially between undergraduate and graduate programs (Bastedo et al., 2018; Posselt et al., 2023), and relatively little is known about holistic admissions and its outcomes in graduate and professional education. While single policy levers are often used in organizations and quantitative research, systemic changes to organizational practices may be more effectual when equitable processes and student diversity are goals (Posselt et al., 2020; Young, Tollefson, & Caballero, 2023, Young, Verboncoeur et al., 2023).

In the wake of the US Supreme Court's 2023 decisions on race-conscious admissions, universities must receive and act on guidance about what actions are legal to foster diversity. This paper reports the outcomes of a grant-funded pilot intervention designed to facilitate learning, change, and diversity in admissions and recruiting practices in 26 STEM PhD programs at 5 California universities. These universities were subject to California Proposition 209, which banned race-conscious admissions in the 1990s. Therefore, the model refined here may be of interest in other states.

The California Consortium for Inclusive Doctoral Education¹ (hereafter, C-CIDE or the consortium) combined a research-based model of holistic review, training for faculty involved with admissions, and informal coaching in critically analyzing and redesigning admissions processes. The effort was purposefully not conducted on a random sample of people or organizations. Rather, given evidence that many faculty resist change (Dana et al., 2021; Tagg, 2012), particularly related to diversity and equity (Bensimon & Malcolm, 2023; Thomas, 2007), the consortium identified and organized change-ready faculty, programs, and graduate school administrators for involvement. A centerpiece of participation was attending and acting upon workshops that used research and data to challenge dominant assumptions and practices in graduate admissions, engaged admissions committees in developing and implementing more equitable approaches, and provided tools for carrying out equity-minded holistic review. This paper reports an external evaluation examining changes in racial and gender diversity and program practices associated with consortium involvement, answering the following questions:

1. To what extent do comprehensive training and support oriented toward holistic admissions relate to the racial and gender composition of applicants, admits, and enrollees?
2. What changes in recruiting and admissions practices occur in association with comprehensive training and support oriented toward holistic admissions?
3. To what extent do participants attribute changes in recruiting and admissions practices to the COVID-19 pandemic, the movement for Black lives and related events of 2020-21, and participation in the consortium?
4. To what extent do participants expect changes in recruiting and admissions practices to be sustained in the coming years?

¹ Now called the Equity in Graduate Education Consortium.

We draw on survey and administrative data from consortium programs to offer some of the earliest quantitative evidence in the graduate education context about the possible outcomes of holistic admissions and the process of changing admissions.

Literature Review

Holistic Admissions in the Undergraduate Context

Prior research on holistic admissions has mostly focused on selective undergraduate education. While the term “holistic admissions” is relatively new, the practice of applicants submitting materials (academic and non-academic) and colleges reviewing these materials is longstanding (see Bastedo et al. (2018)). Its origins lie in an anti-semitic practice employed by selective private universities to privilege the admission of white, Protestant men who exhibited desired “character” and “leadership” traits (Karabel, 2005). Intervening decades, however, saw an embrace of comprehensive review as one way to promote access among talented students from disadvantaged backgrounds (Bastedo et al., 2018). In California, comprehensive review helped limit diversity losses after Proposition 209 (Marin & Yun, 2011).

In holistic admissions, colleges consider academic and non-academic factors, often contextualizing achievements within family and school environments (Hossler et al., 2019). Bastedo et al. (2018) identified three forms of holistic review in undergraduate education: whole file (reviewing academic and non-academic components); whole person (reviewing the whole file while assessing “fit” at a particular campus); and whole context (placing accomplishments in applicants’ home, community, and school context).

Admissions practices that seek to contextualize accomplishments relate to an increased likelihood of admission among disadvantaged and low-income students in hypothetical and real admissions decisions (Bastedo et al., 2022; Bastedo et al., 2018; Mabel et al., 2022). Moreover, contextualized measures of high school performance are more predictive of first-year GPA, retention, and graduation than test scores and non-contextualized metrics (Bastedo et al., 2023). However, most

selective institutions do not practice whole context review (Bastedo et al., 2018); neglecting context or ascribed characteristics of applicants, such as race and class, can reproduce inequity (Rosinger et al., 2021; Taylor et al., 2024).

Admissions in Graduate and Professional Education Contexts

But what do we know about graduate admissions processes? Many studies examine the GRE's role and validity in graduate admissions. Programs often use the GRE to segregate the applicant pool into those that merit additional consideration versus those that do not (Posselt, 2016). As with undergraduate admissions exams (College Board, 2023), racially minoritized students and women receive lower scores, on average, on the GRE and other exams used in graduate and professional school admissions (Dalessandro et al., 2015; Miller & Stassun, 2014). Using GRE scores to sort or screen applicants, therefore, perpetuates racial and gender inequities (Miller & Stassun, 2014; Posselt, 2016). At the same time, although GRE scores correlate with first-year grades in graduate school, most studies find they have limited ability to predict longer-term outcomes (Miller et al., 2019; Morrison & Morrison, 1995). A meta-analysis (Feldon et al., 2023) concluded the GRE's validity has declined as the population of test-takers diversifies.

As graduate programs grapple with equity concerns along with limitations in the GRE's predictive validity, a growing number of programs have eliminated it (Langin, 2019, 2022). This trend mirrors a similar movement in undergraduate education to de-emphasize standardized tests, which accelerated during the pandemic (Rosinger, 2020). Professional associations have issued statements urging caution over how programs interpret and use test scores in admissions, or discouraging their use (American Physical Society, 2021; American Sociological Association, 2021; Urry, 2015).

Test-optional graduate admissions coincides with growing interest in holistic review (Langin, 2022). However, research on holistic admissions in this context is nascent. With rare exception, we know little about the specific practices faculty apply when they say they are doing holistic review (Posselt et

al., 2023), little about their *outcomes* (such as the racial and gender composition of applicants, admits, and enrollees), and nothing about how training and support oriented toward holistic admissions influences practices or outcomes.

Single Policy Changes vs. Systemic Changes in Graduate Admissions

Prior work examining the impacts of single policy changes, such as test-optional policies, often find limited effects in promoting more equitable outcomes (e.g., Belasco et al., 2015; Bennett, 2022). In legal education, for example, allowing applicants to submit the LSAT or GRE did not increase racial diversity at adopting law schools (Rosinger et al., 2022). Authors of the study examined motivations for law schools enacting GRE-accepting policies, finding mixed motives that included expanding diversity and increasing applications. Changes compelled by mixed motivations can produce mixed results.

In contrast, research focusing on a multi-faceted, equity-minded, and/or systemic approach to holistic review in graduate and professional school admissions has yielded promising results. Some work documents the extent to which programs use holistic admissions and perceptions of outcomes. Sixty percent of speech-language pathology programs, for example, report using holistic review or elements thereof, with most reporting positive impacts (Guiberson & Vigil, 2021). However, it is unclear the extent to which holistic admissions changed practices or whether programs simply changed one or two requirements to create a more holistic process.

Other research offers evidence regarding specific changes programs have made in admissions to create a more holistic review. A study of one institution's biomedical sciences graduate programs found moving to holistic review conducted by a committee (rather than mechanically screening applicants using GRE scores and GPAs) increased the diversity of applicants who were considered for admission, even when test scores were considered (Wilson et al., 2019). In another example, a physics PhD program implemented rubric-based holistic review using predefined criteria to assess applicants. After implementing the rubric, researchers found that differences in rubric scores by gender reflected known

differences (e.g., in GRE scores) rather than new biases (Young et al., 2022). The new process was associated with an increase in the racial and gender diversity of admits (Young, Tollefson, & Caballero, 2023; Young, Verboncoeur, et al., 2023). The researchers found careful attention to rubric implementation was critical in achieving more equitable outcomes.

Additional research in graduate and professional education supports the notion that systemic changes, often involving changes to recruitment and mentoring in combination with admissions practices, are required to create sustained changes. A comparative case study of STEM PhD programs with high levels of student diversity found sustained changes resulted from altering recruitment and admissions practices, improving student mentoring and program climate, and re-evaluating mission and cultural norms (Posselt et al., 2020). Thus, there is reason to believe comprehensive training and support that scaffolds organizations in reflection, discussion, and evolution of admissions practices toward holistic approaches could lead to sustained increases in diversity.

Conceptual Framework

Organizational learning theory centers on “the study of whether, how, and under what conditions organizations can be said to learn” (Kezar, 2005, p. 10). Most scholarship assumes learning creates a path to improvement (Fiol & Lyles, 1985), although critically oriented works recognize organizational power dynamics may supersede the impact of learning (Bensimon, 2005). To frame the current research, we outline mechanisms of organizational learning and their relevance to changing graduate admissions, how learning is recognized, and approaches to organizational learning that are suited to institutional change.

What Does Organizational Learning Entail?

Acquiring and acting on new knowledge are the heart of organizational learning (Fiol & Lyles, 1985). Huber (1991) asserted knowledge acquisition, information distribution, information interpretation, and organizational memory as specific mechanisms that constitute organizational

learning. Others have proposed knowledge creation (Nonaka, 2009), knowledge management, and knowledge sharing (Connelly et al., 2012) as additional salient mechanisms. Given the standard of practice for graduate admissions described in the literature review, we propose that observed changes in program-level admissions practices and student compositional diversity are likely to follow from cycles of knowledge acquisition, distribution, interpretation, and legitimation. Among these, Sturdy et al. (2009) underscored knowledge legitimation's importance in contexts where knowledge is politicized, such as admissions. Without attention to legitimation, learning is unlikely to be organizational, i.e., unlikely to diffuse, translate into new practice, or yield measurable changes (Sturdy et al., 2009). Table 1 summarizes how these mechanisms are relevant in organizational learning about holistic review.

[Table 1 Here]

A qualitative study of the holistic review implementation that resulted from the consortium sheds light on how organizational learning leads to STEM doctoral admissions changes (Posselt et al., 2023). Movement toward holistic review started with admissions leaders collectively engaging with data and research during faculty-to-faculty professional development workshops. It continued with leaders presenting research on how typical admissions processes create barriers to diversity, equity, and inclusion (knowledge acquisition), creating space for reflection and analysis of current processes (knowledge interpretation), and introducing equity-minded holistic review as an alternative to typical approaches (knowledge acquisition). Research participants described a dialogic process in which learning was communicated throughout the organization (knowledge distribution), enabling continued reflection and discussion. Typical for institutional change, it took time and internal debate for holistic review to be collectively viewed as a viable alternative to the status quo (knowledge interpretation and knowledge legitimation) (Posselt et al., 2023). Common holistic practices adopted were: GRE-optional or GRE-free requirements, evaluation rubrics, and contextualized review (Posselt et al., 2023). Participants described rubrics as developmental tools through which they could apply what they learned (knowledge

creation) and political tools that represented colleagues' varied interests through stated criteria and related operationalizations (knowledge legitimation). Even after exploring evidence with careful reasoning and designing a locally resonant process, participants noted additional efforts—sometimes years-long—might be needed to legitimate the new approach (Posselt et al., 2023). Knowledge legitimation involved a secondary cycle of learning consisting of collecting, interpreting, and translating data about the effectiveness of new practices.

Across the mechanisms of organizational learning, theorists debate when learning has occurred. A classic standard is enhanced organizational effectiveness (Argyris & Schon, 1978; Fiol & Lyles, 1985). Huber (1991) took a broad view, arguing learning has occurred when an organization has changed “the range of its *potential* behaviors” (p. 89). From this perspective, exploring new horizons of possibility defines learning, not the enactment of new practice (since enactment may be contingent upon factors unrelated to learning). Recently, Basten and Haamann (2018) argued that learning has occurred with the uptake of practices that align with a different paradigm. For the current research, we measure learning to have occurred via two outcomes: changes in admissions practices (i.e., uptake) and changes in composition (i.e., effectiveness).

Organizational Learning for Institutional Change

Some conditions are more conducive than others to organizational learning that leads to changes in norms and standard practices (i.e., institutional change). For example, theory and research suggest learning in community and learning by engaging with underlying beliefs, assumptions, and goals are promising approaches for sustainable institutional change. Kezar et al. (2017) advocate designing **learning communities** in STEM disciplines to maximize impact and engagement. They write:

Given the size and scale of higher education, changing individual faculty members or even isolated departments will have minimal impact.... networks [should] systematically engage large numbers of faculty on an on-going and sustained basis, which is more likely to lead to change....

Among the top factors is professional development that involves communities of practice that “provide opportunities for faculty members to interact with others as they explore new assumptions and try out new approaches to teaching...in an environment that simultaneously provides challenge and support” (Fairweather, 2009; cited in Kezar et al., 2017, p. 218).

Several design factors are noteworthy, including creating networks to support change at scale and sustain engagement, specifically via communities of practice dedicated to professional development. Within these communities, interactions should be sufficiently safe to “explore new assumptions and try out new approaches” in “an environment that simultaneously provides challenge and support” (p. 218). Although the emphasis is on *individuals* learning in community, theory also offers reasons to expect organizational learning will be more effective when *organizations* learn and change in community with one another. Recent formulations of self-determination theory, for example, recognize connectedness to others—at the individual and organizational levels—as pillars of motivation for change (Deci et al., 2017). Theories of institutional isomorphism recognize that sector-level changes are more likely when organizations are aware of and responsive to one another (Posselt et al., 2023; DiMaggio & Powell, 1983).

Double-loop organizational learning is a related framework that asserts sustainable institutional change requires questioning and changing specific actions and policies alongside goals, values, and strategies that motivate a perceived scope of possible actions (Argyris, 1977). The chances that change “sticks” requires a modicum of consensus about how and why an organization does what it does. Second-order change of this sort leverages knowledge interpretation and legitimation processes. Though this change takes longer to realize than mandates, it is deeper (Kezar & Bernstein-Sierra, 2019).

In short, organizations need to change both how they think and what they do. Knowledge acquisition, distribution, interpretation, and legitimation under double-loop learning involve changing specific practices as well as cognitive frames. Bensimon (2005) writes:

Organizational learning theory can help us understand the nature of cognitive frames and the ways in which some reveal patterns of unequal outcomes, while others hide them. If patterns of inequality are invisible, they will not be discussed, and if institutional participants do not have a reason or opportunity to talk about unequal outcomes, the problem will not be addressed directly (p. 100).

From this perspective, organizational learning directed toward institutional change starts with making inequalities explicit and discussing what drives them. High quality, research-based professional development may be one way to initiate such discussion and change. Research shows high-quality training can positively impact faculty beliefs about the origins of inequities and strategies for remediating them. In a study of a faculty hiring intervention on which the consortium was modeled, Sekaquaptewa et al. (2019) found “an evidence-based recruitment workshop can lead faculty to adopt more favorable attitudes toward strategies that promote gender diversity in hiring.” Thus, it is reasonable to assume organizational learning can occur via the scaffolding provided by the intervention analyzed here.

Research Context

C-CIDE began as a network of faculty and administrators in six universities that came together to improve how PhD programs in California admit and educate science and engineering students. The consortium created innovative systems for faculty-to-faculty professional development through which partners were able to evaluate the efficacy and equity of their inherited practices for recruiting, admitting, and mentoring graduate students, and then initiate improvements and changes. As a multi-institution project inspired by the Networked Improvement Community (NIC) framework’s attention to “common challenges, local solutions” (Bryk, 2015), C-CIDE enabled faculty and staff to connect across campuses to accelerate the adoption of research-informed practices and implement them locally. The learning intervention consisted not only of providing workshops. It also involved the provision of

support for institutional change over two years that followed, including dialogues on common challenges and relevant social science, resources, and tools that facilitate change and equitable admissions, and the opportunity to be part of a larger effort moving in a common direction.

Participating Institutions

C-CIDE's initial partners were the University of Southern California and five University of California campuses: Berkeley, Davis, Irvine, Santa Barbara, and San Diego. Each campus had 3-8 participating PhD programs, with approximately one-third each from the biological sciences, math and physical sciences, and engineering. Table 2 provides a list of participating programs at each university. Due to leadership transitions that limited capacity, one institution is excluded from analysis.

[Table 2 Here]

Rather than selecting and treating a random sample of people and organizations, we identified change-ready PhD programs open to training, having their processes and outcomes studied, and participating in the learning community for three years.² We operationalized change-readiness as recognizing responsibility for inequities or need to increase diversity, having some record of diversity, equity, and inclusion-related changes underway, and willingness to review and potentially change practices.

Comprehensive Training and Support

We describe the training and support as comprehensive because the consortium provided support over the next two years for implementing changes after intensive professional development workshops, which enabled recognition of inequities and potential paths to redressing them under a

² At the beginning of the project, each university partner identified two individuals to serve as campus liaisons. Typically Associate Deans or Graduate Diversity Officers, they met monthly as a learning community and coordinated the workshops alongside other institutional change efforts on their campuses. Campus liaisons identified and coordinated a collective of change-ready graduate programs that would become the focus of workshops, coaching, and other resources. In short, cohort-based learning accompanied both campus liaisons' engagement in change leadership and graduate programs' engagement in consortium activities.

framework for more equitable selection. All programs participated in workshops, but they varied considerably in the uptake of resources for continuous support through C-CIDE. We describe both types of support in this section.

Workshops. The project's Principal Investigators (PIs) designed and facilitated a two-part workshop on equity in graduate admissions. Half of C-CIDE programs participated in the first workshop in year one (2017-18) and the second workshop in year two (2018-19); the other half participated in both workshops in year two. The first workshop presented national data on diversity in relevant disciplines; discussed the legal landscape surrounding admissions; reported on research studies about traditional admissions processes; highlighted inequities in traditional admissions approaches; and introduced a framework for equity-minded holistic admissions as an alternative to the traditional approach. The second workshop guided participants through critical reflection about their current admissions practices and what they seek in prospective students; introduced non-cognitive/socio-emotional competencies and how to consider them; and engaged participants in the development of rubrics for admissions.

Holistic Admissions Framework. Developed using theory and research from higher education, sociology of evaluation, organizational science, and industrial-organizational psychology (Posselt, 2020; Miller & Posselt, 2020), the framework for equity-minded holistic admissions encourages the construction of selection systems characterized by four principles, each associated with potential practices. Specifically, selection should be *comprehensive* (considering numerous and diverse criteria that assess the whole person and their potential), *contextualized* (putting metrics and achievements in context of opportunities and barriers, as well as how students align with program context), and *systematic* (using structured protocols and equity checks, thoughtfully selecting and training gatekeepers, and coordinating selection with recruitment and yield efforts), with *equity-mindedness*, as advocated by Dowd and Bensimon (2015), underlying the practices associated with each of the three

principles. Equity-mindedness refers to the mindset exhibited by practitioners who see and take responsibility for inequities in student outcomes, and who redesign standard practices to reduce gaps.

Workshops pointed leaders and committees toward potential areas for reconsidering admissions and recruitment processes and creating change, and it offered examples of specific practices, prompts, and rubrics used elsewhere. Other than broadly recommending committees develop a rubric or other evaluation protocol, however, workshops and facilitators did not advocate specific policies. The example rubrics used in the training, for example, evaluated students along several dimensions of admissibility (e.g., academic preparation; scholarly potential; alignment with program; alignment with diversity values; socio-emotional competencies) with three rating levels that could be operationalized within specific program-level contexts. Operationalizations of quality at each level were written to value diverse contexts where desirable qualities might have been cultivated and to reduce the chances of disparate impact for any racial/ethnic groups. Participants were also encouraged to adapt essay prompts to encourage applicants to address areas assessed by the rubric.

Continuous Support. Having counseled numerous PhD programs in transforming their admissions processes before creating C-CIDE, the PI's anticipated that 1) it could take departments up to a full year to implement changes to policy and practice, due to the layers of dialogue required to confront underlying assumptions and navigate institutional structures that govern admissions, and 2) benefits of change might take one or more years to appear, as faculty gained comfort, confidence, and capacity for equity-minded holistic review. We introduce these learning processes in the Theoretical Framework section and published patterns in holistic admissions implementation under C-CIDE elsewhere (Posselt et al., 2023).

For two years following the workshops, additional types of support were made available to participating programs and their respective graduate schools/divisions. They included: email-based coaching on admissions, recruitment, and change management; tools and research-based resources that

could be asynchronously applied; and quarterly online discussions of relevant social science research. Discussions covered current issues (e.g., trauma-informed practice during the pandemic), and leading institutional change (e.g., using data for equity). Consistent with research on professional learning communities (Kezar et al., 2017), the PIs created multiple means of engagement so partners could choose based on needs, availability, and interests.

Several months after the workshops, two professors from each institution were identified as prospective workshop facilitators for future years; we considered this an important sustainability design feature in the intervention, as it enabled universities to offer training to new faculty, members of admissions committees, and programs that were not part of the C-CIDE pilot. Following the group-based facilitator training, these individuals received scaffolding from the consortium as they prepared to lead workshops. Scaffolding consisted of previously trained facilitators hosting practice sessions with individualized feedback; attending and debriefing their first workshop series; and generally making themselves available for consultation. These trained faculty teams delivered the workshop series on their campuses in subsequent years.

Data and Methods

We used two data sources to evaluate our research questions. To explore patterns in the racial and gender composition of programs following consortium participation (RQ1), we collected administrative data from the 2014-15 through the 2020-21 admissions cycles.³ Outcomes include the number (logged) and share of applicants, admits, and enrollees who are racially minoritized (defined as Black, Latinx, and Indigenous) and women at a program in a given year.

³ Our data collection protocol asked for information on the composition of faculty (by rank, race, and gender), and funding for graduate students since these features of programs are likely to shape our outcomes. Only about half of participating programs that submitted data were able to report these data, so we did not include these variables in our analysis.

To evaluate changes in recruiting, admissions, and other program practices that occurred in association with consortium participation (RQ2), we collected several waves of survey data from admissions chairs regarding program practices during the most recent admissions cycle. The survey included around 40 questions and took about 10-15 minutes to complete.

We conducted three survey waves, one each admissions cycle from 2018-19 through 2020-21. Seven programs responded to the 2018-19 survey, 23 responded to the 2019-20 survey, and 19 responded to the 2020-21 survey. We included 47 responses from 5 universities in our analysis, excluding two responses that could not be linked to a unique program (i.e., responses from individuals associated with more than one program). The survey data included eight responses from programs during the initial stages of participation (i.e., baseline data on program practices) and thirty-nine responses from programs after participation was underway (i.e., follow-up data).

The 2020-21 academic year was shaped by the pandemic and associated economic downturn, as well as the movement for Black lives and calls for racial equity and justice after the murder of George Floyd. These factors may have contributed to patterns in the racial and gender composition of applicants, admits, and enrollees examined via RQ1. To understand the mechanisms that drove changes in program practices (RQ3), the final survey wave asked respondents about their perceptions of what led to changes in practices. This allowed us to examine the extent to which COVID-19, the movement for Black lives and calls for racial equity, and participation in C-CIDE influenced changes (RQ3), and to what extent participants expected changes to be sustained (RQ4). Finally, to further illuminate mechanisms driving changes in practices, we asked programs to describe additional activities undertaken in 2020-21 to increase diversity or reduce racial or gender inequities.

All but two programs provided at least one survey response, with most providing two responses. Seventeen programs at five universities provided administrative data. The 17 programs that submitted administrative data provided that data for all years. However, for our final set of outcomes (the share of

applicants, admits, and enrollees who are racially minoritized and women), only 12 programs submitted data on the total number of applicants, admits, and enrollees required to calculate shares. For these outcomes, we include only those 12 programs.

Analytic Method

To answer RQ1, we used fixed effects regression analysis and administrative data collected from participating programs to analyze patterns in the number and share of applicants, admits, and enrollees by race and gender following consortium participation. The model can be expressed:

$$y_{pt} = \beta_0 + \lambda_p + \delta_t + \varepsilon_{pt}$$

where y_{pt} is the outcome (number (logged) and share of applicants, admits, and enrollees by race and gender) for program p in time t , λ_p are program fixed effects, δ_t are year fixed effects, and ε_{pt} is the error term. Robust standard errors were clustered at the program level.

Coefficients from year fixed effects are our independent variables of interest. In particular, we are interested in coefficients for 2019, 2020, and 2021, which show patterns in the racial and gender composition of applicants, admits, and enrollees following consortium participation (relative to 2015). By observing patterns in the three years after initial participation, we were able to examine whether changes in the racial or gender composition of programs were immediate or whether it took time for programs to adjust program practices to promote more equitable outcomes. This also offered insight into whether changes in outcomes were sustained over time.

To answer RQ2, we compared survey responses from programs' initial year of participation (baseline data; $n = 8$) to follow-up responses after at least one year of participation (follow-up data; $n = 39$). For questions with yes/no responses (e.g., Please indicate whether GRE scores are optional for applicants to submit or not collected), we created a binary variable equal to 1 if the respondent indicated yes and 0 if they indicated no. For questions with a Likert scale of response options (e.g., Please indicate the extent to which your program conducts a fine-grained read of transcripts), we coded

never and rarely responses as 0 and sometimes, often, and always responses as 1. We used a t-test to indicate whether mean responses were significantly different between baseline and follow-up. To account for multiple comparisons, we place more emphasis on findings that are significant at $p < 0.01$.

To answer RQ3 and RQ4, we draw upon survey responses from the 2020-21 admissions cycle. We examined responses to questions regarding the potential drivers of changes to program practices (RQ3) and the extent to which respondents perceived changes would be sustained in the coming years (RQ4). We also examined responses to an open-ended question regarding additional activities programs undertook to increase diversity.

Positionalities

Research team members represent diverse disciplines and roles in the research-practice consortium. Co-authors include two experts in equity-minded admissions practices and a physicist who is an expert in graduate admissions in STEM fields. One co-author served as the external evaluator, and she leveraged expertise in examining the outcomes of equity-minded admissions practices with distance from the design and implementation of C-CIDE training and support. Two co-authors were PIs for the project. Having led consortium development and implementation, they were deeply knowledgeable about the support and training participating programs received. They also built relationships at participating institutions and programs; the trust they established allowed for a rich exploration of the research questions through survey and administrative data. These perspectives shaped how we approached the division of labor in this study. They also informed data analysis and interpretation of results as we aimed to use our combined interests in creating more equitable admissions practices in graduate education.

Our gender and racial identities influence our approach to the study and the interpretations and understandings we draw from findings. All co-authors identify as white; two identify as women and one as a man. The lived experiences of our research team members navigating systems of power in society

and academia influence our understanding of gender inequities and how recruiting, admissions, and program practices sustain inequities. We recognize that our lived experiences and trajectories within academia, and broader American society, have benefited from systemic racism that benefits white individuals; our collective scholarship aims to identify practices and policies that promote racial equity, and this shapes our interpretation of findings that show improvements in quantitative outcomes for racially minoritized students. At the same time, we recognize any outcomes of efforts to reshape recruiting, admissions, and program practices are more nuanced than quantitative figures alone can show, may be attributable to more factors and forces than are measured in our models, and that even those outcomes we find to be statistically significant are modest gains relative to the deep inequalities in STEM doctoral education.

Finally, we recognize that data collection and reporting practices are hardly neutral: the ways gender and racial identity shape individuals' lived experiences do not fit into discrete categories that align with collection and reporting practices (e.g., Ford, Rosinger et al., 2021; Johnston et al., 2014). Therefore, individuals for whom race and gender categories do not accurately reflect their lived experiences—for example, people with multi-racial identities or people for whom static data collection processes do not align with the fluidity of their identity—are further marginalized in data collection and reporting (Ford, Patterson & Johnston-Guerrero, 2021; Ford, Rosinger et al., 2021). We emphasize that our results offer broad evidence regarding the extent to which holistic admissions review might promote racial and gender equity but do not shed light on additional marginalization that occurs for individuals for whom race and gender data collection do not fully capture lived experiences. These ideas are consistent with QuantCrit approaches that seek to interrogate the racist structures that shape data collection and reporting practices and the interpretation of findings and reimagines how quantitative research can be used to promote equity (e.g., see Castillo and Babb (2024) for a review of this approach in education research).

Results

Since consortium training and support emphasized deconstructing current practices and offered alternative processes oriented around holistic review, we were interested in understanding how participation related to diversity (RQ1). Table 3 provides descriptive statistics for the number and share of racially minoritized and women applicants, admits, and enrollees, drawn from administrative data submitted by participating programs. The first column lists descriptive statistics for these outcomes aggregated into pre-consortium years (defined as years prior to consortium participation and include the 2015-16 through 2017-18 admissions cycles) and the second lists descriptive statistics for post-consortium years (defined as years after initial participation began and include 2018-19 through 2020-21). The final column reports the difference in the means for each outcome before and after consortium participation and indicates whether results from a *t*-test indicate the difference is statistically significant.

[Table 3 Here]

The average number and share of applicants, admits, and enrollees who were racially minoritized and women increased following consortium participation. The average program received applications from 42 racially minoritized students (up from an average of 27 in pre-consortium years) and 167 women (up from 140), admitted 9 racially minoritized students (up from 5) and 27 women (up from 24), and enrolled 4 racially minoritized students (up from 2.5) and 11.5 women (up from 10). Similarly, the shares of applicants, admits, and enrollees who identified as racially minoritized and as women increased following participation. *T*-Tests indicated that the difference in means in pre- and post-consortium years were statistically different for outcomes among racially minoritized students, but the differences for women were not significantly different.

These changes are descriptive and do not adjust for differences across programs in campus climate or other factors that might drive changes in outcomes. Results from fixed effects analyses, which adjust for some of these differences, are presented in Table 4 (for the number and share of applicants,

admits, and enrollees by race and gender) and depicted in Figures 1 (number) and 2 (share). We place greater emphasis on the first set of findings regarding the number of applicants, admits, and enrollees by race and gender since only 12 programs submitted data necessary to calculate the share of applicants, admits, and enrollees by race and gender.

[Table 4 Here]

[Figure 1 Here]

We found a statistically significant increase in the number of applicants, admits, and enrollees who were racially minoritized from 2018 through 2021 (relative to 2015). We also found a statistically significant increase one to two years prior to consortium participation, which could reflect that participating programs were already motivated to make changes prior to participating in formal training and support. Importantly, however, the coefficients grew over time in post-consortium years. We found some evidence of increases in the number of women applicants and admits following participation, but these changes were delayed. We did not find statistically significant changes in the number of women enrolled at participating programs in subsequent years.

We also examined the share of racially minoritized and women applicants, admits, and enrollees to understand whether the overall composition changed after programs began receiving consortium training and support.⁴ We found similar patterns among racially minoritized students after participation: the percent of applicants, admits, and enrollees who were racially minoritized grew in 2019, 2020, and 2021. Again, statistically significant changes before participation potentially reflect change-readiness among participating programs. While we did not find evidence of changes in the share of women enrollees following participation relative to 2015, we found an increase in representation of women in

⁴ Sample size was smaller because five programs did not provide data on total applications, admissions, and enrollment, making it impossible to calculate the share of racially minoritized students and women.

the applicant and admit pools (the share of women applicants and admits increased from 2019 to 2021, though the overall number changed little, so we interpret this with caution).

[Figure 2 Here]

We next drew on survey data to understand changes in program practices that occurred alongside consortium participation (RQ2). Table 5 shows means for responses relating to recruitment (Panel A), admissions (Panel B), and program practices (Panel C) for during responding programs' initial year of participation (Column 1) and follow-up years (Column 2). While we requested administrative and survey data from all participating programs, not all responded to one or both, so survey responses do not represent precisely the same programs as the administrative data.

[Table 5 Here]

When it came to recruiting practices, programs were more likely to report that they communicated a commitment to diversity through websites and/or social media after being involved in the consortium. We view this as evidence of potential changes in recruitment practices, but the difference in mean responses was only significant at the 0.05 level.

Through survey data, we also found evidence of changes to admissions practices after programs' initial participation in the consortium. Most notably, programs surveyed in follow-up years were more likely to make GRE scores optional or to not collect scores. Just under 40% of programs indicated they had GRE-optional policies when they began participation while 85% were GRE optional in follow-up years. This finding was statistically significant at the 0.01 level. We found weak evidence of increases in admissions committees meeting to discuss criteria before file review, revisiting admissions practices at least every three years, conducting a fine-grained read of transcripts, and encouraging reviewers to consider applicants' potential rather than just achievements. However, these findings were only

significant at the 0.05 level. For program practices, we found weak evidence of an increase in programs regularly monitoring student progress, significant at the 0.05 level.⁵

We next drew on the final wave of survey data to understand the mechanisms that participating programs attributed to changes in practices and whether they anticipated the changes would be sustained (RQ3 and RQ4). Figure 3 shows mean responses from 19 programs that responded to the 2020-21 survey.

[Figure 3 Here]

Most survey respondents either somewhat or strongly agreed that the pandemic, the movement for Black lives, and C-CIDE training and support all drove changes in recruiting and admissions practices. Nearly 80% somewhat or strongly agreed the movement for Black lives helped drive changes while nearly 90% somewhat or strongly agreed that C-CIDE training and support drove changes. Around 60% somewhat or strongly agreed that COVID-19 helped drive changes. All 19 programs responding to the final survey agreed changes in recruiting and admissions practices would be sustained in the coming years, with 5 respondents somewhat agreeing and 14 strongly agreeing.

Our final survey also asked respondents to describe additional activities their program undertook to increase diversity or reduce racial or gender inequities. Common responses included issuing statements of commitment to equity and anti-racism; establishing committees focused on diversity, equity, and inclusion; and hosting events focused on diversity, equity, and inclusion. For instance, one respondent described concrete steps their program (and students) had taken:

This year our department developed an anti-racism plan with many action items and we've been tackling those one at a time. We held a...department seminar series this semester which featured a lot of diverse speakers. The students started [an anti-racism] group which meets

⁵ Appendix A presents survey response means with the sample restricted to programs for which we have data from both the initial year of participation and follow-up years. Results show similar patterns as those from the unrestricted sample.

regularly and they hosted an additional welcome event during the virtual visit day...We also created a diversity fellowship within our department this year to be able to offer additional funding to more candidates.

When it came to recruiting, one respondent described using public federal data to target recruitment efforts toward undergraduate departments with high numbers of racially minoritized students. Another program reported offering weekly workshops during the application process for underserved students. Spurred by student activism and the movement for Black Lives, another respondent described efforts to review program practices ranging from admissions to mentorship: “We undertook a comprehensive review of admissions; we undertook to provide laptops to incoming students; we have overhauled our mentorship and awareness training resources for faculty, and are looking at ways to incentivize/enforce this.” Others provided coursework focused on equity, diversity, and inclusion or offered training or resources for mentorship. One respondent noted:

Leadership also developed documentation on maintaining inclusive research labs (for faculty) and conflict resolution flowcharts (for graduate students). This summer we will be working on a set of documents that outline minimum expectations for graduate students and faculty advisors in our department.

These responses highlighted additional changes in program practices that coincided with consortium participation and offered insight into how programs responded to calls for increased attention to racial justice.

Discussion

This study offers early quantitative evidence regarding changes to admissions and recruitment practices that STEM PhD programs made in association with their involvement in an externally-funded consortium of change-ready universities, and the compositional outcomes associated with these changes. The training and support that partners had access to included two research- and reflection-

based faculty development workshops followed by additional coaching, resources, and networks. We identified significant changes to admissions practices, consistent with the prospect that double-loop organizational learning, carried out in community, can help facilitate the organizational learning processes (i.e., knowledge acquisition, interpretation, creation, legitimation, and critical reflection) that enable institutional change. For example, programs were also more likely to use evaluation rubrics and be GRE-optional, with 85% of responding programs reporting the latter practice. Survey data also revealed that participants attributed changes in practices to consortium participation and anticipated that changes would be sustained. We provide evidence suggestive that consortium participation was associated with increases in the number and share of racially minoritized applicants, admits, and, enrollees, and weak yet statistically significant evidence of increases in the number and share of women applicants and admits. These changes, particularly for racially minoritized students, appeared to be sustained after workshop participation, relative to 2015 levels.

This early evidence regarding the implications of holistic review in graduate education for racial diversity makes a noteworthy contribution to the literature and can inform efforts to adapt to the legal context created by the 2023 Supreme Court's rulings on race-conscious admissions. Two recent reports by the National Academies of Science, Engineering, and Medicine (NASEM) have also recommended holistic review as means to increase diversity, equity, and inclusion in graduate education (NASEM, 2018, 2023). Their recommendations are part of a trend advocating for changing admissions in light of the misalignment of typical admissions practices with the pursuit of diversity, equity, and inclusion (Khalid & Snyder, 2021). However, there is a sparse research basis for the outcomes of holistic admissions in graduate education and the relationship of admissions training with organizational learning and change.

To contextualize our findings within broader state and national enrollment trends, we see larger increases in the composition of applicants and admits who are racially minoritized individuals in C-CIDE

programs than statewide data from the University of California System institutions (University of California Information Center, 2024) and national data from the National Center for Science and Engineering Statistics (Survey of Graduate Students and Postdoctorates in Science and Engineering, 2022) show over the same period. Although the exact fields of study cannot be compared with existing state and national data, these rough comparisons strengthen our conclusion that participation in comprehensive training and support may improve the racial diversity of applicants and admits. State and national comparisons, however, suggest findings related to changes in the racial composition of enrollees should be interpreted with caution since they are not consistently larger than general enrollment trends.

Limitations

Several other limitations of our study should be noted. Importantly, we are unable to draw causal conclusions based on our evaluation design. Due to the timing of project funding and program interest, programs' participation in consortium training and support was not staggered across admissions cycles, which would more easily allow for a quasi-experimental analysis of changes in outcomes before and after consortium participation. Rather, participating programs all received some type of training and support through the project during the 2018-19 admissions cycle. As a result, we did not have a comparison group that consisted of programs that were later (or earlier) adopters for formal training and support. In addition, because the survey and administrative data came from programs themselves, we did not have a comparison group that never participated in C-CIDE activities.

Selection bias due to focusing on change-ready STEM programs further limits the interpretation of our findings as causal, although careful selection was integral to the project as a whole. Since training and support could only be offered to a limited number of programs, the project focused on programs that were ready to begin deconstructing and rebuilding their practices. These programs may be different

from other programs in ways that would influence outcomes, biasing results and making it difficult to generalize findings to a wider range of programs.

The pandemic also imposed constraints that limit our ability to identify causal relationships. COVID-19 shaped both students' decisions about graduate school enrollment as well as graduate programs' practices. This makes it difficult to disentangle whether changes in outcomes are driven by consortium participation versus the pandemic and its associated disruptions, along with the coinciding Black Lives Matter (BLM) movement. Our final survey asked about the extent to which the pandemic, BLM, and C-CIDE contributed to changes in program practices, but our evaluation cannot fully disentangle these factors.

We are also limited in the conclusions that we can draw from our findings given that not all participating programs submitted administrative and survey data. We have survey responses from nearly all participating programs (two did not submit a response to any survey wave), and most programs provided survey responses at least two times, but all programs did not respond in all waves. In regard to administrative data, just 65% of participating programs submitted historical data, so results relating to compositional outcomes should be interpreted with caution. Given these limitations, results should be viewed as early suggestive evidence regarding the implications of systemic, scaffolded approaches to organizational learning and change for admissions practices and racial diversity.

Implications for Future Research

In contrast to quantitative studies of admissions that infer the effect of a single policy, such as test score requirements, this study examined changes over time for programs that received training and support in reconstructing admissions processes. This support was comprehensive in that it occurred over multiple years, took multiple forms (e.g., group workshops, individual coaching), and addressed multiple mechanisms of learning that institutional change requires (e.g., learning to critically reflect on current policy, learning evidence for a new approach, learning to carry out holistic admissions, learning

to manage dialogue around change). While we were limited in making causal inferences, future research could relax the prerequisite of change-readiness and study a larger number of graduate programs that undertook holistic admissions review.

Future research could also study the conditions under which new admissions policies stick, are subverted (i.e., by symbolic adoption), or erode in support over time. The changes that universities make to comply with the 2023 Supreme Court decisions present one such opportunity. As it concerns voluntary change, the outcomes we observed may be replicable for programs willing to critically reflect upon why they do what they do in admissions (or other areas of educational practice). Where programs are not willing to question assumptions or practices, policy changes are subject to symbolic adoption and/or repeal. In other words, a stronger foundation for change is created when an organization engages in double-loop learning versus aligning practices with mandates or mimicking others. Such research would expand our understanding of the conditions under which institutional change can be sustained, particularly when changes are politically divisive.

The changing test-optional landscape in higher education also presents an opportunity to understand the conditions under which new policies are sustained or abandoned. A small number of highly selective colleges have reinstated SAT and ACT requirements for undergraduate admissions even while many remain test optional (Knox, 2024). While participants in our study reported they anticipate admissions changes persisting, it is possible some practices, such as GRE-optional admissions, could lose support. Future studies might consider what factors lead institutions to maintain or abandon specific admissions practices. Such findings might illuminate the extent to which organizational learning and change through scaffolding and community protect against the erosion of support for specific policies oriented toward equity.

Implications for Holistic Admissions Practice

This study offers evidence that when admissions changes are oriented toward equity and organizational learning is scaffolded so changes are legitimized, positive and sustained gains may be made within the bounds of race-neutral policy. It is unlikely these outcomes would be observed without significant organizational learning and change management work following the workshops. More than adopting a new policy, the consortium created a framework for departments to think about and do admissions differently, while also providing an engaged community structure within and across universities. These results are promising because participating programs intend to continue their new practices, and because evidence of impacts of test-optional and holistic admissions in undergraduate admissions have been mixed. Prior research has not found consistent effects of test-optional policies in undergraduate and professional school contexts, for example, perhaps due in part to mixed motivations for adopting such policies. When changes to admissions are adopted isomorphically or with mixed motivations, it is unsurprising prior research shows little evidence of changes in diversity. This speaks to an important implication for being transferable to other types of interventions: just as individual learners benefit from developmentally appropriate content in learning environments, organizations will benefit from different types of knowledge and activities, depending upon where they are in recognizing their own need for structural and cultural change. We believe that one of the reasons for the successful outcomes observed in this evaluation is that consortium training and support was well-tuned to the needs and dispositions of participating programs.

Conclusion

This study offers some of the first quantitative evidence about the processes and outcomes of holistic admissions in graduate education. We investigated an externally-funded intervention that provided comprehensive training and support for holistic review in 26 STEM programs at five California universities. Our evidence suggests organizational learning—specifically, comprehensive learning that interrogates typical admissions practices, introduces a research-based framework for equity-minded

holistic review, and provides continuous support for change management—can lead to two types of changes. Firstly, we observed evidence for the uptake of more inclusive, equitable admissions and recruitment practices. Secondly, we observed evidence of changes in the racial—and sometimes gender—composition of applicants, admits, and, potentially, enrollees. Our findings also indicate these gains may be sustained over time, and institutional leaders intended to continue the new equity-minded practices developed through the consortium. In the wake of a changing legal landscape around admissions, implementing constellations of changes that comply with the 2023 Supreme Court ruling, improve the fairness of standard practices, and increase diversity will be increasingly important, especially amid evidence that single policy changes have been unable to remediate inequities.

As discussed above, this intervention was not designed for any and every university and graduate program. We purposefully invited universities whose graduate education leaders saw their role as not only that of a caretaker of graduate education, but as a hub of support for graduate programs to improve how they select and serve students. We worked with these leaders to select PhD programs that had three indicators of, as we describe it, *change-readiness*: recognition of inequities and taking responsibility for addressing them; having a developing or sustained record of effort in advancing DEI; and possessing some evidence of supportive leadership, including sufficient administrative bandwidth to manage the change process. Additionally, we sought programs that were willing to have candid discussions about the efficacy and equity of their standard practices. Only under these conditions did we expect programs would be ready to advance substantive change; indeed, more than mere reform, the transformation of admissions requires confronting deeply embedded assumptions about how to recognize and reward merit and excellence, as well as about the relevance of diversity to organizational mission. In short, we did not offer an “intervention” for highly resistant departments or people, but rather scaffolding to help facilitate conversations and changes that many faculty struggle to manage on their own.

What does this mean for faculty or administrators in programs that may not yet be change ready? We suggest on the basis of the evidence presented here, qualitative research from C-CIDE (Posselt et al., 2023), and our lived experience leading this effort for seven years, that a valuable step is to create spaces for reflection and dialogue (e.g., in faculty meetings, department colloquia, and other collective spaces) about 1) patterns in the demographics of applicants and admitted, enrolled, and graduating students, 2) current research about inequities and promising practices in selection (a body of literature that many faculty do not realize exists), and 3) changes in the legal landscape. Reflection and dialogue are designed into the consortium's workshops because they are critical levers for developing critical consciousness and equity-mindedness (Dowd and Bensimon, 2015). In addition, those with leadership roles—whether it is admissions chair, department chair, director of graduate studies, or deans—should lean into their authority to drive and shape agendas. They can also build knowledge and skills in change management and shared equity leadership (Kezar et al., 2023). Developing a culture of individual learning toward equity as professionals helps create conditions conducive to organizational learning for equity. This is critical because reconstructing admissions in ways that stick does not occur through a formula or recipe, but through people in various roles using their spheres of influence, one admissions cycle at a time.

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Table 1. Mechanisms of organizational learning and applications in graduate admissions

Learning mechanism	Definition	Application in graduate programs
Knowledge acquisition	Obtaining information that opens current standard to analysis or broadens possibilities for policy/practice	Evidence that disrupts satisfaction with typical practices; knowledge about the availability of alternative approaches; tools and resources for carrying out holistic file review practices.
Knowledge distribution	Circulation of information with key community members to embed at the organizational level	Communication of knowledge that individuals or small groups acquired in workshops or personal learning to the collectives and leaders who set policy and practice
Knowledge interpretation	Collective sensemaking about the implications of knowledge for the organization	Discussion, debate, and refinement of options in faculty meetings, admissions committee meetings, DEI committee meetings, etc. leading to the design of a local policy
Knowledge legitimation	Establishing the local resonance and relevance of knowledge	Following implementation, which involves separate processes of learning, assessment of individual and organizational experiences with and outcomes of holistic admissions

Table 2. List of consortium universities and programs

UC-Berkeley	UC-Davis	UC-Irvine	UC-San Diego	UC-Santa Barbara	University of Southern California
College of Engineering (Mechanical, Civil and Environmental, Bioengineering)	Biochemistry, Molecular, Cellular, and Developmental Biology	DECADE Mentors Program	Physics	Chemical Engineering	Chemistry
College of Natural Resources	Materials Science and Engineering	Samueli School of Engineering	Chemistry/Biochemistry	Molecular, Cellular, and Developmental Biology	Physics
Nutritional Science and Technology	Chemistry	Math	Neuroscience	Environmental Science and Management	Molecular Biology
Plant and Microbial Biology	Ecology	Computer Science	Scripps Institute for Oceanography		Psychology
Environmental Science Policy and Management	Math				

Table 3. Descriptive statistics for outcome variables before and after consortium participation

	Before participation		After participation		Difference in means
	<i>N</i>	Mean	<i>N</i>	Mean	
Number of racially minoritized applicants	68	26.57 (31.11)	51	41.59 (44.27)	15.01** (6.91)
Number of racially minoritized admits	68	4.99 (4.95)	51	8.92 (9.18)	3.94*** (1.31)
Number of racially minoritized enrollees	68	2.50 (2.24)	50	3.90 (3.36)	1.40*** (0.52)
Number of women applicants	65	139.71 (116.09)	45	166.64 (156.23)	26.94 (25.97)
Number of women admits	68	24.43 (17.95)	47	26.87 (22.59)	2.45 (3.79)
Number of women enrollees	68	10.40 (5.98)	51	11.39 (6.81)	0.99 (1.18)
Percent of racially minoritized applicants	48	7.63 (5.94)	36	10.66 (5.81)	3.03** (1.30)
Percent of racially minoritized admits	48	9.47 (8.05)	36	14.11 (8.29)	4.64** (1.80)
Percent of racially minoritized enrollees	48	10.94 (9.43)	35	14.40 (8.71)	3.46* (2.03)
Percent of women applicants	45	39.83 (18.05)	30	44.05 (19.66)	4.22 (4.41)
Percent of women admits	48	44.76 (18.08)	32	49.42 (18.00)	4.66 (4.12)
Percent of women enrollees	48	44.46 (19.76)	36	46.98 (20.32)	2.52 (4.41)

Notes. Before consortium participation observations come from the 2014-15 through 2017-18 admissions cycles for students enrolling fall 2015 to fall 2018. After participation observations come from 2018-19 through 2020-21 for students enrolling fall 2019 to fall 2021. Results from *t*-test shown in last column. Administrative data come from 17 reporting programs.

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

Table 4. Fixed effects regression results

	Number (logged)						Percent					
	Racially minoritized applicants	Racially minoritized admits	Racially minoritized enrollees	Women applicants	Women admits	Women enrollees	Racially minoritized applicants	Racially minoritized admits	Racially minoritized enrollees	Women applicants	Women admits	Women enrollees
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
2016	0.155 (0.113)	0.063 (0.145)	0.206 (0.168)	-0.004 (0.048)	-0.095 (0.085)	-0.197 (0.122)	0.718 (0.932)	2.681 (1.750)	4.764 (3.619)	1.529 (1.504)	2.031 (2.466)	-0.618 (4.811)
2017	0.361** (0.147)	0.294 (0.184)	0.303* (0.169)	0.023 (0.044)	0.087 (0.067)	-0.081 (0.079)	3.062* (1.703)	6.898** (2.298)	7.014* (3.229)	2.791* (1.426)	8.323** (3.554)	2.114 (5.499)
2018	0.413*** (0.098)	0.465** (0.194)	0.579*** (0.162)	0.032 (0.053)	0.140 (0.108)	0.162* (0.090)	2.347** (0.919)	5.673** (2.520)	8.468*** (2.690)	3.923 (2.272)	8.577 (6.074)	8.879 (5.726)
2019	0.441*** (0.116)	0.371* (0.192)	0.452** (0.162)	0.081 (0.098)	-0.026 (0.101)	-0.078 (0.069)	2.794* (1.362)	5.908** (2.260)	7.386** (2.722)	4.781*** (1.520)	7.993** (3.609)	5.126 (2.971)
2020	0.539*** (0.173)	0.635** (0.232)	0.571*** (0.193)	0.094 (0.065)	0.151* (0.079)	0.025 (0.074)	3.638*** (1.131)	6.252*** (2.002)	6.233* (2.925)	6.661*** (2.031)	10.868** (4.100)	3.521 (5.079)
2021	0.948*** (0.167)	0.947*** (0.220)	0.808*** (0.180)	0.243** (0.093)	0.152* (0.083)	0.131 (0.097)	7.240*** (1.111)	13.213*** (2.186)	12.646*** (3.548)	6.815** (2.364)	8.445** (3.747)	6.699 (4.568)
Constant	2.655*** (0.094)	1.249*** (0.138)	0.759*** (0.123)	4.556*** (0.045)	2.921*** (0.049)	2.305*** (0.039)	6.099*** (0.812)	5.655*** (1.053)	5.826*** (1.862)	37.793*** (1.338)	40.091*** (2.397)	41.865*** (3.088)
Observations	119	119	118	110	115	119	84	84	83	75	80	84
Programs	17	17	17	17	17	17	12	12	12	12	12	12

Notes. Robust standard errors clustered at the program level in parentheses. Referent year is 2015. Administrative data come from 17 reporting programs.

* p<0.10 ** p<0.05 *** p<0.01

Table 5. Mean survey responses for program practices during initial and follow-up consortium participation

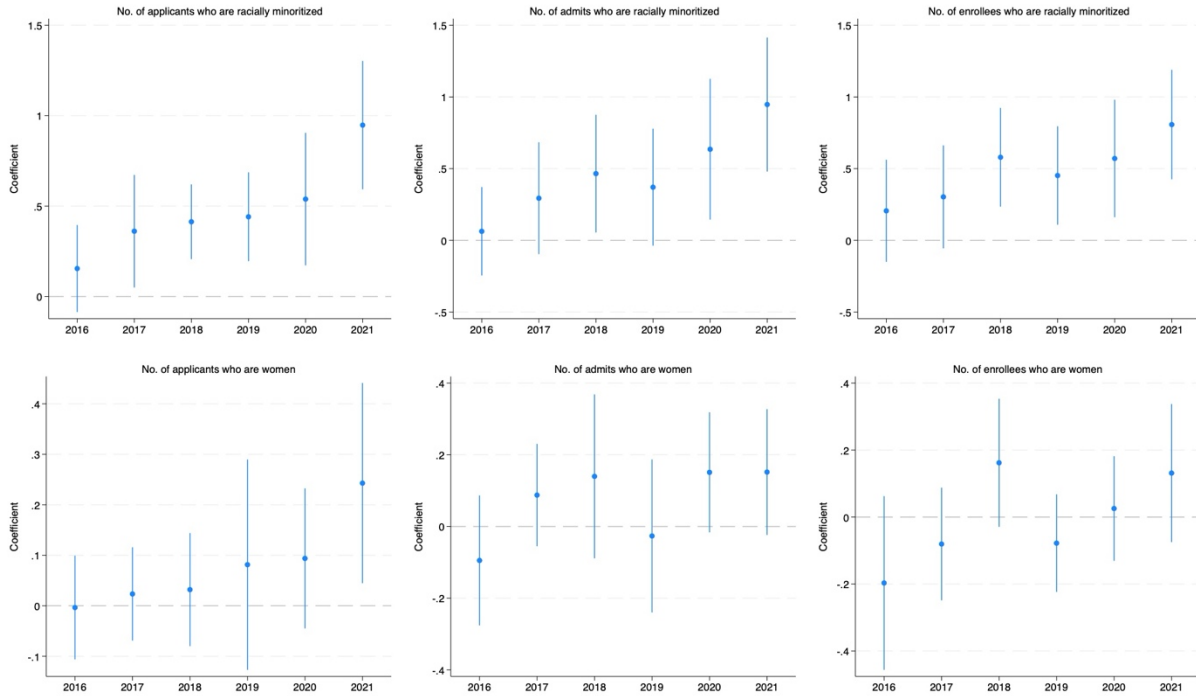
	Initial Mean	Follow-Up Mean	Difference
<i>Panel A: Recruitment practices</i>			
Frequency with which program uses the following recruitment practices (1 = Sometimes/Often/Always; 0 = Rarely/Never)			
Communicates commitment to diversity in online presence (e.g., website, social media)	0.75	0.974	0.224**
Engages with minority serving institutions (MSIs)	0.5	0.744	0.244
Designs the campus visit / open house to communicate commitment to diversity	0.875	0.949	0.074
Responds to all email inquiries from prospective students in a timely manner	1	1	0
Recruits undergraduates from your institution	0.75	0.846	0.096
Has or participates in a bridge to the doctorate program	0.5	0.615	0.115
Provides diversity fellowships (at program, school, or university level)	0.875	0.974	0.099
<i>Panel B: Admissions practices</i>			
Program used the following admissions practices (1 = Yes; 0 = No)			
GRE scores are optional for applicants to submit or not collected	0.375	0.846	0.471***
Selects a diverse admissions committee	1	0.923	-0.077
Admissions committee meets to discuss criteria before file review	0.5	0.872	0.372**
Uses an evaluation rubric for admissions file review	0.625	0.769	0.144
Intentionally assesses non-cognitive competencies	0.625	0.769	0.144
Asks applicants to address contributions to diversity in the personal statement	0.5	0.821	0.321*
Revisits admissions practices at least every three years	0.625	0.923	0.298**
Extent to which program used the following admissions practices (1 = Sometimes/Often/Always; 0 = Rarely/Never)			
Conducts a fine-grained read of transcripts	0.75	0.974	0.224**
Encourages file reviewers to consider applicant potential, not just achievements	0.875	1	0.125**
Encourages file reviewers to read research about selection, generally, or admissions, specifically	0.5	0.744	0.244
<i>Panel C: Program practices</i>			
Program uses the following mentoring and program practices (1 = Yes; 0 = No)			
Monitors progress of current PhD students regularly	0.75	0.974	0.224**
Involves administrative staff in student recruitment or support	1	1	0
Provides departmental support in the form of logistics, funds, and/or space for student organizations	1	1	0
Includes students in faculty committees and/or decision making	0.625	0.846	0.221
Has administered a climate assessment in the last three years	0.5	0.667	0.167

Has taken steps following a climate assessment	0.5	0.718	0.218
Established an ombudsperson or other means for students to report harassment, bias, and/or assault	0.625	0.769	0.144
Emphasizes the social relevance of your discipline, specifically, and/or of science, generally	0.75	0.897	0.147
Coordinates with university leaders on the improvement of your graduate program	0.875	0.974	0.099
Coordinates with disciplinary societies on the improvement of graduate education	0.75	0.769	0.019
Formally recognizes diversity champions in your department	1	0.846	-0.154
Encourages collective responsibility for diversity	0.75	0.872	0.122
Incentivizes faculty professional development	0.625	0.821	0.196
Program use following mentoring practices (1 = Yes; 0 = No)			
Has departmental policies or governance structures that support continual improvements of graduate education	0.875	0.974	0.099
Has a critical mass of women faculty	0.375	0.641	0.266
Has a critical mass of faculty of color	0	0.077	0.077
Collects and analyzes program data that is disaggregated by race and gender	0.75	0.667	-0.083
Has a program diversity committee	0.75	0.821	0.071
Number of responses	8	39	

Notes. Data come from surveys of participating programs.

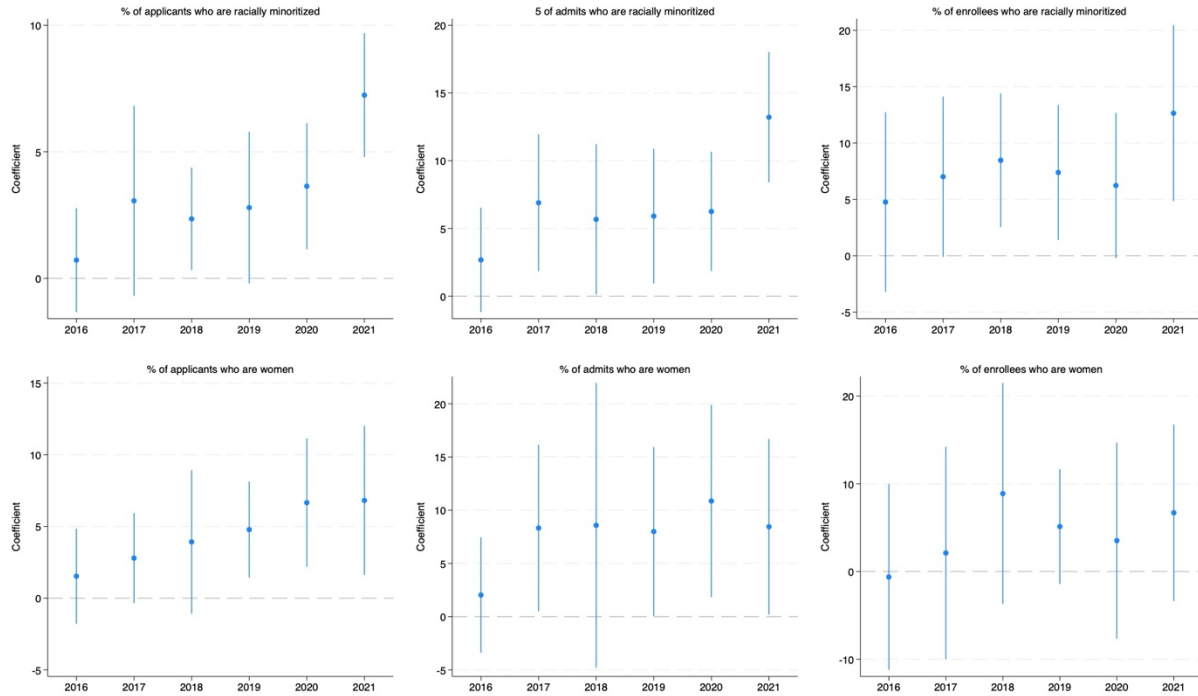
* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

Figure 1. Fixed effects regression results for number of applicants, admits, and enrollees by race and gender (logged)



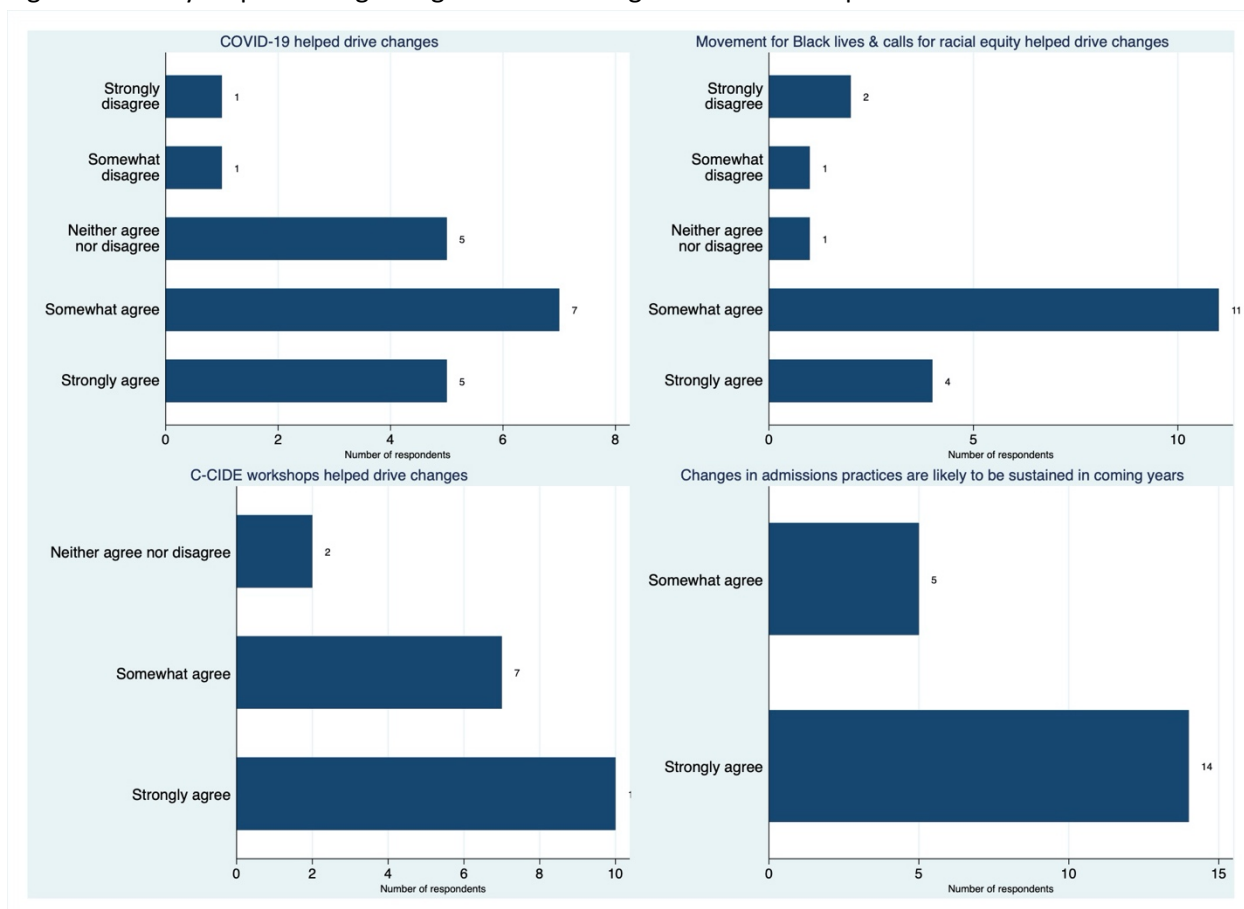
Notes. 95% confidence intervals shown. Referent year is 2015. Administrative data come from 17 reporting programs.

Figure 2. Fixed effects regression results for percent of applicants, admits, and enrollees by race and gender



Notes. 95% confidence intervals shown. Referent year is 2015. Administrative data come from 17 reporting programs.

Figure 3. Survey responses regarding drivers of changes to admissions practices



Notes. Data come from final wave of survey responses in 2020-21 ($n=19$).

Appendix A

Mean survey responses for program practices during initial and follow-up consortium participation, restricted sample

	Initial Mean	Follow-Up Mean	Difference
<i>Panel A: Recruitment practices</i>			
Frequency with which program uses the following recruitment practices (1 = Sometimes/Often/Always; 0 = Rarely/Never)			
Communicates commitment to diversity in online presence (e.g., website, social media)	0.75	0.9	0.15
Engages with minority serving institutions (MSIs)	0.5	0.5	0
Designs the campus visit / open house to communicate commitment to diversity	0.875	0.9	0.025
Responds to all email inquiries from prospective students in a timely manner	1	1	0
Recruits undergraduates from your institution	0.75	0.7	-0.05
Has or participates in a bridge to the doctorate program	0.5	0.6	0.1
Provides diversity fellowships (at program, school, or university level)	0.875	1	0.125
<i>Panel B: Admissions practices</i>			
Program used the following admissions practices (1 = Yes; 0 = No)			
GRE scores are optional for applicants to submit or not collected	0.375	0.8	0.425*
Selects a diverse admissions committee	1	0.8	-0.2
Admissions committee meets to discuss criteria before file review	0.5	0.7	0.2
Uses an evaluation rubric for admissions file review	0.625	0.6	-0.025
Intentionally assesses non-cognitive competencies	0.625	0.8	0.175
Asks applicants to address contributions to diversity in the personal statement	0.5	0.8	0.3
Revisits admissions practices at least every three years	0.625	0.9	0.275
Extent to which program used the following admissions practices (1 = Sometimes/Often/Always; 0 = Rarely/Never)			
Conducts a fine-grained read of transcripts	0.75	0.9	0.15
Encourages file reviewers to consider applicant potential, not just achievements	0.875	1	0.125
Encourages file reviewers to read research about selection, generally, or admissions, specifically	0.5	0.4	-0.1
<i>Panel C: Program practices</i>			
Program uses the following mentoring and program practices (1 = Yes; 0 = No)			
Monitors progress of current PhD students regularly	0.75	1	0.25
Involves administrative staff in student recruitment or support	1	1	0
Provides departmental support in the form of logistics, funds, and/or space for student organizations	1	1	0
Includes students in faculty committees and/or decision making	0.625	0.9	0.275

Has administered a climate assessment in the last three years	0.5	0.4	-0.1
Has taken steps following a climate assessment	0.5	0.6	0.1
Established an ombudsperson or other means for students to report harassment, bias, and/or assault	0.625	0.7	0.075
Emphasizes the social relevance of your discipline, specifically, and/or of science, generally	0.75	0.7	-0.05
Coordinates with university leaders on the improvement of your graduate program	0.875	1	0.125
Coordinates with disciplinary societies on the improvement of graduate education	0.75	0.5	-0.25
Formally recognizes diversity champions in your department	1	0.9	-0.1
Encourages collective responsibility for diversity	0.75	0.7	-0.05
Incentivizes faculty professional development	0.625	0.8	0.175
Program use following mentoring practices (1 = Yes; 0 = No)			
Has departmental policies or governance structures that support continual improvements of graduate education	0.875	0.9	0.025
Has a critical mass of women faculty	0.375	0.5	0.125
Has a critical mass of faculty of color	0	0.2	0.2
Collects and analyzes program data that is disaggregated by race and gender	0.75	0.4	-0.35
Has a program diversity committee	0.75	0.8	0.05
Number of responses	8	10	

Notes. Data come from surveys of participating programs.

* $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$