

Enacting and Sustaining Inclusive Culture and Values in Hispanic-Serving Institutions to Dismantle Racism in STEM Fields

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Introduction

A lack of equity and inclusion has been a long-standing and critical issue in science, technical, engineering, and mathematics (STEM) higher education. Addressing disparate STEM outcomes has been a sustained issue of national concern (NASEM, 2011), however little progress has been made in ensuring that racially minoritized students (Black, Hispanic/Latinx, and Native American) are achieving equitable STEM outcomes at a national level (Cobian et al., 2024). Scholars have asserted that a critical step in transforming the STEM landscape is addressing and dismantling racism embedded within STEM (McGee, 2020). While racial equity needs to be achieved in all STEM fields, there are some fields that require greater efforts. For example, among STEM fields, computer science (CS) is one of the least diverse disciplines, and recent progress has been halting and slow (NSB, 2022). Computer science has also inherited a significant history of racism and racist practices (Mack et al., 2019; Noble, 2018). The Latinx community is especially underrepresented; while one quarter of the youth population is comprised of Latinx students, only 11% of computer science bachelor's degrees are awarded to Latinx students (NSB, 2022). Hispanic-Serving Institutions (HSIs)—defined by 25% or more enrollment of Latinx students—can play an important role in increasing the participation of Latinx and other minoritized populations since more than a third of the nation's Latinx CS baccalaureates are awarded by HSIs (NSB, 2022). HSIs have been highlighted as exemplars of inclusive STEM practices (NASEM, 2019), although there is concern about the extent to which all HSIs serve their students through equity-centered values and practices (Garcia, 2019).

To examine how systemic racism can be mitigated in HSIs and in STEM, **this study explores the institutionalization and sustainability of equity-centered values within a long-standing network of HSI computing departments that are dedicated to the advancement of Latinx students.** The Computing Alliance of Hispanic-Serving Institutions (CAHSI) was formed in 2006 with National Science Foundation funding as a consortium of seven computer science/computer engineering departments in HSIs with the goal of recruiting, retaining, and advancing Latinx students in computing. With the infusion of funding in 2017 from the National Science Foundation Eddie Bernice Johnson Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science Initiative (INCLUDES), CAHSI has grown to a network of nearly 80 HSI computing departments and industry and nonprofit partners. CAHSI has implemented and sustained a suite of evidence-based signature practices that have been shown to promote students' belonging, persistence, and computing aspirations, including the Affinity Research Group model of undergraduate research (Gates et al., 1999; NASEM, 2017; Thiry et al., 2011; Villa et al., 2013), peer-led team learning (Hockings et al, 2002; Lewis & Lewis, 2008; Lewis, 2011; Preszler, 2009; Tien et al., 2002; Wilson & Varma-Nelson, 2016), a sequence of introductory problem-solving courses (Gates et al., 2019; Hug et al., 2021), and academic clubs and support for intersectional identities (Espinosa, 2011; Ong et al, 2018). CAHSI departments are deeply invested in equity-focused cultural and organizational change. CAHSI's departmental change initiatives are anti-racist

in that they center the experiences of students from marginalized backgrounds, are developed or adapted to meet local students' needs and lived experiences, and focus on changing organizational and faculty mindsets to be student-centered and equity driven.

Structural racism in STEM

The reasons for vast racial and other inequities in computer science are many. For one, structural racism in STEM fields is maintained and reinforced by discriminatory values and beliefs that underlie higher education (McGee, 2020). Computer science departments, particularly those in primarily white institutions (PWIs), have been described as “saturated sites of violence in which interconnected systems of power converge to enact oppression (Rankin et al, 2021, p. 802). Both Rankin (2021) and McGee (2020) contend that racist structures in STEM education must be interrogated and disrupted to foster equity and social change. Further, the focus must not be on “fixing” students to fit into a racist structure, but on transforming structures to serve students (McGee, 2020). Inherent in this transformation is the need to create and cultivate STEM cultures that value equity and remove norms and ideologies that create toxic environments for racially minoritized students such as individualism, hyper-competitiveness, color blindness, and deficit-mindsets associated with meritocracy (McGee, 2020; NASEM, 2011; Posselt, 2020). Through these actions institutions can engage in institutional change and what Posselt (2020) has coined as “equity work”, defined as “reconfiguring structures, cultures, and systems to empower marginalized groups and close disparities” (p. 2).

Organizational change, including transforming racist structures, in STEM fields must also be disciplinarily focused (Chapman, 2019). Much of the research on racial structures in higher education has focused on environments in institutions more broadly, rather than on disciplinary contexts within departments (author, 2023). Moreover, much of the research on minoritized students and racial institutional structures has focused on PWIs, while less attention has been paid to equity efforts within HSIs, particularly in STEM fields (NASEM, 2019). Although HSIs enroll large numbers of minoritized students, they do not necessarily have a racially just organizational identity (Aguilar-Smith, 2021; Comeaux et al, 2021; Garcia, 2016; Petrov & Garcia, 2021; Sanchez, 2019). Therefore, we need to know more about how equity-centered STEM departments within HSIs enact and sustain inclusive values.

Theoretical framework

Institutional, or departmental, transformation, including that to mitigate systemic racism, is dependent on changing organizational behavior along with organizational mindsets (Kegan & Lahey, 2009). Failing to address organizational mindsets can derail transformational goals. To understand how equity-centered and antiracist organizational mindsets are generated and sustained within CS departments within HSIs, we draw on a framework of institutional logics. Institutional logics are “the socially constructed, historical patterns of practices, assumptions, values, beliefs, and rules by which individuals... organize time and space and provide meaning to their social reality” (Thornton & Ocasio, 1999, p.804). Understanding institutional logics is vital for equity efforts because they fall within the second-order change category of institutional transformation espoused by Kezar (2018) that is systemic in nature and focuses on “values, assumptions, structures, processes and culture” (p. 71). Understanding how multiple institutional logics converge, rather than compete, within an organization fosters nuanced insights into organizational actions (behaviors) and expectations for action (norms) (Gonzales & Ayers,

2018). In this way, investigating the institutional logics within computing departments can foster understanding of how and why reform efforts either succeed or fail to achieve full success (Kezar & Bernstein-Serra, 2020).

In this study, we investigated the institutional logics of equity, inclusivity, and excellence within the Computing Alliance of Hispanic-Serving Institutions (CAHSI). *CAHSI is a long-standing network of departments whose central mission is to accelerate the progress of Latinx students in computer science via an array of equity-centered practices.* Organizational change has been widely studied at the institutional level, and less often at the departmental level; yet more nuanced understanding of departmental efforts is necessary to advance disciplinary-based change efforts, such as those in STEM fields (Nunez, 2023).

This paper examines how equity-centered values were enacted and sustained, or institutionalized, within departments. Institutionalization occurs when policies or practices become part of the norms, values, and assumptions that are embedded in organizational culture (Kezar & Sam, 2013). Accordingly, the research question guiding the study was: ***How are the institutional logics of equity, inclusivity, and excellence enacted and sustained within HSI computer science departments?***

Research design, methodology and data sources

We used a qualitative multiple case study method (Stake, 2005; Yin, 2018) to examine the institutional logics of computer science departments within the CAHSI network. Data included interviews, a faculty survey, and participant observations at departmental and CAHSI meetings and events. The research team has a history of collaboration and involvement with the CAHSI network. Two members of the research team have worked with CAHSI for nearly two decades as external evaluators and have collected and analyzed abundant survey, interview, and observational data from that period. A third team member has been involved with CAHSI since 2018 and conducted an in-depth case study of antiracist practices in four CAHSI departments in spring 2020. The fourth team member is a postdoctoral scholar with no prior affiliation with CAHSI and expertise in STEM networks and organizational change efforts. The team is currently updating the previous case study with data collected in spring 2024 from the same four departments. This paper, however, is based on the analysis of data collected in spring 2023 from the CAHSI national network, although informed by our understanding of the network from research and evaluation efforts conducted in previous years.

The data sources for this paper are semi-structured interviews and a survey. In spring 2023, we conducted individual and focus group interviews with 46 CAHSI participants from 24 departments. We invited faculty, chairs, and staff from each of the departments who were most involved with the CAHSI network so that we could better understand how institutional logics were enacted within the departments. Because CAHSI has been rapidly expanding in recent years, departments were based on longevity and regular participation in regional and national meetings and events. The research team chose 24 departments for the investigation. Interviews were conducted virtually and were digitally recorded and transcribed verbatim for analysis. Interviews focused on participant's experiences within the department, the discipline, and the CAHSI network, including changes in practices, policies, norms, or values. Example questions include: What was your most important accomplishment in the past year? What is your greatest barrier to change? Have you observed shifts in values or norms since your department joined CAHSI—if so, can you provide an example? Please describe the most important teaching or classroom changes you have made in your department. Please describe the most important

co-curricular or out-of-class activities you've implemented in your department. What impact has being in the CAHSI network had on your department? Interviews typically lasted 60 minutes. The protocol was semi-structured so the interview could ask probing or follow-up questions. Two researchers conducted the interviews.

We triangulated these interviews with a faculty survey that addressed workloads, leadership, inclusive behaviors and practices, and departmental support. This survey was sent to all faculty and staff within the departments in spring 2023, to reach those with varying degrees of involvement in the CAHSI network, and 131 members from the participating departments responded. Survey analysis and findings will be included in the full conference paper. The survey was developed based on surveys that have been used in the National Science Foundation ADVANCE network for organizational change. Questions were adapted to fit the goals of the CAHSI network and the institutional contexts of HSIs (e.g., to be more teaching oriented for teaching institutions and community colleges, etc.). We electronically distributed the survey to all faculty and staff in the same 24 departments and received 150 responses. We triangulated the survey and interviews with participant observation of regional and national meetings, and analysis of nearly 100 interviews with faculty and staff from our 15 years of involvement with CAHSI.

Interview analysis was conducted using methods outline by Miles, Huberman & Saldana (2014). This process involved generating first cycle codes to identify important issues in the data. We then used second cycle coding to organize first cycle codes into larger patterns or themes. First cycle codes were generated deductively, based on our research question and theoretical framework (e.g., the institutional logics of equity, inclusivity and excellence) and inductively, based on emerging issues that were salient to our participants (e.g., upward mobility of students, etc.). Second cycle codes identified overarching patterns and unifying themes, such as student opportunity and opportunities for learning and reflection. First cycle and second cycle codes were compared to better understand similarities and differences according to institutional type, longevity with CAHSI, and other characteristics. Because the sample was strategic, we could not analyze for differences in gender or race/ethnicity within the focus group interview format. Descriptive analysis was conducted using Microsoft Excel and SPSS. Data were cleaned and organized so that data could be analyzed for differences according to survey scales. Descriptive statistics (means, frequencies, crosstabs) were computed. Additionally, tests of statistical significance, such as t-tests, were performed to understand group differences in responses.

Findings

From the qualitative analysis, three themes indicated institutional logics that can be characterized as inclusive mindsets. These organizational mindsets emphasize and support transformative institutional structures that are created to meet students' needs rather than trying to force students to conform to existing, racist structures. The following convergent logics were enacted and sustained within departments and CAHSI more broadly: Equity-centered alignment between departments and their institutions, Student opportunity, and Learning and reflection. Thus, CAHSI has enacted and sustained organizational transformation by placing the onus to be antiracist on the institution and institutional agents.

Equity-centered alignment between departments and their institutions

Departments cultivated equity-centered mindsets by infusing these values into practices and mindsets within the department. Due to the demand to pursue computer science as a career, CS

departments nationally are overenrolled, and many universities are tightening admissions requirements to CS programs and becoming more exclusive (NASEM, 2018). Countering these trends, CAHSI departments have expanded access by creating new degree and certificate programs and continuing to enact open admissions policies. These efforts are most successful when departmental values aligned with the mission and values of the broader institution. As one chair described creating a new program, “Everything we do is to help students to bring up their mobility, and the CAHSI mission is in line with the computer science mission and with the school mission. That’s why we have such an easy way to go through the process (of creating new degree programs). We don’t have any conflict here.” A chair in another long-standing CAHSI department described the influence of CAHSI’s values on the department over time. He noted, “[Equity] is ingrained in what we do. We came under the mentorship of CAHSI and were influenced by CAHSI principles, CAHSI practices. And I think the department continues to be that way. It’s just become part of life.”

Institutions that had embraced a larger mission of “servingness” to provide multidimensional support structures that develop students’ academic, professional, leadership, and racial identities were aligned with the vision of CAHSI to serve and support Latinx students in computing (Garcia et al., 2019). A chair at one department commented that her university was engaged in an institution-wide initiative to create a more inclusive and equity-centered climate and increase students’ persistence and success through multifaceted academic and career support. She noted that the institutional efforts aligned with their equity focused change efforts in the computer science department. The institution had revised academic policies and advising processes which, in turn, directly benefited many students in the computer science department. The chair commented that this institutional effort had allowed the department to better track and communicate academic progress to students which removed roadblocks to student persistence.

So we're now permitting them to continue [with their degree program]. [Advising processes] are not a prohibitor. So it's an inclusive thing, I think. But it's just going over the road signs a little bit more to make sure they're going to have a better exit. And I believe they do. Our graduation numbers are up, our completion numbers are up. The time to completion has declined, and the overall GPA has gone up as well.

The department had embraced institutional efforts to enact more proactive advising and implemented changes within the department that aligned with these goals. In this way, the convergence of inclusive logics between departments and institutions amplified departments’ capacity to adopt and enact equity-centered organizational mindsets.

Student opportunity

Part of the mission of excellence within CAHSI departments is to cultivate student growth and development systemically and broadly. To that end, most departments designed multiple opportunity structures for student success within and outside of the formal curriculum that were holistic and sustainable. For instance, one department offered multiple talent development opportunities intentionally dispersed across students’ computing pathways, both within and outside of coursework. These opportunities included (a) an on-campus internship program that often led to full-time jobs for students; (b) a regional hack-a-thon experience with industry sponsors; (c) multiple co-curricular diversity-oriented student organizations; (d) proactive, student-centered advising; and (e) embedding research, teamwork, and professional skills into required courses. These opportunity structures were

also designed to address students' holistic needs, including mental health, emotional support, and economic well-being. Our prior research indicates that these opportunity structures were sustained into and during the pandemic, leading students in CAHSI departments to feel more supported despite the considerable disruption. As a result, students' maintained their computing identity and aspirations (Hug, Jurow & Thiry, 2021; Thiry & Hug, 2021).

Departments throughout the CAHSI network were focused on providing professional opportunities to students because of their involvement in the CAHSI network. From its inception, CAHSI has focused on preparing undergraduate students for the workforce and graduate education. All of CAHSI's signature practices (e.g., peer-led team learning, peer mentoring, undergraduate research experiences, problem solving courses, etc.) are disseminated and implemented throughout the network with the goal of preparing students for the next steps in their education or career. The CAHSI organization has developed strong partnerships with Google, Microsoft and other industry partners that have designed dedicated programs for CAHSI students. Local departments within the CAHSI network have developed partnerships with regional industry companies such as Lockheed Martin and Northrup Grumman. Some departments have begun to offer a professional development course focused on interview techniques, resume preparation, mentorship, and expanding access to professional opportunities, such as internships and research experiences. Other departments offer workshops in these areas. As departments have strengthened their ties with industry, they have a better understanding of what companies expect or desire in computing interns and workers. A staff member commented on her departments' approach to preparing students to enter the workforce.

It really is a skill set. And they have to build not just their technical skills, but also their soft skills and know how to interview and all of that. So when I came in and I started talking to these companies, I started to understand how they view students and what they were trying to do and try to figure out how can we match it as best as possible.

The chair of the department followed on that comment by stating that they focus on "coaching" students by adopting a "growth mindset model" that involves "encouraging and coaching the students towards whatever their success might be."

Learning and reflection

Equity-centered change takes time, work, attention, and growth (Kezar, 2018). CAHSI members acknowledged that advancing equity-centered change was ongoing work with no clear finish line and, subsequently, allowed plentiful opportunities for discussion, reflection, training, and sharing. Through dialogue within CAHSI activities and events, CAHSI members adopted growth mindsets, not just for their students, but for themselves as well. Over time, we have witnessed the evolution in perceptions of inclusivity and excellence among multiple CAHSI members. For instance, one university faculty member who expressed perceptions of student deficits when he joined CAHSI over a decade ago, over time has begun to empathize more with students and adapt his actions accordingly. He expressed that many students in CAHSI departments were from low-income backgrounds, had to work long hours outside of school, and had multiple, competing responsibilities, such as school, parenting, or supporting their families. He noted that it was important to design policies and services with students' lived experiences in mind. He has advanced into the role of department chair and is now in a position to make changes to better meet students' needs based on their lived experiences. A community college faculty member in the network likewise evolved in her actions within her department, with the intent to promote the

alignment between espoused and enacted equity-centered values across her department and institution. Over time she has embedded equity-centered values into departmental policies, including syllabi, learning outcomes and program objectives, and expanded hands-on opportunities for students. These examples demonstrate the evolution of mindsets and practices, ranging from classroom pedagogy to departmental curricula and policies.

The CAHSI network has also begun to sustain ongoing opportunities for critical dialogue, learning, and reflection in annual events, workshops, and learning communities. In one example, CAHSI offers a CAHSI Collaborative Learning Community (CCLC) for faculty who serve as research mentors to undergraduates in the CAHSI Local Research Experiences for Undergraduates (LREU) program. This virtual community meets weekly to learn about equity-centered mentoring practices, forge relationships and connections, and discuss successes and challenges. In the virtual sessions, the facilitator presents evidence-based mentoring practices and encourages the adoption of a growth mindset toward students and the adoption of inclusive mentoring practices. On a survey, 85% of mentors reported that they had used materials offered by CAHSI and had offered activities and workshops within their research team to deliberately develop students' professional and scientific skills, such as elevator speeches and writing an abstract.

Aligning with CAHSI's antiracist and student development principles, a common theme reported by LREU mentors was an expansion of their conceptions of the capabilities of undergraduates. Mentors commented that they realized that undergraduates could learn quickly and make tangible contributions to research. Therefore, they had adopted a growth mindset orientation towards undergraduate students and their capacities. This theme was most prominent among mentors from HSI R1 institutions who were less likely to have experience in mentoring undergraduate research students because they work primarily with advanced undergraduate students, graduate students and postdoctoral scholars. However, CAHSI encourages the participation of less experienced undergraduate students in research to foster their social and cultural integration into computing and to promote an early sense of belonging in the field. A mentor from an R1 institution commented, "I thought that only graduating seniors were capable of doing sophisticated research but this is not the case." Another R1 faculty member commented, "I learned that undergraduates are capable of designing interesting and impactful studies and going through the steps to run those studies. It was great to see such independence from the students."

Institutional differences in equity-oriented mindsets

Longstanding CAHSI departments are primarily teaching-oriented institutions, while CAHSI has recently expanded its reach to include many R1 and emerging R1 institutions. However, there were differences in the adoption of antiracist and inclusive practices between these institutional types. In general, highly research active institutions (R1s) had created fewer opportunity structures involving equity-centered practices than teaching-oriented HSIs. In particular, R1 CAHSI departments were statistically significantly less likely to offer diversity-oriented computing student clubs or organizations (R1 HSI mean of 2.32 compared with teaching institutions, 3.04, $p=0.000602$), to implement culturally relevant activities in the department (R1 HSI mean of 1.97 compared with teaching institutions, 2.54, $p=0.006321$), and implement academic co-curricular opportunities, such as peer-led team learning or supplemental instruction (R1 HSI mean of 2.22 compared with teaching institutions, mean=2.98, $p=0.000542$). On the other hand, R1 departments were equally likely to offer undergraduate research opportunities and to value research mentoring.

To inform the understanding of these patterns in the survey data, the qualitative interviews with active CAHSI faculty in many of these departments affirmed that the culture and values of R1 departments, at times, is in conflict with the equity-focused values and practices upheld by the CAHSI network. Leadership in R1 departments noted that research is valued above teaching and service, and there is an emphasis on meritocratic excellence, rather than the inclusive excellence focus that is promoted by CAHSI. For instance, in the first year of the Local Research Experiences for Undergraduates (LREU) program, most of the R1 departments met their targets for the number of undergraduate research students to recruit; yet most of these students did not meet CAHSI's target demographics of Latinx, low-income, or other underrepresented students. However, in the second year, many of the R1 departments recruited more diverse students into the LREU program, suggesting that they are in the process of implementing and testing equity-centered practices.

On the other hand, survey results suggest that R1 faculty are more satisfied with their workload, distribution of tasks, and work-life balance than faculty at teaching-oriented HSIs. In particular, they are statistically significantly more satisfied with the support in the department for research activities (R1 HSI mean of 3.25 compared with teaching institutions, 2.45, $p=0.000845$), the level of funding they receive for research (R1 HSI mean of 3.35 compared with teaching institutions, 2.73, $p=0.00528$), and the number of advisees they support (R1 HSI mean of 4.06 compared with teaching institutions, 3.60, $p=0.02159$). Interviews affirm that faculty in teaching-oriented HSIs often have high advising loads which may diminish their overall workload satisfaction. Further, faculty at teaching-oriented HSIs noted that it is difficult to structure an undergraduate research program in their institutions because of a lack of administrative support for research and grants and a lack of time to advise undergraduate research students.

Discussion and Conclusion

To dismantle racism in STEM fields, discriminatory and exclusionary organizational cultures must be interrogated and transformed. The systemic change to institutional structures envisioned by Kezar (2018) and others will only be achieved if departments infuse equity-centered values into everyday actions and decision-making. CAHSI departments have achieved some success on this challenging journey by aligning departmental and institutional missions, embedding opportunity structures within and outside the curriculum to provide multiple entry points for students, and engaging in ongoing learning and reflection to strengthen these opportunity structures. HSIs can play a leading role in broadening participation in STEM fields (NASEM, 2019). However, departments and the HSIs where they are situated must adopt and enact organizational mindsets that disrupt the logics of narrowly defined merit and exclusivity in STEM (Blair-Loy & Cech, 2022) to adopt more expansive logics of inclusivity and equity.

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