

Building HSIs' Capacity to Raise Latinx Computing Attainment through Federal Policy Efforts

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ABSTRACT

Although traditionally underfunded and overlooked in federal, state, and local policy efforts, Hispanic- Serving Institutions (HSIs) play a central role in shaping the ecosystem of the nation's STEM workforce by preparing disproportionately high shares of Latinx, African American, and Native American STEM graduates [4]. Enrolling more than 25% Latinx students, HSIs can play a critical role in preparing Latinx communities to pursue computing fields and increasing the diversity of the computing workforce. Despite their documented success at producing racially minoritized STEM graduates, research about why HSIs and other MSIs are so effective at producing high shares of STEM and computing graduates is scant [4]. This paper integrates the perspectives of computer science education research, higher education organizational change, and research on HSIs to demonstrate their potential to shape participation and policy in computing and technology. It employs scholarship about a nationally funded alliance as a case study to illustrate how research can inform policy and support student success.

CCS Concepts

Professional topics- Computing education - Computing education programs- Computer science education

KEYWORDS

Hispanic-Serving Institutions; Computer Science; Federal policy

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1 POLICY AND SYSTEMIC CHANGE

To date, investments to diversify computing have largely been concentrated in selective Historically White Institutions (HWIs), moreover, popular literature has emphasized the role of the “Big 12” most “elite” departments of computer science education in diversifying the tech industry [1]. Though it is important to diversify these spaces, this recommendation is short-sighted, given the low enrollments of minoritized students in these departments and the negative experiences they often encounter [2.3.4]. The exclusion of minority serving institutions in federal computing investments [5] perpetuates structural racism and upholds a discriminatory “eurocentric epistemology that focuses on only the “best and brightest” minds” [3]. In order to make significant progress toward equity in computing, our efforts must center institutions that play a vital role in the development of racially minoritized students, namely HSIs.

Although traditionally underfunded and overlooked in federal, state, and local policy efforts, HSIs play a central role in shaping the ecosystem of the nation's STEM workforce by preparing disproportionately high shares of Latinx, African American, and Native American STEM graduates [4]. HSIs make up the majority (70%) of all MSIs and enroll more Black students than Historically Black Colleges and Universities (HBCUs) and more Native American students than Tribal Colleges and Universities (TCUs) [6]. HSIs play a critical role in preparing Latinx students to pursue computing fields. While the most recent national data indicates that 11% of bachelor's degree graduates in computing fields from all postsecondary institutions were Latinx, 37% of bachelor's degree graduates from HSIs were Latinx, a more than three-fold difference [7].

Despite their documented success at producing racially minoritized STEM graduates, research about why HSIs and other MSIs are so

effective at producing high shares of STEM and computing graduates has historically been scant [4]. This condition led the National Academies of Sciences, Engineering, and Medicine to recommend that more research be conducted on MSIs' and HSIs' effective strategies to promote the attainment of historically underserved communities in STEM fields [4]. Meanwhile, the American Association for the Advancement of Science (AAAS) 2019 report *Levers for Change*, which reviewed literature on undergraduate STEM reform in each STEM discipline, identified that the historic disconnection between STEM education and higher education organizational change literature, identified as early as 2011 by Henderson and colleagues [8, 9] and corroborated to the present [10], has hindered reform in undergraduate STEM education. Yet, such reform is sorely needed to broaden participation and form policies that uplift historically underserved communities like Latinx in computing.

Policy efforts can prove to be a powerful mechanism to enact change when they are informed by research. However, current scholarship regarding STEM education is disconnected from higher education and policy research, leading to silos in the literature. Perspectives from computer science education research, higher education organizational change, and research on HSIs has the potential to shape participation and policy in computing and technology if they are better integrated and leveraged.

Emerging organizational change research argues that efforts to address unequal STEM outcomes have largely been aimed at the student-level rather than targeting the organizational dynamics and environments that hinder the success of racially minoritized students [10, 11, 12]. Student level efforts such as implementing a STEM mentoring program can help students navigate STEM environments, however, they don't address larger structural challenges such as racist or sexist STEM cultures that minoritized students face [2]. Addressing harmful environments requires institutional change which focuses on "changing mindsets, policies, practices, across the multiple levels and cultures of a system" [12]. Perspectives from organizational change research suggest that achieving sustained equitable outcomes in computing will result from greater focus on transforming the structures and cultures within institutions that create barriers for minoritized student success [13]. Research focusing on HSIs and computing education has similarly examined how greater equity can be achieved. Work at this intersection has demonstrated that HSIs in a national computing alliance are able to achieve greater Hispanic success in computing by centering Hispanic cultural assets [14]. Centering these values is an example of Hispanic servingness, a multidimensional framework that focuses on institutions moving away from simply enrolling Hispanic students to intentionally serving them [15]. The framework can aid in transforming HSIs to better serve Hispanic students by examining different levels of servingness such as promoting positive academic and non-academic outcomes, building structures to enact the values of serving, and managing external influences on serving [15].

Valuable insights can be gained from the practices of computing departments who are successfully advancing Hispanics in computing. Scholarship about a two-decade network

of Hispanic-Serving Institutions is well positioned to inform policy. Computing equity is at the center of the network's efforts, with the central goal of raising Latinx attainment in computing. This network began in 2004 and was first funded by NSF in 2006. In the ensuing twenty-years, it has evolved from a network of 8 computing departments in HSIs committed to developing and implementing signature pedagogical and undergraduate research practices to a network of over 80 departments aiming to advance equity in computing [16, 17]. The network advances growth mindset, talent development, and asset-based teaching practices through student programming, faculty professional development, and coaching to develop strategic actions for equity [18].

2 POSITIONALITY STATEMENT

The team for this piece includes one Latina, one Latino, and two Whites. Three of the authors are cisgender women and one is a cisgender man. The authors have been immersed in the network's activities for a collective total of 45 years, which has augmented their capacity to trace and engage in policy efforts related to equity in computing education. Two have served as faculty or staff members for over a decade in two different, broadly accessible HSIs similar to the institutions in the study in terms of enrollment composition and resources. These social identity and institutional backgrounds informed the authors' adaptation of an "HSI institutional positionality" where they employed their extensive experiences in HSI and STEM research and policy efforts to expand opportunities for Latinx in computing via support of HSIs. One author is currently a member of the NSF Advisory Subcommittee for STEM Education, meeting regularly with its director and other members to examine the investment, impact, and future direction for the Directorate's resources. In this paper, the authors draw on their personal and professional backgrounds, and a range of research studies over the years, to address the potential for the computer science education community to inform federal policy to advance equity in computing, particularly at HSIs [17, 18].

3 IMPLICATIONS OF POLICY ON COMPUTING EQUITY

Federal agencies including NSF and NIH recently have increased their investments in diversifying the scientific enterprise. In 2015, NSF launched its [Eddie Bernice Johnson Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science Initiative] [INCLUDES] that was the first agency-wide effort to diversify science fields. Conceptualized in 2017, NSF INCLUDES was part of the 10 "big ideas" initiative at the foundation to address the nation's most pressing scientific and technical problems and to support innovation and emerging opportunities. Since the first round of funding in 2018, NSF INCLUDES has provided large scale grants in the \$10 million range to at least two multi-institutional alliances focused on advancing computing equity: CAHSI, led out of the University of Texas at El Paso, and the Alliance for Identity-Inclusive Computing Education, led out of Duke University. CAHSI received funding in 2018, the year after a congressional mandate was issued that required that NSF establish a Program allocating funds to HSIs with the express purpose of strengthening

HSIs' efforts to promote student success in STEM fields. These policy trends have strengthened the capacity to generate research about HSI's effective practices in computer science education.

4 RECOMMENDATIONS TO INFORM POLICY THROUGH COMPUTING EQUITY WORK

To better inform computing equity policy we support NASEM's recommendation that more research be conducted and disseminated about the effective strategies of MSIs, including HSI's, to promote the attainment of Latinx, African Americans, and Native Americans in computing fields [4]. Additionally, NASEM's recommendation for increased federal and state investment in HSI's to broaden the Latinx workforce in STEM fields is critical to the future of computing [4].

Though there is limited research regarding MSIs and HSI's there is existing evidence that can aid in policy efforts. Integrating computer science education research, higher education organizational studies, and research on HSI's can serve as a starting point to develop effective policies that will expand postsecondary opportunities for historically underserved communities. For example, policies that aim to address Hispanic attainment in computing should reference research that has shown the value of centering Hispanic cultural assets [15]. Creating culturally relevant policies can aid in transforming environments to better serve students. Additionally, looking at organizational change literature can aid in creating policies that move beyond the student level to those that aim to change organizational structures and dynamics. Policies that are informed by organizational change should take a systems perspective that focuses on changing deficit mindsets, harmful cultures, and ineffective institutional policies [10, 11, 12, 14]. Lastly, policymakers would benefit from leaning on the expertise of HSI's whose computing departments are successfully advancing minoritized students. The INCLUDES Alliance, CAHSI, has regularly been consulted on the drafting of federal bills that direct resources toward MSIs in STEM fields. Several of the authors of this piece have reviewed these bills and had the opportunity to provide input on these bills, including highlighting empirical research that can be cited to substantiate such efforts.

5 IMPLICATIONS FOR THE RESPECT COMMUNITY

Affirming the NASEM's assertion that research in MSIs can advance equitable STEM education approaches [4], this piece highlights the importance of attuning to the wisdom of knowledge created in HSI's to inform policies and practices that will raise computing attainment for Latinx and the other minoritized communities that HSI's serve. STEM reform can be facilitated through greater synergy between disconnected areas of research. Therefore, researchers should make intentional efforts to conduct their work through integrating multiple perspectives. Additionally, more STEM equity researchers should gear their work toward policymakers as well as academic audiences [1]. With these points in mind, we offer some recommendations for the RESPECT community.

Tap existing resources that support scholars in writing policy-oriented work to disseminate research on equity-centered STEM practices, including those grounded in MSIs like HSI's and HBCUs, for policymakers.

In recent years, new resources have emerged to support researchers in putting their research into the hands of policymakers. These include the Scholars Strategy Network (<https://scholars.org/>) and the Op-ed project (<https://www.theopedproject.org/>). The main requirement to engage in these networks is an interest in preparing research that will reach policymakers, and they are available to researchers at all institutions, not just Historically White Institutions whose researchers often get more policy attention. These networks train and support researchers in translating their work to policy audiences. These networks offer workshops on how to write opinion pieces, how to talk to the media, and how to circulate research to federal and state policymakers. Members of the RESPECT community can tap these resources to spread approaches to policy-making that will center equity. RESPECT community members can also look out for more localized disciplinary resources to support dissemination of their research to policymakers.

Researchers should work in mutually beneficial ways on advisory boards or committees with entities that include federal agencies, non-profits, and industry to strengthen equitable approaches to computing education.

This kind of work can include serving on task forces with federal agencies, non-profits (such as the National Academies of Sciences, Engineering, and Medicine) and industry when invited. While such work often is not monetarily compensated and can be time-consuming, participating in such task forces ensures that those with knowledge about how to advance equitable policies and programs are at the table, that their voices are heard, and that their perspectives have a chance to inform critical policy decisions, including those about resource allocation.

In one example of such work, CAHSI, with the support of NSF, organized a workshop to gather recommendations from HSI computer science faculty and administrators about how NSF could more effectively invest in MSIs. The NSF workshop ultimately led to at least five outcomes: (1) a report sent to NSF within three months documenting the proceedings and recommendations of the workshop, (2) a meeting with two other MSI groups (HBCUs and TCUs), ASEE (American Society for Engineering Education), and NSF stakeholders to further the conversation toward broader recommendations for how both MSIs and NSF can take actions to build capacity in grant applications [20], (3) research workshops led by CAHSI to increase collaboration among Latinx computer scientists and those at HSI's on grant applications, (4) professional development for computer scientists at MSIs to sharpen their grant-writing skills, and (5) a specialized call by the NSF CISE (Computer and Information Science and Engineering).

Directorate for grant proposals whose eligibility standards included requiring the lead PI to be from an MSI that had never received CISE funding to date. The first cycle of grants has already been awarded, and at least one more cycle is planned. These outcomes transpired in less than a year, a relatively short amount of time. Yet, they

indicate progress toward systemic change in building multi-institutional capacity for computer science research in MSIs, supported by policy decisions to allocate funding to historically under-resourced MSIs [21].

Researchers should be poised and ready at all times to contribute to conversations on advancing equitable investments in and approaches to computing education.

Researchers invested in equitable computing education should constantly be scanning the evolving landscape of decision-making for chances to inform policy. Policy windows can open up at unexpected times, as signaled by sudden chances to testify or comment on how to transform or improve existing approaches to investments in STEM education. For example, the authors of this piece have been invited to give feedback on federal bills that have allocated resources to MSIs for STEM education; however, they typically only had 48 hours to respond to calls from legislative staffers on Capitol Hill. Researchers need to be ready to take advantage of these chances to gain the ear of policymakers [22]. When researchers invest time and energy learning how to translate their work to inform policymakers about equity-centered practices, they are better prepared to take advantage of chances to expand policymakers' perspectives on how to cultivate more inclusive and equitable STEM and computer science investments and policies.

6 IMPLICATIONS FOR POLICYMAKERS

Recommendations to diversify computing education by solely focusing on the "top 12" prestigious computer science departments in the country which often receive the most popular and media attention [1] will lack sufficient impact, simply because of the comparatively low numbers of students of color that these Historically White Institutions (HWIs) graduate. Research on effective computing education has primarily taken place in HWIs that do not reflect the full diversity of the US population, and the corresponding limited institutional and student samples have limited the applicability of this research to more diverse students that often attend HSIs [4]. Policymakers must challenge historical underfunding of HSIs toward serving minoritized students in computer science, because HSIs have been so effective at overproducing Latine/x/a STEM graduates [2, 3]. While this paper focuses on HSIs due to its empirical focus on the CAHSI network, the following recommendations apply to all MSI types [4].

Federal policymakers must invest in more research on effective and culturally sustaining computing education approaches in HSIs.

Computing education has inherited a racist and sexist culture [23, 24, 25, 26, 27]. It is not surprising then, that although most students from all majors surveyed four years after beginning college report gains on measures of global and community consciousness, computing students actually report the largest declines on these measures [28]. Our research on CAHSI's approaches reveals that undergraduate computing education does not have to inevitably lead to declines in global and community engagement. Rather, CAHSI's approaches demonstrate that computing education can offer multidimensional academic,

financial, social, cultural, and career student support that empowers administrators, faculty, staff, and students alike in building a culturally affirming community and a sense of belonging [29, 30].

Federal and state policymakers must allocate resources to support the development and institutionalization of effective infrastructure, organizational strategies, practices, and programs at HSIs.

A recent US Government Accounting Agency report documents that 65% of HSIs face 5 or more major challenges in funding their infrastructures to support students; 67% of HSIs perceive a lack of federal funding as a major barrier to implement and sustain capital improvement projects [31]. This same report finds that the decline in public funding for higher education in the past five decades has had an especially adverse impact on HSIs' capacity to provide facilities conducive to student success in STEM fields, particularly facilities in technological infrastructure that are so critical to computing education. To understand how allocations of funds deliver impact, robust data systems must be developed across institutions [32]. With HSIs demonstrating so much promise in their relatively high graduation rates of Latine/x/a computing education students and in their regional as well as national importance, these institutions merit commensurate federal and state investments in their capacity to serve their students.

Federal and state policymakers must actively seek out and listen to the perspectives of HSI leaders and personnel to respond to the most urgent and pressing needs of these institutions.

Policies that focus on HSIs need diverse stakeholder input to ensure impact [33]. Only by directly engaging with HSI communities and listening to the needs of HSIs will policymakers be able to design approaches that best serve these institutions. One of the reasons that the National Science Foundation Computer Information and Science Engineering Directorate's referenced earlier was so successful is that NSF program personnel supported the HSI community, including faculty in many CAHSI institutions and their partners, to convene to distill key recommendations on how NSF CISE could best support HSIs with its investments [8, 21]. Reviewing the extensive research on approaches in HSIs that support student success, such as "servingness" [16] and more specialized applications of servingness in computing education [34] can provide policymakers with tools to inform the design of requests for proposals and other policy mechanisms. In addition, reaching out to HSI leaders to review drafts of federal and state policy documents can help ensure that legislative bills and mandates are more attuned and responsive to HSIs' needs (18)[21]. Since the requests turnaround time for feedback on such bills can often be very rapid (as short as 24 hours), researchers who are experts in culturally sustaining computer science education must be ready to offer quick responses to raise the probability that the voices of HSIs will be heard and incorporated into the final bills.

As the majority of HSIs are public institutions, federal and state policymakers should also design policies to be attuned to the diversity among HSIs, which range from less well-resourced community colleges to Hispanic-

Serving Research Institutions that have more recently become HSIs [35].

These different kinds of HSIs serve different kinds of students in the postsecondary ecosystem. In general, Latine/x/a students, including STEM and computing majors, are more likely than other students to begin their undergraduate educations at community colleges. Policymakers should intentionally fund different institution types to recognize their distinctive roles in paving postsecondary pathways in computing education. While we have emphasized the role of federal and state policymakers here, the recommendations in this section also apply to private funders and foundations who are seeking to engage HSIs.

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REFERENCES

- [1] A. Webb. *The big nine: How the tech titans and their thinking machines could warp*. United States, Hachette Book Group. 2019.
- [2] E. O. McGee, "Interrogating Structural Racism in STEM Higher Education," *Educational Researcher*, vol. 49, no. 9, pp. 633–644, Nov. 2020, doi: <https://doi.org/10.3102/0013189x20972718>.
- [3] E.O. McGee. *Black, brown, bruised: How racialized STEM education stifles innovation*. Boston, MA. Harvard Education Press. 2020.
- [4] L. L. Espinosa, K. McGuire, and L. M. Jackson, Eds., *Minority Serving Institutions*. Washington, D.C.: National Academies Press, 2019. doi: <https://doi.org/10.17226/25257>.
- [5] Kimberly L. King-Jupiter, "From the Guest Editor: Community Engagement and Social Transformation: Understanding the Need for Change." *Journal of Community Engagement and Scholarship* 12, no. 3 (2020): 8.
- [6] A-M. Núñez, S. Hurtado, S., and E. Calderón-Galdeano, E.. Why study Hispanic-Serving Institutions? In A-M. Núñez, S. Hurtado, & E. Calderón-Galdeano (Eds.) *Hispanic-Serving Institutions: Advancing research and transformative practice*. United States, Routledge. Pp.1-22. 2015.
- [7] National Center for Science and Engineering Statistics. *Women, Minorities, and Persons with Disabilities in Science and Engineering* Washington, D.C. NSF 19-304. 2019.
- [8] American Association for the Advancement of Science. *Levers for Change*. Washington, D.C. 2019. Available at: https://www.aaas.org/sites/default/files/2019-07/levers-for-change-WEB100_2019.pdf
- [9] C. Henderson, A. Beach, and N. Finkelstein, "Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature," *Journal of Research in Science Teaching*, vol. 48, no. 8, pp. 952–984, Sep. 2011, doi: <https://doi.org/10.1002/tea.20439>.
- [10] D. L. Reinholz, I. White, and T. Andrews, "Change theory in STEM higher education: a systematic review," *International Journal of STEM Education*, vol. 8, no. 1, Jun. 2021, doi: <https://doi.org/10.1186/s40594-021-00291-2>.
- [11] E. J. Perez, *The Life Cycle of STEMM Intervention Programs: From Adoption to Institutionalization* (Doctoral dissertation, University of California, Los Angeles). 2023.
- [12] N. López, D. L. Morgan, Q. R. Hutchings, and K. Davis, "Revisiting critical STEM interventions: a literature review of STEM organizational learning," *International Journal of STEM Education*, vol. 9, no. 1, Jun. 2022, doi: <https://doi.org/10.1186/s40594-022-00357-9>.
- [13] R.J., Perez, R. Motshubi, & S.L. Rodriguez,. (2022). " We are a huge source of labor": Exploring STEM Graduate Students' Roles in Changing Departmental Climate. *The Review of Higher Education*, 46(1), 33-66.
- [14] J.R. Posselt. *Equity in Science: Representation, Culture, and the Dynamics of Change in Graduate Education*. Palo Alto, CA. Stanford University Press. 2020.
- [15] A.-M. Núñez, J. Rivera, J. Valdez, and V. B. Olivo, "Centering Hispanic- Serving Institutions' strategies to develop talent in computing fields," *Tapuya: Latin American Science, Technology and Society*, vol. 4, no. 1, Jan. 2021, doi: <https://doi.org/10.1080/25729861.2020.1842582>.
- [16] G. A. Garcia, A.-M. Núñez, and V. A. Sansone, "Toward a Multidimensional Conceptual Framework for Understanding 'Servingness' in Hispanic-Serving Institutions: A Synthesis of the Research," *Review of Educational Research*, vol. 89, no. 5, pp. 745–784, Jul. 2019, doi: <https://doi.org/10.3102/0034654319864591>.
- [17] A. Q. Gates, H. Thiry, and S. Hug, "Reflections," *ACM Inroads*, vol. 7, no. 4, pp. 69–73, Nov. 2016, doi: <https://doi.org/10.1145/3010823>.
- [18] M. Beheshti, N. Santiago, P. Morreale, A.Q. Gates, E. Villa,. (2022, August). Broadening participation of latinx in computing graduate studies. In 2022 ASEE Annual Conference & Exposition.
- [19] E. Villa, S. Hug, H. Thiry, D.S. Knight, E.F. Hall and A. Tirres, "Broadening Participation of Hispanics in Computing: The CAHSI INCLUDES Alliance American Society for Engineering Education," *monolith.asee.org*. <https://www.asee.org/public/conferences/148/papers/24674/view>
- [20] American Association of Engineering Education, MSI-CISE report. www.asee.org. <https://www.asee.org/documents/publications/reports/2020-MSI-CISE-Report.pdf>. 2020.
- [21] F. Cobb Payton, F., & A.Q. Gates. The Role of Institutional Leaders in Driving Lasting Change in the STEM Ecosystem. *Issues in Science and Technology*, 39(4).2023.
- [22] M. McGuire and L. W. Perna, "Connecting Policymakers With Academic Research to Inform Public Policy," *Change: The Magazine of Higher Learning*, vol. 55, no. 6, pp. 15–20, Nov. 2023, doi: <https://doi.org/10.1080/00091383.2023.2263188>.
- [23] Benjamin, R. (2019). *Race after technology: Abolitionist tools for the New Jim Code*. Polity.
- [24] Mack, K. M., Winter, K., & Soto, M. (Eds.). (2019). *Culturally responsive strategies for reforming STEM higher education*. Emerald Publishing.
- [25] McGee, E. O. (2020). *Black, brown, bruised: How racialized STEM education stifles innovation*. Harvard Education Press.
- [26] Noble, S. U. (2018). *Algorithms of oppression: How search engines reinforce racism*. New York University Press.
- [27] Sax, L. J., Blaney, J. M., Lehman, K. J., Rodríguez, S. L., George, K. L., & Zavala, C. (2018). Sense of belonging in computer science: The role of introductory courses for women and underrepresented minority students. *Social Sciences*, 7(122), 1–23.
- [28] Anne-Marie Núñez, Matthew J. Mayhew, Musbah Shaheen and Laura S. Dahl, Let's Teach Computer Science Majors to Be Good Citizens. The Whole World Depends on It. <https://www.edsurge.com/>. <https://www.edsurge.com/news/2021-03-15-let-s-teach-computer-science-majors-to-be-good-citizens-the-whole-world-depends-on-it>, 2021
- [29] Núñez, A. M. (2022). Creating cultures of student success: Insights from Hispanic-Serving Institution computer science

- departments. *Change: The Magazine of Higher Learning*, 54(5), 44-51.
- [30] Núñez, A. M. (2023). Examining organizational behavior of Hispanic-Serving Institution computer science departments: Toward servingness and equity in the field. *Journal of Women and Minorities in Science and Engineering*.
- [31] U.S. Government Accountability Office, Higher Education: Hispanic-Serving Institutions Reported Extensive Facility and Digital Infrastructure Needs. <https://www.gao.gov/.https://www.gao.gov/products/gao-24-106162> , 2024
- [32] Zarch, R., & Dunton, S. (2022, May). Looking Back to Move Forward: Measuring K-12 Computer Science Education Requires an Equity-Explicit Perspective. In 2022 Conference on Research in Equitable and Sustained Participation in Engineering, Computing, and Technology (RESPECT) (pp. 100-104). IEEE.
- [33] E. Litzler, & B. Serafini, 2018. NCIT End of Year External Evaluation Report. Retrieved April 15, 2024: www.ncwit.org/resources
- [34] Rivera, J., & Núñez, A-M. (2022). Staff at Hispanic-Serving Institutions: Debugging challenges in navigating computer science. *About Campus*, 27(1), 38-47.
- [35] A. M., Núñez, G. Crisp, & D. Elizondo (2016). Mapping Hispanic-Serving Institutions: A Typology of Institutional Diversity. *The Journal of Higher Education*, 87(1), 55-83. <https://doi.org/10.1080/00221546.2016.11777394>