WIP: Embracing Challenges for Transformative Change in Research Capacity at Hispanic-Serving Institutions

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Abstract*— This work-in-progress innovative practice paper describes an approach and presents preliminary results of an effort by the NSF-funded Computing Alliance of Hispanic-Serving Institutions (CAHSI) to build research capacity of faculty at HSIs and students from underserved populations. A key factor in our nation's ability to innovate solutions to grand challenges and compete in a technology-enhanced world that rapidly changes is the involvement of individuals with different perspectives, experiences, and disciplinary knowledge. Diversifying representation in research cannot be achieved without involvement of HSIs, which enroll significant numbers of minoritized students in U.S. higher education. This paper describes a CAHSI-Google Institutional Research Program (IRP) that builds research capacity through partnerships between computing doctoral-granting CAHSI institutions and computing non-doctoral granting CAHSI institutions. This paper describes the IRP and its well-defined process to support faculty as they develop and refine research ideas and submit competitive proposals for funding through the IRP that includes a collaboration plan outlining coordination mechanisms and student professional development efforts.

Keywords—research capacity building, computing research

I. INTRODUCTION

A key factor in our nation's ability to innovate solutions to grand challenges and compete in a rapidly changing technology-enhanced world is the involvement of individuals with different perspectives, lived experiences, and disciplinary knowledge. Diversifying representation in research cannot be achieved without involvement of Minority-Serving Institutions (**MSIs**), which enrolls significant numbers of minoritized students in U.S. higher education. The National Academies in Science, Engineering, and Medicine's report [1], *Minority-Serving Institutions America's Underutilized Resource for Strengthening the STEM Workforce*, states: "MSI presidents and senior leadership should take aggressive, proactive steps to better position themselves to compete for public and private STEM research grants and contracts, either independently or in collaboration with local, regional, and national partners" (p.88).

The Computing Alliance of Hispanic-Serving Institutions (**CAHSI**), a national alliance of over 125 Hispanic-Serving Institutions (**HSIs**) and partners across our nation, has accepted a call to action to build research capacity of students and faculty at HSIs, i.e., increasing competitive research efforts. Partnering with Google, CAHSI defined initiatives to increase student engagement in research and build research capacity at HSIs. The Institutional Research Program (**IRP**) invites researchers to submit abstracts in areas of mutual interest to Google, provides researchers with feedback on their ideas and an opportunity to refine their submissions, and then invites researchers to submit proposals for further review. This paper provides background information on the alliance, an overview of the IRP, initial results, and ends with a summary.

II. BACKGROUND

A. Overview of CAHSI

For over 15 years, CAHSI has served as a national resource for diversifying the computing workforce and academia. CAHSI was established in 2006 to fulfill its overarching goal of serving as a unified voice to support HSIs and Hispanics in computing fields. CAHSI set an ambitious vision in 2019 following extensive consultations with its diverse stakeholders: to increase Hispanic representation among computing graduates to 20% by the year 2030 (parity with the overall U.S. Hispanic population) [2][3]. Using a collective impact framework [4][5], CAHSI operates through a shared vision and common agenda for cultivating computing leaders, supporting students through signature practices, and achieving systemic change. A strength of CAHSI is its dissemination of signature practices adapted to the local culture of the adopting institution.

B. CAHSI's Efforts to Build Research Capacity

Over the years, CAHSI has engaged in a series of impactful efforts to bolster research at HSIs. In 2019, CAHSI convened a workshop that influenced the creation of the NSF Computer and Information Science & Engineering (**CISE**) MSI Research Expansion program. In 2020, CAHSI hosted an ideation workshop to foster the development of research projects that address key challenges and align with NSF's research priorities.

Another significant effort to build research capacity at HSIs is CAHSI's undergraduate research experiences initiative that focuses on strengthening students' scientific identities to bolster their aspirations to STEM research careers and sharpen their understanding of tools and practice of scientific research [6][7]. The effort included involvement of African Americans/

Blacks, Hispanics/Latinx, Native Americans/ Alaskan Natives (**AHN**) students in STEM fields [8][9]. Research experiences at MSIs and, particularly HSIs, can promote student success and entry into STEM professions [6][8] and graduate programs.

With funding from the NSF Broadening Participation in Computing and Google, CAHSI began a local REU (**LREU**) initiative that provides research experiences at the home institution for AHN students with financial need and preference to first-generation college students. The initiative builds upon the features of the CAHSI virtual REU (**vREU**) model [10][11]: students are matched based on their areas of interest with a balance on developing students' domain knowledge in areas aligned with CAHSI research institutions; faculty mentors co-create a research plan with their mentees; students maintain a research journal in which they record their learnings and areas for growth and development as researchers; and students create and refine their research poster based on constructive critique. Mentors receive training on the Affinity Research Group (**ARG**) model [2] for building student research success. Many IRP faculty have been involved in the LREU and ARG training.

C. *Related Work*

The American Society of Engineering Education (**ASEE**) established the Capacity Building for Research at MSIs: Infrastructure Research Readiness program (**CyBR-MSI: IRR**) to increase the capacity of researchers from MSIs to prepare competitive research proposals to the NSF. This effort included a dedicated workshop focused on preparing competitive applications to the NSF CISE Research Expansion Program by providing sessions on key proposal components and best practices for proposal preparation that included individualized mentoring and coaching. The IRR program also focused on the university's campus research readiness for pre-award and post-award duties and budget creation; communities of practice; coaching from experienced mentees; and a research readiness action plan. ASEE's capacity building programs were established based on insights from the 2020 Conference on Increasing Participation of Minority-Serving Institutions in NSF CISE Core Program [12].

A strategy to build capacity at emerging research universities with limited resources is to develop research in cluster areas [13] that bring together faculty from multiple disciplines to conduct research centered on a common theme. The intent is to address regional needs while leveraging regional capabilities, strengths, and resources. Using this approach, the University of Puerto Rico [14] defined initiatives to promote interdisciplinary research and facilitate research relevant to Puerto Rico. An example of a partnership strategy is the Comprehensive Partnerships to Advance Cancer Health Equity (**CPACHE**) [15], funded by the National Cancer Institute (**NCI**), which aims to increase capacity for cancer-related research at institutions serving under-represented minority populations through collaboration with NCI-designated comprehensive cancer centers.

III. The Institutional Research Program Approach

A. *Overview*

In late Fall 2022, CAHSI entered a three-year collaboration with Google to build research capacity at HSIs by establishing a research proposal and refinement process involving CAHSI researchers who are conducting research in areas of mutual interest to Google. This effort, referred to as the CAHSI-Google Institutional Research Program (**IRP**), intentionally builds faculty research collaborations across the Alliance and supplies seed funds and Google Cloud Platform credits to support competitive research projects. Funded projects also support HSI undergraduate and graduate students to engage in intensive computing research experiences with the intent to bridge more Hispanic students into computing doctoral programs.

The IRP provides annual funding for ten to fifteen one-year projects that involve an investigator from a computing doctoral-granting CAHSI institution and one from a computing non-doctoral granting CAHSI institution, as well as at least one student from each institution. Using a well-defined process, CAHSI supports faculty in their development and refinement of research ideas and submission of competitive proposals for funding through the IRP or other programs.

The process used for the CAHSI-Google IRP consists of an iterative review process as shown in Fig. 1. The ideation sessions provide an opportunity for peers and reviewers (senior members of CAHSI's Research Network) to provide constructive critique about submitted abstracts and identify areas of improvement. In the Research Refinement phase, faculty sign-up for one of several virtual abstract-review meetings at which they receive additional feedback. The reviewers submit their top choices for invitations to submit a full proposal. The IRP planning committee reviews the recommendations and selects the top 30. The elevator pitches are live sessions at which faculty investigators receive additional feedback from Google researchers before submitting a full proposal. An NSF-style review panel reviews and selects the top fifteen proposals. Google provides input on the selection of the final proposals to be funded.

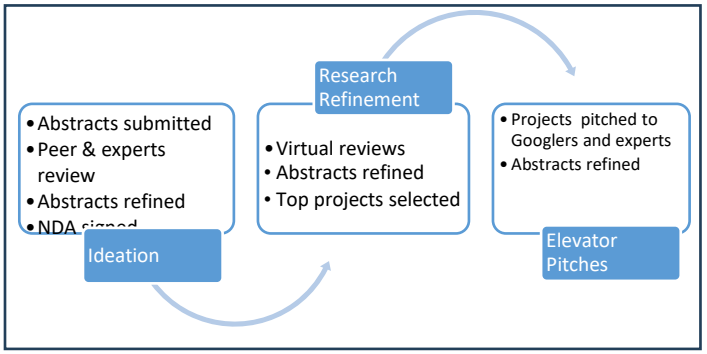

Figure 1: Abstract refinement process.

B. *Call for Abstracts*

Active researchers from CAHSI non-doctoral and doctoral computing programs are encouraged to submit abstracts through a call disseminated broadly by CAHSI regional leads, connectors, department chairs, and institutional points of contact (**POC**). The CAHSI Backbone also announces the call for abstracts at regional meetings to ensure broad participation.

Interested researchers are required to submit abstracts addressing the following narrative components: research

problem (describe the problem or need); justification (why people should care); and goals/approach. Researchers are asked to identify relevant research keywords to describe their ideas and the expertise that would be ideal in a collaborator.

As part of the abstract submission process, researchers are required to sign a non-disclosure agreement and complete profiles on the CAHSI Expertise Connector system, an online tool that allows faculty and professional staff to highlight their research, state their areas of interest, and build communities of practice. The CAHSI Expertise Connector broadens the faculty member's research network and helps other researchers within the Alliance to find them.

C. *Information and Ideation*

Researchers submitting abstracts are required to attend one of several *information sessions*, providing them an opportunity to better understand the work of CAHSI and the urgency for building research capacity at HSIs; gain an overview of the IRP process and Google interests; seek clarification; and meet other potential collaborators. CAHSI researchers who do not submit an abstract, but who are interested in participating in a project, are also invited to attend the information sessions.

Ideation is realized through a virtual collaboration board that allows researchers to view all abstracts. Each frame on the board includes a submitted narrative and space for peers and reviewers to comment via sticky notes. Researchers seeking collaborators can find peers with the necessary research expertise and can suggest combining ideas.

Figure 2: Example feedback provided on collaboration board.

The IRP planning committee recruits senior computing research experts to provide constructive critique on the abstracts. The research experts come from within the CAHSI Research Network, faculty at non-CAHSI institutions, and researchers from national labs and industry. Identified research experts are assigned abstracts within their areas of expertise for review and commenting on the collaboration board. By the end of ideation, each abstract will have received constructive critique and potentially even collaboration requests from peers. Fig. 2 shows example feedback that was provided to a researcher.

D. *Research Refinement*

Participating researchers are invited to attend one of a couple of virtual research refinement office hours hosted by their assigned CAHSI-identified research expert. During the office hours, researchers have an opportunity to seek clarity about feedback and discuss ways to improve their abstracts. Research experts often ask probing questions and explain what aspects of the abstract could be clarified. Project scope and research methods are common points of discussion. One of the most discussed topics is how to be succinct while highlighting the necessary points, an art form many early career researchers have not yet mastered.

Following office hours, abstract submitters have a final opportunity to edit their abstracts. Researchers can also choose to combine research ideas with a collaborator or join another project. Based on the finalized abstracts, the research experts give final recommendations on the project they feel should be invited to submit a full proposal. After vetting by the IRP planning committee, the top projects are identified and invited by the IRP planning committee to submit a full proposal.

E. *Building the Research Network*

The call for proposals requires the top projects to submit a one-page project summary, six-page project description, two-page collaboration plan, and a budget justification. Research teams are also provided the opportunity to request up to $20,000 in Google Cloud Platform (GCP) credits. By the time of full proposal submission, projects must identify partnerships between a researcher from a CAHSI computing doctoral program and one from a CAHSI non-doctoral program.

Principal investigators who have not yet identified an eligible collaborator are invited to review abstracts that were not selected and search CAHSI's Expertise Connector website that provides biographies of CAHSI researchers. The Backbone also actively works to find collaborators for unpaired researchers. The Backbone then circulates those expertise keywords to CAHSI department chairs and POCs to find potential collaborator matches. To protect the intellectual property of participants, abstracts are not shared by the Backbone outside the applicants. Furthermore, the name of the institution or institutional type (i.e., doctoral, non-doctoral, R1, R2) is not circulated to avoid bias. As potential collaborators come forward to express interest in participating, the Backbone connects researchers, another key aspect for building the CAHSI Research Network and potential research collaborations across the Alliance.

F. *Elevator Pitches*

Each researcher who is invited to submit a full proposal is also invited to pitch their ideas to Google researchers at a live elevator pitch session. Participating researchers are provided a template from which they must model their elevator pitch slide deck. The presentation is limited to six slides and must hit key points such as the problem, significance, approach, long-term and one-year goals, objectives or research question(s), how the research will advance the field, investigator qualifications, measures of success, and broader impacts. The IRP Panning

Committee uses the slide decks to identify Googlers who would be best suited to provide feedback in the live sessions. Googlers also review the slide decks prior to the elevator pitches to be better prepared with constructive critique.

As part of the elevator pitch session, a Googler gives a keynote talk providing researchers more insight as to research interests at Google. Researchers and collaborators are assigned a virtual breakout room assigned to a research area. Within a week of the elevator pitches, the CAHSI Backbone provides each research team with a summary of questions raised and constructive critique given during their pitches. The elevator pitches provide yet another critical opportunity for invited researchers to receive constructive critique (this time from an industry perspective) that can be used to refine their ideas and make their full proposals more competitive. Additionally, the elevator pitches not only function to increase awareness within CAHSI of active research paths, but they also serve to increase Google's awareness of CAHSI faculty's research.

G. Process to Select Final Awardees

The review process for full proposals mimics that of an NSF review panel. Each full proposal is reviewed and scored by a minimum of three research experts, with a fourth research expert who must be familiar with each of the proposals and serve as a blue-ribbon panelist. Each research expert is renowned in their respective field. Conflicts of interest are identified prior to proposal assignments.

Scoring summaries are assembled prior to the review panels. Proposals are scored based on the following criteria: originality of the proposed research (innovative beyond prior work in the field with transformative concepts); soundness of the proposed project plan (well-reasoned, well-organized, feasible in a 12-month period, and clear metrics of success); potential for scientific and real-world impact (advances scientific discovery and understanding, and investigators well-suited to carry out the proposed research); potential for broader impact (potential to contribute to the broadening participation goals of the program and leverage Google Cloud credits and other resources); and the collaboration plan. Proposals should adhere to Google's AI Principles [16] that include items such as: be socially beneficial, avoid creating or reinforcing unfair bias, be built and tested for safety, and incorporate privacy design principles.

A unique aspect of the IRP is that it pairs a faculty member from a doctoral program with one from a non-doctoral program, and these researchers are intended to be peers in the project. This shifts the typical uneven power dynamics between a faculty member at a research-intensive institution and one at a more teaching-focused institution. The collaboration plan is intended to capture how well-integrated each faculty researcher will be in the project, define how each member will contribute, and identify opportunities for shared learning. A successful collaboration plan should also outline student engagement, research capacity building, and opportunities for student researchers to meet, collaborate, and receive co-mentoring.

Review panels are grouped by research area. An individual with experience in leading review panels (e.g., a former NSF program officer) leads each of the review panels. Notes are taken during the review panels to provide review summaries to project teams. Lead reviewers assigned to each research area attend a "Blue Ribbon" panel to discuss proposals across all areas. The previous panels' recommendations regarding competitiveness are combined and discussed to calibrate proposal rankings. After extensive discussion and questioning, the Blue-Ribbon panel agrees upon the top fifteen projects to recommend to Google. Feedback from the internal CAHSI review panel is provided to all research projects, regardless of funding, to further build faculty research capacity.

Google undertakes its own internal review process of the fifteen recommended projects. Proposal packets are evaluated on strength of the research proposal, soundness of proposed project plan, potential for broader impact, relevance to Google's research areas, and potential field impact. Based on the reviews, a Google panel recommends the final projects to be funded. Finally, the joint CAHSI-Google IRP planning committee meets to discuss final decisions.

At the time of award notification, investigators are told they must submit a mid-term and final report and are provided templates. Google and CAHSI work together with project teams to identify the appropriate Google Cloud Platform (**GCP**) credit distribution, get compliance letters signed by the receiving institution, and to distribute the GCP.

During the 2023-2024 funding cycle, CAHSI received 88 project abstracts. Of these, 83 were from doctoral computing programs and 20 from non-doctoral programs. The top 30 projects were selected, with 25 led by doctoral program PIs and five by non-doctoral program PIs. Of the top 30, 27 teams submitted full proposals. The final ten funded projects supported 20 Latino and six Latina students. One project was led by a non-doctoral institution and another project involved a two-year college.

In the 2024-2025 cycle, 75 abstracts were submitted (55 from doctoral and 20 from non-doctoral programs). Notably, 85.3% were submitted without pre-identified collaborators, and 73.3% of the principal investigators (**PIs**) were assistant professors. Among the top 30 projects, 22 were led by doctoral PIs and eight by non-doctoral PIs, and 27 teams submitted full proposals. Google extended funding to 15 awardees, 12 of which were new awards and three were renewals. Nine of the new awards were led by PIs from doctoral computing programs. Notable is that six of the PIs and six of the co-PIs in the new cohort are female as opposed to the previous cohort that had a total of six female investigators with only one serving as the PI.

IV. Initial Results

The impact of the IRP has shown promising results for both faculty and students. The 2023-2024 CAHSI Collective Impact Survey revealed that 71% of faculty survey respondents submitted grant proposals in the past year (n=52 survey respondents), and 57% of faculty survey respondents submitted collaborative grant proposals with other CAHSI institutions to support fundamental CS/engineering research [17]. Out of 118 faculty who participated in the IRP program, 23 NSF awards were granted to a subset prior to participation in the IRP (1/2021-12/2022). Fourteen months after IRP participation, the number of NSF awards almost doubled (n=43).

The benefit of continuous feedback and refinement of abstracts, an essential feature of the IRP initiative, is captured from a chair's comment regarding a faculty member who is in her first year in a tenure-track position and a top 30 IRP finalist in the first cohort. Her chair made appropriate consolatory comments to let the faculty member know that being declined for funding was part of the academic process. To her surprise, the faculty member reponded by stating "Oh no! It was a great experience. While our project did not get funded, we have some good ideas about a proposal we can do in the future … suggestions about how we could use the strengths of [the collaborator's] team to support my work here [at a non-PhD granting institution]." The faculty member continues to work with the collaborator she found through the IRP process.

The student outcomes described below are those reported by the IRP leads. The IRP research projects have served as the core components of several Hispanic students' master's thesis projects and several leads reported that their students presented papers in top-tier conferences and were co-authors on paper submissions. Moreover, other faculty reported that their undergraduate students' exposure to research provided them confidence to pursue graduate studies in computing and the guidance to prepare graduate program applications. After being inspired to continue his research, a Latino community college student, who received funding from the IRP, earned his associate's degree, entered the bachelor's program, and is now a member of the research lab at the partner R1 institution. Another undergraduate Latino from an R1 CAHSI institution entered a highly competitive graduate program at a R1, non-CAHSI institution. Two other Latino students have entered doctoral programs after their involvement in the program. The IRP also revealed unanticipated educational impact. Several researchers reported that they integrated novel research findings into their courses, opening pathways for the upcoming cohort of students to explore innovative concepts. Another IRP PI reported that his doctoral students have benefitted from mentoring master's students at the partner non-doctoral institution because they felt that their interactions with students are preparing them for their future faculty careers.

V. SUMMARY

The IRP fosters mutually beneficial partnerships between HSIs, including those with and without doctoral programs, and even extends to collaborations with Google researchers. By enhancing HSI research capacity to tackle critical issues, the IRP opens doors to selective funding opportunities which supports student professional growth, preparing them to enter competitive academic, workforce, or entrepreneurial positions. The IRP team professes that the approach will transform how we think about who can be involved in research, who should be involved in research, and how we can support research success, which will ultimately lead to broadened participation in computing research. Such a change is needed to address the national call to action to increase the number of domestic students who enter and complete doctoral programs, which is critical for our nation to maintain it global prominence and competitive edge in STEM.

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