EXTERNAL EVALUATION OF THE CAHSI INCLUDES ALLIANCE, 2021
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Executive Summary

In the past year, CAHSI expanded, sustained, and scaled its efforts, despite continued disruptions from the pandemic. CAHSI made great strides in coordinating regional efforts and strengthening regional collaborations by hosting virtual events, such as hack-a-thons, within and across regions. CAHSI also demonstrated progress in the use of data for strategic planning as a result of two all-hands meetings that focused on departmental enrollment data at the undergraduate and graduate levels. Overall, CAHSI grew its efforts to build the capacity of HSIs to support underrepresented students in computing. The continued support of the CAHSI backbone team and regional leadership, and capacity-building efforts such as the mini-IDEAS workshop, were integral to this growth.

Despite the pandemic, the CAHSI INCLUDES community made progress in putting CAHSI’s mission and vision into action by developing and implementing strategic action plans. Almost all faculty and staff survey respondents (85%, 41) had developed strategic actions during the past year at varying levels of effort. Nearly the same number of survey respondents had implemented strategic activities in the past year, a higher rate than in the beginning of the CAHSI expansion, and similar to the rate of the previous academic year prior to the pandemic. Therefore, CAHSI sustained its strategic planning and activities in the midst of the COVID-19 pandemic. Although the most notable barrier to advancing strategic actions continued to be a lack of time to engage in planning and strategic actions. Lack of time was mentioned by many faculty in response to an open-ended question about barriers to achieving CAHSI’s vision.

As CAHSI reaches the end of year 3 in the INCLUDES grant, the regional ecosystems envisioned in the grant proposal have solidified into productive, highly collaborative regional networks and partnerships. All of the regions collaborated on virtual student support activities in the past year, such as hack-a-thons and professional development workshops. In the past year, CAHSI participants needed less guidance about the vision and mission of CAHSI as they settled into their roles and gained momentum in strategic planning and action. Indeed, the percentage of CAHSI participants who received support from CAHSI national leadership in understanding how their role relates to CAHSI’s vision declined from nearly half to about a third (30%). This result suggests that participants, especially newcomers, have gained understanding of their roles and are more familiar with CAHSI’s vision, a finding corroborated by interviews with CAHSI personnel. A similar percentage of CAHSI faculty and staff survey respondents marked that they had received resources or training related to signature practices, an equal rate as the previous year, suggesting that the CAHSI national leadership maintained their support for signature practices during the pandemic. The Alliance, as measured by individuals’ ratings of their peers in the social network,
has increased in its already strong perceptions of one another as reliable, trusted, and mission-driven (means of 3.88 to 3.98 out of 4 on all items).

According to the faculty and staff survey, in the past year, CAHSI participants used data to improve programs and make decisions at similar rates that they had in previous years (e.g., about 70% of participants had used data for these purposes to “a slight extent” “some extent” or “great extent”). The percentage of CAHSI participants who had used data “to a great extent” remained consistent at about one quarter of survey respondents. Additionally, about ¾ of participants had shared evidence-based practices, demonstrating the benefits of regional networks and regular, cross-institutional communication and coordination among participants. Similarly, about the same percentage of CAHSI participants (about 75%) as in previous years had used data in the past year to identify regional or local needs. However, the way that participants used data changed from previous years in that CAHSI held two all-hands meetings related to review enrollment and graduation data and use it for strategic planning. Subsequently, the regions met independently to review regional data and discuss how to use it to inform their planning and actions. As a result of this process, several regions decided to focus more effort on the recruitment, retention, and advancement of women, specifically Latinas, as they saw that there was room for improvement in their graduation.

Despite the COVID-19 pandemic, CAHSI departments continued to expand, sustain, and scale multiple student support activities, such as research experiences, hack-a-thons, conferences, workshops, clubs, and leadership positions. The student advocate program expanded in the past year as almost all departments recruited and supported student advocates. The GMiS conference was also shifted to a virtual format and continued to provide an opportunity, albeit slightly more limited, for students and faculty to connect and interact. Additionally, CAHSI departments sustained their high rate of student clubs and organizations (75% of departments reported sponsoring student clubs) during the pandemic. Adoption of CAHSI signature practices was moderately high throughout the network in the past years, although some practices have been adopted at higher rates than others. Still, the rate of implementation of signature practices fell from 83% of survey respondents to 62% of survey respondents, indicating that some departments may have struggled in the past year to sustain signature practices during the pandemic. For instance, the percentage of respondents who reported that they offered a problem-solving course in their department fell from about 67% to 58% of participants. Nevertheless, the most common signature practice continues to be the problem-solving courses, which has been facilitated by the Faculty-in-Residence program at Google and the community of practice that has been formed around the course. Departmental uptake of peer-led team learning also fell slightly, from 50% of departmental respondents to 43% of departmental survey respondents.
Introduction

The Inclusion Across the Nation of Communities of Learners (INCLUDES) initiative is one of the National Science Foundation’s Ten Big Ideas with the goal of dramatically broadening participation in STEM fields by creating networked relationships among organizations and across sectors. The Computing Alliance of Hispanic-Serving Institution (CAHSI) INCLUDES community builds upon the success of CAHSI in the past decade in developing the organizational capacity and partnerships to promote the recruitment, retention, and advancement of Hispanics in computing. CAHSI INCLUDES uses the collective impact framework to bring together stakeholders across sectors to tackle the problem of the underrepresentation of Hispanics in computing.

This mixed-methods evaluation study contains formative, summative, and needs assessment elements. The evaluation goals are to provide summative results to assist CAHSI determine whether it is meeting its goals related to collaborative infrastructure and to provide formative information and feedback to help CAHSI INCLUDES in understanding the reach, capacity, connections, and strategic actions in its collective impact efforts. The evaluation data collected for this report includes participant observation at CAHSI INCLUDES events and meetings, stakeholder interviews, website and document analysis, social network and collective impact surveys of CAHSI members and affiliates, and case study data of particular initiatives. Survey results from scale-up efforts in the past year appear in summary form under “Expansion, Sustainability, and Scale” and as separate reports in the Appendices. The evaluation questions addressed in this report are:

1) How has the CAHSI INCLUDES community developed the capacity, connections, and expertise to be able to work collectively across regions to achieve a common vision?

2) How has CAHSI utilized the collective impact model and its principles of effective practice to facilitate change, specifically, the collaborative infrastructure elements as designated by NSF?

3) In what ways does capacity and strategic planning differ by region and by the length of involvement of members in the CAHSI community?

4) To what extent has communication and trust developed across the network facilitated strategic planning and action?

5) In what ways has the Backbone functioned to support the growth and development of the CAHSI INCLUDES network in relation to the five elements of collective impact?

Rather than focusing on individual institutional results within regions, this report focuses on the work of the national CAHSI INCLUDES community in solidifying its vision and partnerships and advancing common goals. To this end, the evaluation focuses on the connections within the
CAHSI network; the commitment, values, and organizational capacity of network members and affiliates; and the strategic actions undertaken within the network. The evaluation focuses exclusively on capacity and activities of the regional and national network overall to implement strategic action and does not address individual or institutional outcomes related to achieving CAHSI’s vision. The CAHSI data management team will be responsible for tracking each institution’s progress towards reaching CAHSI’s vision and monitoring national benchmarks related to enrollment, graduation, and other metrics of Hispanic representation in computing. In turn, the external evaluation will focus on the health, growth, and capacity of the network overall. This report is framed within the five elements of collaborative infrastructure to provide insight into the development of the CAHSI community as related to the five critical areas of emphasis.

**Evaluation Methodology: Data Sources for Annual Report**

**Collective Impact Survey**

One of the goals of the evaluation is to better understand how regional members participate in CAHSI, how they view the value of the collaborative infrastructure, the progress they have made in thinking strategically about working toward the common goals, how regional strategic planning is informed by CAHSI’s vision, and how implementation is guided by data. The evaluation also seeks to identify what is working well in encouraging regional relationships, communication, and strategies. To that end, the evaluators distributed the collective impact survey to all regional CAHSI participants to measure progress in achieving the outcomes laid out in the CAHSI visioning document. The survey was sent to all faculty, collaborators, and others who have attended CAHSI regional or national meetings or events within the past two years. The survey was sent to 163 CAHSI participants and 48 responded. The survey was sent to 25% more recipients than in the prior year, demonstrating the expansion of CAHSI’s reach within the past year. Respondents were largely from the southwest region (50%) and west region (21%), but the north region (16%) and southeast region (12%) were also represented. Many respondents were relatively new to CAHSI: nearly 2/3 of respondents (61%) had participated in CAHSI for two years or less, about one quarter of respondents had participated in CAHSI for 3-5 years, and the remainder were long-time veterans who had participated in CAHSI for 10+ years.

**Social Network Analysis**

The social network analysis was developed to map the social network and its health throughout the life of the CAHSI BPC Alliance. Two years of data serves as comparative longitudinal information about the functioning of CAHSI, and is further analyzed at the regional and role level. The evaluators utilized the Partner tool, developed by Danielle Varda and her team from the University of Colorado, Denver. The tool was adapted to focus on computer science education
and is based on the theory of social network management and optimization. Questions address whom is connected to whom and the quality of those relationships (e.g., trust, value), what contributions individuals bring to the collaborative, the extent to which the collaborative is reaching its goals, and how the change to collective impact might influence the CAHSI community. The evaluators utilized the analysis tools provided by PARTNER to develop social network maps on multiple variables, including types of joint activities with which members engage together and frequency of communication. See https://visiblenetworklabs.com/partner-tool-resources/ for more information on the resource. The survey was distributed to backbone staff, regional leads, co-leads, coordinators and connectors electronically. This year, all participants received additional documentation requested by participants to easily link individuals to roles as they completed their survey. The survey was held open for approximately 3 months and reminders were sent to individuals who had not completed the survey. This year, 27 CAHSI staff and leaders took the survey out of a possible 33 who were asked to do so. Four of the six have never complied with the request.

**Interviews with Regional Leadership**

CAHSI leads, co-leads, connectors, and coordinators were asked to participate in interviews with evaluation team members. Interviews typically lasted 60 minutes and were audio recorded and transcribed using an online transcription service. Transcripts were analyzed using content analysis methods and incorporating the 5 elements of collaborative infrastructure as well as the case of the Engage tool to draw out how CAHSI is developing collaborative infrastructure for impact. Interview data was utilized to illustrate and provide examples of how collective impact is understood from multiple perspectives within CAHSI, and quotes appear throughout the evaluation report, as they are relevant to Collaborative Infrastructure. Quotes are representative of the larger findings and themes that arose from the interview data. Because the interviews were lengthy and complex, there was not always a single quote that best typified the themes in the interviews, and therefore, interview themes may be discussed in broader terms and without representative quotes.

**Interviews with CAHS Scholars**

CAHSI Scholars were interviewed for the first time this year to serve as an in-depth case study of student capacity building. All Scholars were invited to participate in interviews, and all 11 Scholars were interviewed by an evaluation team member via telephone. Interviews were coded for themes that related to CAHSI participation.

**Focus groups with FemProf Alumna**

A small study of Fem Prof Alumna was conducted in late fall 2020. Fem Prof alumna were recruited to participate in focus groups to discuss their career trajectories and their experiences with the Fem Prof program, a student capacity building program emphasizing graduate school,
research, and the professoriate. This report includes a summary of findings from 4 focus groups in fall of 2020 with 13 Fem Prof alumna from the University of Puerto Rico Mayaguez. The study highlighted benefits of the Fem Prof program according to alumna, programmatic elements that Fem Prof participants found most valuable, the programmatic approaches appreciated by the alumna. They also described some potential additions to Fem Prof that could bolster the program, as CAHSI considers expanding graduate school preparation.

**Participant Observation**
CAHSI evaluators were present at all national meetings and nearly all regional meetings throughout the year. At each of these meetings and trainings, CAHSI evaluators took extensive notes that were then analyzed using similar processes as interviews. Observation notes were searched for key themes and examples of each of those themes (e.g., regional communication, mentoring, strategic planning, etc.) were identified.

**Experiential Surveys**
CAHSI evaluation covers national and new local activity to measure impact of new initiatives. Most survey instruments emphasize capacity building, belonging, confidence, skill and knowledge development, as well as actionable impact such as what respondents have accomplished because of their work in one of the CAHSI initiatives. This year, full reports appear in Appendices covering GMiS, the virtual REU, Mini Ideas lab, and two of the Google ECR programs. The impact of these initiatives is summarized in the Expansion, Sustainability, and Scale section.

**Analytic methods**
The quantitative data were entered into SPSS or Microsoft Excel where descriptive statistics were computed. Frequencies and/or means are reported for most of the items, These items were rated on a 5-point or 7-point Likert scale. Centrality and density of the social network data were computed. Tests of statistical significance, such as t-tests or one-way ANOVAs, were not conducted because they were not appropriate given the data. Although inferential statistics were not computed, group differences are reported, when relevant, using descriptive statistics, such as crosstabs and means.

Write-in responses to the open-ended questions and stakeholder interviews were coded using domain analysis methods. Each new idea raised in a written response was given a unique code name. As these same ideas were raised by later respondents, each segment was added to an existing code reflecting that idea. At times the write-in answers were brief and represented a single category, but more frequently, responses contained ideas that fit under multiple categories, and these were coded separately. Codes were organized into larger, descriptive categories, or “domains.” Domains were generated deductively, from the research and evaluation questions and theoretical concepts guiding this study (e.g., five elements of collective
impact), and inductively, from the data itself. The coding framework was organized into
taxonomies linked by a semantic relationship, such as “a is a kind of b,” or “a is a result of b.”
Componental analysis allowed for examination of outcomes and differences among groups, such
as gender, ethnicity, organizational affiliation or career rank.

Evaluation Findings
The report is divided into sections based on the elements of collaborative infrastructure: shared
vision, partnerships, common goals and metrics, leadership and communication, and expansion
sustainability and scale. Relevant data are described and discussed within each section. The
report includes an executive summary, an impact of initiatives section, and final
recommendations for future consideration as CAHSI continues to scale its efforts and expand its
reach.

Shared Vision
Throughout the project, CAHSI made great progress each year in democratically and
deliberatively developing vision and mission statements. In recent years, the focus has centered
on solidifying regional networks, scaling CAHSI activities, and broadening the visibility and reach
of CAHSI. As a mechanism for documenting efforts and tracking participants, CAHSI established
use of the Engage Tool across national and regional membership. CAHSI has shifted its
perspective on membership and has expanded access to key programs, while emphasizing a more
deliberately collaborative technical research agenda across faculty. Defining and promoting a
common agenda, or vision, among members and participants is one of the key tasks of a
collaborative infrastructure. To that end, one of the goals of the evaluation this year was to better
understand how members view the vision and the progress they have made in thinking
strategically about working toward the common goals.

Shared Vision: Collective Impact Survey
The results of the vision and practices survey demonstrate that the CAHSI community
continued to make progress in putting CAHSI’s mission and vision into action through developing
and implementing strategic action plans. Almost all survey respondents (85%, 41) had developed
strategic actions during the past year at varying levels of effort. Therefore, CAHSI participants
continued to engage in strategic planning and action as the community continued to grow and
develop. Nearly the same number of survey respondents had implemented strategic activities,
a higher rate than in the beginning of the CAHSI expansion, but similar to the rate of the previous
grant year. Slightly fewer CAHSI participants developed and managed partnerships to advance
CAHSI’s vision than in the previous year (66% compared to 76%); however the difference was
small and the survey response indicates that participants are still focused on leveraging local and
regional partnerships to support their work with CAHSI. Finally, nearly the same percentage of participants submitted grant proposals to seek funding to advance CAHSI’s vision (42% in the past year compared to 43% in the previous year).

Figure 1. Advance CAHSI’s Shared Vision

![Bar chart showing the percentage of participants engaged in various activities related to implementing CAHSI’s vision.]

There was some regional variation in activities related to implementing CAHSI’s vision. Overall, the North region was relatively engaged in all aspects of implementing CAHSI’s vision, while the Southwest was focused more on designing and implementing strategic actions. Still, all regions were active in strategic planning and implementing strategic activities, while there was more variability in engaging in developing cross-sector partnerships or submitting grant proposals related to CAHSI.

Figure 2. Regional efforts in advancing CAHSI’s Vision

<table>
<thead>
<tr>
<th></th>
<th>Southwest</th>
<th>West</th>
<th>North</th>
<th>Southeast</th>
<th>ALL CAHSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designed strategic actions</td>
<td>83%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>82%</td>
</tr>
<tr>
<td>Implemented strategic actions</td>
<td>88%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>84%</td>
</tr>
<tr>
<td>Developed cross-sector</td>
<td>66%</td>
<td>50%</td>
<td>50%</td>
<td>60%</td>
<td>58%</td>
</tr>
<tr>
<td>partnerships</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submitted grant proposals</td>
<td>33%</td>
<td>40%</td>
<td>80%</td>
<td>60%</td>
<td>45%</td>
</tr>
</tbody>
</table>
The length of affiliation with CAHSI and attendance at regional meetings were more important than regional affiliation for participants’ actions to advance CAHSI’s vision. For instance, 93% those who attend every CAHSI meeting were involved in developing and implementing strategic actions, while only 60% of those who seldom attend meetings were similarly engaged. Therefore, regular attendance at regional and all-hands meetings is a strong indicator of engagement in strategic planning and action. In addition to expanding its reach, CAHSI national and regional leadership could also identify how to engage some of the participants who are currently peripherally engaged in CAHSI.

Newcomers to CAHSI were more involved in developing and implementing strategic actions than they had been in previous years. Veteran CAHSI participants continued to be highly engaged: 100% of participants who had been involved with CAHSI for 10+ years were involved “to a great extent” in implementing strategic actions. On the other hand, about ¾ of newer CAHSI participants (77%) were also involved in implementing strategic actions, although to a varying extent. However, newcomers were slightly less involved in managing local cross-sector partnerships (60% of those with less than 2 years of affiliation with CAHSI and 100% of those with more than 10 years of CAHSI participation). Likewise, CAHSI veterans were much more likely to submit grant proposals related to CAHSI activities (100% of those with more than 10 years of participation and 27% of those with less than 2 years of participation).

**Barriers to Achieving CAHSI’s Vision**

Similar to previous years, the most frequently reported barrier in response to an open-ended question about barriers to achieving CAHSI’s vision was a lack of support and buy-in of CAHSI’s vision from faculty colleagues, and to a lesser extent, administrators/chairs. Other notable barriers included faculty time to implement strategic actions and a lack of support staff from institutions without a connector or coordinator in the department. Other CAHSI participants mentioned lack of financial support or resources as barriers to implementing CAHSI’s vision in their department and/or region. Finally, a fair number of CAHSI faculty also commented that the COVID-19 pandemic continued to be a barrier as all activities were still conducted remotely in the past year.
Typical responses about organizational barriers include:

*Faculty buy-in. Our organization has a lot of students, and not enough faculty. A lot of them are overworked, and do not have the time to participate in CAHSI activities/outreach.*

*Faculty resistance in accepting the challenge of BPC*

*Getting buy-in with everyone in upper administration. Another barrier is getting assistance with endeavors that might not "pay", such as with the event planning, club meetings and outreach to the K-12 schools. Other instructors and admins dismiss non-paid activities as not worthwhile and to find others to help with everything is sometimes difficult.*

*I believe our greatest barrier is the lack of participation from our faculty in professional development programs focusing on equity and inclusion, as well as understanding that some of them are the major contributors of students leaving the CS degree, as they are told that because they struggle with math and CS course they do not belong in CS.*

*Maybe some staffing support can really help us.*

**Benefits of Collective Impact for fulfilling the Shared Vision of CAHSI: Network Survey**

In the social network survey, leadership and staff were asked to describe what the most important potential benefit of the collective impact approach could potentially be. The data
changed slightly from last year, and “improved resource sharing” became the most common response, followed by the increased sense of belonging among those who influence Hispanics, and improved community support across sectors. This change indicates a shift in understanding of the collaborative infrastructure functioning—the resource sharing, a moderately deep level of collaboration, sense of belonging that motivates participation, and cross sector emphasis all appear in more advanced collective impact systems (such as those in years 3-5). When asked what the most IMPORTANT element of collective impact for fulfilling shared vision, participants included a sense of urgency in the top 3. See charts.

Figure 4. Potential Benefits of Collective Impact in the work of CAHSI INCLUDES
Respondents to the CAHSI Social network survey described what aspects of the INCLUDES Alliance support its success. All options were selected by more than half of the respondents,
indicating a fairly robust set of practices that support CAHSI in realizing the shared vision. In fact, having a shared mission and goals was most often selected as a contributing factor for success, tied with exchanging information and knowledge. Sharing resources and using data to make decisions were the next most common, with 23 and 22 survey respondents out of the 27 who completed the network survey.

Figure 6. Aspects of collaboration that contribute to CAHSI's success

Shared Vision: Regional partners' assets for contributing to CAHSI

To accomplish the shared vision, CAHSI INCLUDES needs to procure resources vital to its success. In the social network analysis survey, participants were asked to describe the knowledge, expertise, actions, and networks they brought to bear on the CAHSI project, and how they were able to support the alliance. Results were broken down by region to understand how the larger network might supplement region assets based on strengths and weaknesses supported. Regional differences across newer regions may be attributed to the size of the region and the relative importance of non-response at the regional level. The three attributes least reported across groups were connections to national industry, ability to facilitate/lead, and ability to train others on signature practices. See below.
Figure 7. Contributions made to CAHSI by region

Shared Vision: Interview Evidence

A regional co-lead described the experience of collaborating in a local CAHSI meeting, and the ways in which they share ideas openly to support the vision of CAHSI.

“We have the same agenda, we are always talking about things and collaborating together. So that’s how we’re having a common vision. We don’t want each individual college to go about doing whatever. We’re collaborating together and helping each other.”

In interviews, CAHSI stakeholders brought up a tension they are facing related to shared vision—that of concentrating on regional not just local efforts to “move the needle” regarding Hispanic representation and participation in computing—the tension regarding how to ramp up activity on both levels was described by multiple interviewees. A connector put it this way:

“So I feel especially in this last year, we’ve definitely gained reach within our alliance, our (Region) Alliance. But we’ve also had other universities reach out and bring in their partners as well. So we’re looking at what we can do, not just at (institution), but within our region, because I think that is where I struggle sometimes. I think we’re doing really great things at (institution) but we need to make sure that we’re reaching other institutions in our region and sharing what other institutions are doing with everyone else.”

A co-lead described how the vision is actualized locally based on subregional and regional data and local intentions. The co-lead describes how the problem of Hispanic underrepresentation in computing is addressed through retention and career marketability locally:
“So, one thing that we have been focusing on is undergraduate student retention and success. So, as I mentioned, I very strongly believed that before they graduate, they should have a job. And in order to reach that, what can we do? So retention is a primary interest that I have been focused on.”

Another lead described the vision for CAHSL and the ways the region is zeroing in on the issues they find most compelling for their contexts. The lead describes a need to constantly look at alignment of activities and the problems they are trying to solve.

“The common agenda, the common agenda we discuss at the beginning, and that’s what we are trying to fix now because we think that, not necessarily that the departments are aligned. The measurements, the mutually reinforcing activity we’re trying to help each other in terms of curriculum and also in terms of increasing participation of women.”

Understanding the vision in CAHSL stakeholders own words is important for developing local and regional buy-in as well as for developing concrete understanding across CAHSL implementation sites. In the next section, the focus on partnerships emphasizes the ways in which CAHSL INCLUDES partners collaborate, strength of relationships, and the resources and processes that make such collaboration possible.

**Partnerships**
Collective efforts depend on strong partnerships with overlapping goals, distinct roles, and differing perspectives to help leverage promising practices in developing inclusive learning environments. We evaluate the partnerships developed in CAHSL primarily through the use of the social network analysis, which asks participants to evaluate the contributions, characteristics, and value of connections with their peers and with other colleagues in the structured CAHSL network. Roles are important in the regional and support network of CAHSL—different roles were created with differing expectations—this analysis looks at role and region to understand the growth and enrichment of the CAHSL network as a support system for creating inclusive change in computing.

**Partnerships: Social Network Analysis**
The tables below show the network relationships as they relate to individuals’ involvement with colleagues in CAHSL. First, we present the whole network at the level of leads, co-leads, connectors, coordinators, and backbone staff. There is a separate object for each region, in which backbone respondents are also included. The colors indicate region or belonging in the backbone. The first image shows the whole network in terms of its connections involving communication once per month as well as weekly. It differs from past years because of the deeper integration of key members across regions—in years one and two, the visual representation showed the backbone as the nucleus with regions spreading out like petals in all directions. This year, the
monthly communication shows richer integration of backbone members within regions, and a denser arrangement across regions. The central nodes for each region are typically leads or connectors.

Figure 8. Monthly Communication of CAHSI INCLUDES Members

Weekly communication shows a similar shape to the network, with fewer connections across members. Those at the periphery were less likely to have a weekly collaborator. Backbone members still had 3 or more connections weekly, and larger regions were more likely to maintain 3 or more connections weekly.
Figure 9. Weekly Communication of CAHSI INCLUDES Members
The social network analysis includes items regarding **how, or at what depth**, participants interact with other participants, and the extent to which they engage deeply through cooperative, low-commitment activities (level 1, e.g., sharing information about REUs) through integrated activities (level 3, e.g., developing shared content like the GMiS conference workshops) The table below defines the types of relationships CAHSI stakeholders may have with one another.

**Figure 10. Network depth of activities**

<table>
<thead>
<tr>
<th>Cooperative Activities:</th>
</tr>
</thead>
<tbody>
<tr>
<td>involves exchanging information, attending meetings together, and offering resources to partners. (Example: Informs other departments of a national or regional event for computing students)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coordinated Activities:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Include cooperative activities in addition to intentional efforts to enhance each other’s capacity for the mutual benefit of programs. (Examples: Sharing curriculum materials, discussing shared mentoring practices, sharing evaluation materials.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Integrated Activities:</th>
</tr>
</thead>
<tbody>
<tr>
<td>In addition to cooperative and coordinated activities, this is the act of using commonalities to create a unified center of knowledge and programming that supports work in related content areas. (Example: Working together to fund, provide content, and recruit participants for a co-sponsored event.)</td>
</tr>
</tbody>
</table>

**Figure 11. Regional networks mapped to cooperative activities**

Backbone (blue) and **West Region** (pink) mapped by cooperative activities

Backbone (blue) and **Southwest Region** (green) mapped by cooperative activities
What is notable about the backbone and its integration into regions is the way in which larger regions with subregion leadership and staff named as integral participants are intertwined more directly with backbone members. In the smaller regions, backbone relationships with region members appear more peripheral. In practice, there are faculty at institutions that practice the roles of the “co-Lead” without the designation- it is possible that if they were included, the system would appear more greatly intertwined with backbone.

At the level of integrated activities, we note the ways in which network maps, which in past years showed sub-regional or institution level collaboration at the level of integrated activities, now show integrated activity across all but one institution, and the lines, while connecting region members more completely, also cross over to backbone members. As regions move forward with plans for strategic action, it is possible they will create richer, more connected networks with appropriate redundancy.
Network comparison over time - 2019 through 2021

The overall network scores show similarities in density, with a slight increase in the number of possible connections that are fulfilled by participants (i.e., 1.3% more of the possible one to one connections have been made this year in comparison with last year). The decentralization of the network has gone down, yet the variability in the number of participant links is relatively high. This is by design—for example, the role of the connector is such that we would expect a large number of connections for those in that role, similar to the backbone, yet co-leads and coordinators are not expected to have as many one-to-one connections across the network, as they are designed to be ending nodes in the distribution structure. Trust, which was already quite high within CAHSI, has climbed to 91.6% out of a possible 100%. The next section will detail each element of trust more specifically.

Object 13. Network scores compared year to year

<table>
<thead>
<tr>
<th>Network Scores</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density</strong>: Percentage of ties present in the network in relation to the total number of possible ties in the entire network.</td>
<td>32.50%</td>
<td>33.80%</td>
<td>26.70%</td>
</tr>
<tr>
<td><strong>Degree Centralization</strong>: The lower the centralization score, the more similar the members are in terms of their number of connections to others (e.g. more decentralized).</td>
<td>72.60%</td>
<td>67.20%</td>
<td>39.7%</td>
</tr>
<tr>
<td><strong>Trust</strong>: The percentage of how much members trust one another. A 100% occurs when all members trust others at the highest level.</td>
<td>86.00%</td>
<td>91.60%</td>
<td>97.21%</td>
</tr>
</tbody>
</table>

While the value scores across the network have fallen slightly, and fall at or between 2019 and 2020 values, while remaining very high, above three out of 4 in all cases. Issues related to the pandemic may relate to this decline—it has been more difficult to hold events, so sharing resources has been less common, for example. However, trust scores have climbed, with support...
This may indicate a strengthening of resolve during COVID-19 to support underrepresented students, or at least the perception of ones’ peers has having strengthened resolve.

Object 14. Network connectivity, trust, and value

<table>
<thead>
<tr>
<th></th>
<th>2019 results mean values</th>
<th>2020 results mean values</th>
<th>2021 results mean values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Network connectivity values</strong></td>
<td>Degree Centrality: # of connections to other members of the network</td>
<td>8.79</td>
<td>10.13</td>
</tr>
<tr>
<td></td>
<td>Overall Value (1-4)</td>
<td>3.16</td>
<td>3.48</td>
</tr>
<tr>
<td></td>
<td>Power/Influence (1-4)</td>
<td>2.86</td>
<td>3.30</td>
</tr>
<tr>
<td></td>
<td>Level of Involvement (1-4)</td>
<td>3.42</td>
<td>3.72</td>
</tr>
<tr>
<td></td>
<td>Resource Contribution (1-4)</td>
<td>3.21</td>
<td>3.42</td>
</tr>
<tr>
<td><strong>Trust Scores:</strong> an average of the ranking given by all other members for that organization along three dimensions: reliability, support of mission, and open to discussion. Scale of 1-4.</td>
<td>Total Trust (1-4)</td>
<td>3.58</td>
<td>3.75</td>
</tr>
<tr>
<td></td>
<td>Reliability (1-4)</td>
<td>3.53</td>
<td>3.66</td>
</tr>
<tr>
<td></td>
<td>In Support of Mission (1-4)</td>
<td>3.65</td>
<td>3.84</td>
</tr>
<tr>
<td></td>
<td>Open to Discussion (1-4)</td>
<td>3.56</td>
<td>3.75</td>
</tr>
</tbody>
</table>

**Goals and Metrics**

The use of goals and metrics to track progress, inform decisions, and improve practice is central to the work of alliances employing a collaborative infrastructure. The data management team is responsible for developing common metrics and tracking institutional, regional, and national progress in achieving enrollment, graduation, and other goals. Additionally, the data management team will measure departmental climate as another outcome metric to track CAHSM's progress in creating equitable, inclusive learning environments for students and faculty. The evaluation focuses on the network’s use of data to drive decisions, documentation of strategies, and attitudes and actions towards data driven decision making.

Goals and Metrics via the Engage Tool- A case of measuring, documenting activity nationally
The Engage Tool is a database software system for reporting CAHSI activity across institutional partners. The software tool allows for multiple institutional stakeholders to enter information about the activities they have engaged in that supports the mission, vision, and strategic actions developed at the regional and national level. The tool is designed to produce reports for stakeholders at multiple levels, such as institution and region. This new tool is one way that CAHSI is developing shared methods for tracking progress. While enrollment and graduation data is still under the purview of the Data management team, CAHSI staff and leads are creating their own tracking metrics to understand how many students are receiving what kind of support. We asked CAHSI stakeholders specifically about the Engage Tool because we view it as an important step in ramping up documentation of impact.

**Tool with Potential**

In the February All Hands Meeting, Backbone leadership described some potential changes to the tool that will allow for “student capacity building” and “departmental capacity building” to become more prominent concepts. In addition, there was discussion of additional training related to categorization and technical aspects of the tool.

Staff who have been using the tool describe its potential for richer collaboration and communication across regions:

“I think one of the ways that potentially it could help is if the reports on the Engage tool were set up in a way where we can easily see what everyone else is working on. I think that's one of the things that the developers for the Engage tool were trying to figure out because there was a lot of errors in the report running. And so I think if we finally tap into that resource, it would be a really good way to see what everyone is working on, similarities between campuses that could potentially involve collaboration even though we're on different coasts.”

**Value**

CAHSI stakeholders see the value in the Engage Tool, as a way of documenting their efforts and showing others the impact they are having locally and regionally. Some find the tool user friendly as it is and find the useability a valuable aspect of the tool.

“Before we didn't have it all, okay, yeah, we just did this, this, and then we have to put the report together. So this makes it a lot easier at the end when you've got to do the report, because it's all there. It's just getting in the habit of making sure, oh yeah, we just did this, make sure we put it in.”

“I am understanding more with time and experience and practicing, but I'm getting it, and then the region is getting it a little bit, and with these meetings that we have been having (with backbone staff). Without the meetings, we'd be a mess, but with the meetings, they are understanding how to do it, and it's something that it will help them, REGIONAL LEAD explains
in the meetings. It will help them also to understand their accomplishments and the impact that they're having to present them for the directors or the deans ... It's useful for them.”

“The platform itself is very user friendly. You know where things are, they're labeled, you know how to input them. We have been changing the way that we input it so that way it shows on our end that INSTITUTION led the event or had such and such involvement and stuff like that. As for the usability, it's fine. I haven't had any issues with it.”

**Barriers/Needs**

Needs related to both conceptual and technical difficulties with the Engage Tool. For some, only allowing an .edu email address has slowed progress, particularly for schools where students are often co-enrolled in community college and four-year institutions. Other technical issues include how the regional affiliations influence which partner gets credited for work based on how the effort is documented in the tool.

Conceptually, CAHSI staff and leads are not always considering the strategic elements of their activities in a way that aligns with tool use—they may input an activity in a way that is out of alignment with the tool’s intent, and then are asked to re-do their documentation. This is frustrating to the staff and leads.

**Regional Differentiation**

All regions have different strategies for inputting data into the Engage Tool. Some regions have had multiple training sessions with a backbone staff member with experience of the tool, others have asked Backbone leadership for support. In some regions, coordinators and connectors input the data, while in others, co-Leads and leads do the data management on the Engage Tool. Some connectors meet with faculty to assist in the documentation, while other connectors take the information for the entire region and document it for all.

**Connection to Strategy**

Stakeholders have described the alignment between the activities they document and the strategic plans that they have developed based on the mission of CAHSI. Their quotes show that while they are not yet aligned at the local or regional level, they have plans to achieve this alignment.

“Overall, I want us to always be able to capture activities and things we’re doing, and then relate it to our vision and what we're striving for, our goals.”

“The plan, the strategic action plan that we’re trying to develop is something that needs to be real. It needs to be based on the men and women power they have in their hands. It's realistic.
(Departments) probably have lots of needs and areas that they want to work on, but they need to figure out what we can do in collaboration together, and documenting is important, and we have to put efforts on that, trying to get them understand how the Engage tool works. That also happens. It maybe happened a couple of workshops we arranged where we can really start something. As a region, we're working on alignment.”

Goals, Metrics and Strategic Planning: Collective Impact Survey

In the past year, CAHSI participants used data to improve programs and make decisions at similar rates that they had in previous years (e.g., about 70% of participants had used data for these purposes to “a slight extent” “some extent” or “great extent”). The percentage of CAHSI participants who had used data for these purposes “to a great extent” remained consistent at about one quarter of survey respondents. Additionally, about ¾ of participants had shared evidence-based practices, demonstrating the benefits of regional networks and regular, cross-institutional communication and coordination among participants. Similarly, about the same percentage of CAHSI participants (about 75%) as in previous years had used data in the past year to identify regional or local needs. Though fewer participants (about 60%) had used data to track organizational progress in meeting CAHSI’s goals. A similar percentage (about 60%) had used the CAHSI Engage tool or had used the Engage tool for strategic planning at their institution. Therefore, the majority of CAHSI participants report that they used data in the past year to identify needs and improve programs, although a smaller number of participants are highly engaged in data use.
Leadership and Communication

The Backbone organization and executive team constitute the leadership of the alliance, and the system of CAHSI INCLUDES with regional hubs, staff, and backbone support provides the infrastructure for collaboration and effective communication. The Backbone is responsible for providing a guiding vision and strategy for local efforts, promoting and marketing CAHSI at a national level, supporting strategic actions, and establishing common measures. Leadership and communication systems have been developing in the past 3 years to support collaborative action.

CAHSI Leadership Support: Collective Impact Survey

In the past year, CAHSI participants needed less guidance about the vision and mission of CAHSI as they settled into their roles and gained momentum in strategic planning and action. Indeed, the percentage of CAHSI participants who received support from CAHSI national leadership in understanding how their role relates to CAHSI’s vision declined from nearly half to about a third (30%). This result suggests that participants, especially newcomers, have gained understanding of their roles and are more familiar with CAHSI’s vision. A similar percentage marked that they had received resources or training related to signature practices, an equal rate.
as the previous year, suggesting that the CAHSI national leadership maintained support for signature practices during the pandemic. The percentage of respondents who received communication and coordination about CAHSI strategies from the backbone decreased from 44% to 24%, suggesting that regions are working more independently and may be relying less on CAHSI national leadership for coordination of strategies. Additionally, about one third of participants marked that CAHSI national leadership provides a guiding vision for CAHSI, suggesting that CAHSI could continue to regularly reinforce the guiding vision. Finally, 11% of participants marked that they received support in data use from CAHSI national leadership. In all, most CAHSI participants relied less on CAHSI national leadership in the past year, indicating that regional networks have strengthened and participants rely more on their regional and sub-regional partners as suggested by other survey findings.

Figure 16. Support Received from the Backbone Organization

Support Received from the Backbone Organization

- Understanding CAHSI’s mission/vision: 30%
- Resources/training/support in signature practices: 28%
- Communication/coordination about strategy/activities: 24%
- Data use: 24%
- Providing guiding vision: 20%
- Assistance with advocacy or policy: 13%
- Providing or securing funding: 6%

Overall, regions gained similar support from national leadership and placed the same amount of value on the support received. Therefore, there were no regional differences in support received from CAHSI national leadership, indicating national leadership is engaged with each of the regions at equivalent rates. On the other hand, CAHSI newcomers and veterans had distinct differences in their use of support from national leadership. For instance, only about 25% of veterans marked that they had received support from national leadership on any of the indicators, while 80%-90% of newcomers (those with less than 2 years of experience with CAHSI)
had utilized such support. Therefore, veterans seem to be implementing CAHSI’s vision and strategies relatively independently, while newcomers obviously need more support as they learn more about and become oriented to CAHSI’s vision and strategies. In this way, veterans do not need day-to-day support from national leadership, but newcomers to CAHSI clearly still have a strong need for support, especially concerning their role within CAHSI and implementing signature practices. Finally, participants who regularly attend CAHSI meetings utilized more support from national leadership, which is not surprising given that regular meeting attendance allows participants to interact more with CAHSI national leadership. In sum, newcomers needed more support from national leadership and regular meeting attendees benefited from the attendance of national members at regional meetings. Across the board, CAHSI participants received the most support in navigating their role within CAHSI, learning about CAHSI’s vision and strategies, and implementing signature practices.

Support Needed from National Leadership

In an open-ended question about how CAHSI national leadership can better support local efforts, there was general consensus that national leadership had provided important support for collective impact work and respondents offered some suggestions about the most important types of support that they still needed. A fair number of respondents (35%) reported that they did not need any further support or that they were not sure about additional support. Another common response (35%) was more opportunities for cross-regional interaction and collaboration. A few respondents noted that they had received support in strategic planning, but they still needed additional support with the implementation aspect of the plan. A few respondents also noted that they would like additional resources or trainings in signature practices. Finally, a few respondents noted that they would benefit from more advance notice to plan for convenings and to support student opportunities. In contrast to the previous year, no participants noted that they needed support in proposal writing due to the mini-ideas workshop, and one participant noted that it would be beneficial to continue the support in proposal and grant development. In all, participants had fewer suggestions for support than in previous years and the most common suggestion was for more interaction and collaboration across the regions.
Sample comments are as follows:

*Improve communication across the entire alliance - regions tend to be isolated.*
*Provide greater dissemination of opportunities. Be more inclusive of representatives from the region in national initiatives.*

*Enhance communication (e.g., shared platform for communication)*

*Mini-IDEAs workshops are the best. Please continue helping us with the proposal until its submission. Once we gain the experience, we will help out with future Mini-IDEAs workshops.*

*Opportunities for students and faculty shared with enough time and information for all.*

*Would like training and clarification on how to approach Industry. Are we looking for funding, outreach, volunteers, etc.? If funding is what we are looking for...then how much? how often? do we have a 501c3 document we present to them? Lots of questions still. What do we give them (industry) in return?*

*More resources for signature practices, but I would not say this is critical or high importance, but probably medium importance.*
For the most part, participants from each region reported similar rates of communication and dissemination of activities. For instance, nearly 100% of participants from all regions marked that they had actively identified and shared opportunities for students in the past year. Likewise, all regions were active in disseminating CAHSI’s accomplishments to computing audiences through presentations or publications (ranging from 65% to 100% of participants, depending on the region). Additionally, the West and North regions were slightly more active on social media than the Southwest or Southeast regions. Finally, all regions reported high levels of engagement in regional activities, and moderately high rates of coordination of activities with the backbone organization. In contrast, veterans were much more likely to coordinate activities with regional partners or with the backbone (85% and 65%, respectively) than newcomers (65% and 50%, respectively). This result suggests that regional partnerships take some time to develop and yield productive collaboration and implementation of activities. Frequency of attendance at CAHSI meetings also impacted regional collaboration efforts, as 40% of infrequent attendees and 90% of frequent attendees reported that they had actively engaged in regional collaborations in the past year. Therefore, continuous communication through regular meeting attendance is critical.
for achieving CAHSI’s objectives, such as sharing ideas, collaborating on activities and disseminating outcomes.

**Leadership and Communication - Structure of the CAHSI Alliance Network**

Roles are defined in CAHSI, particularly in relation to leadership and networking. CAHSI hypothesizes, through its enacted theory of change and structure, that local connectors are needed to move the work of CAHSI forward. With the Social Network Analysis, we review the data by role. We average the data across connectors, across leads (taken as director and deputy director nationally as well as leads at each region) and looked to see how their results compared with all others involved in CAHSI.

- **Connectors are more “connected” than other members of CAHSI’s network, less than the leadership.** Connectors were chosen by others as collaborators nearly at the same rate that they chose others on the network survey as collaborators (in degree and out degree values are similar). While similar patterns occur for the staff and co-leads of CAHSI, the numbers are remarkably different—near 11 to 7. This indicates connectors have a wider reach than average CAHSI participants, which follows the intended goal of the connectors.
- Connectors are viewed as involved, as resource distributors, but are not seen as having as much power as other members of the network. They are valued slightly more than the typical CAHSI member, but not as highly as leadership. They are not viewed as particularly powerful in the network, when compared with other roles.
- Leaders are perceived as particularly powerful, as providing resources, most involved in the CAHSI network, and perceived as the most valued. In these categories, the “leader” role out scores others by up to 0.72 points on a 4 point scale.
- The mean scores are exceptionally high across all categories in the areas of trust, mission congruence, reliability, and openness to discussion.

![Figure 19. Social Network Data by Role](image-url)
<table>
<thead>
<tr>
<th></th>
<th>1-4</th>
<th>2-5</th>
<th>3-4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Value (1-4)</strong></td>
<td>3.36</td>
<td>3.73</td>
<td>3.24</td>
</tr>
<tr>
<td><strong>Power / Influence (1-4)</strong></td>
<td>2.98</td>
<td>3.70</td>
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<td><strong>Level of Involvement (1-4)</strong></td>
<td>3.77</td>
<td>3.86</td>
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<td><strong>Resource Contribution (1-4)</strong></td>
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<td>3.61</td>
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<td><strong>Total Trust (1-4)</strong></td>
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<td><strong>Reliability (1-4)</strong></td>
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<td><strong>In Support of Mission (1-4)</strong></td>
<td>3.88</td>
<td>3.99</td>
<td>3.92</td>
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<tr>
<td><strong>Open to Discussion (1-4)</strong></td>
<td>3.74</td>
<td>3.87</td>
<td>3.91</td>
</tr>
</tbody>
</table>

**Leadership and Communication: Qualitative Evidence**

The CAHSI regional and national leadership are codifying the ways in which they engage with one another, the manners in which they meet and share information, and their regional and local priorities related to the 2030 Vision for Hispanic participation in computing. One coordinator describes the communication patterns succinctly:

“I meet monthly with (deputy director) and the other coordinators and connectors. So that’s more national. ...Continually we meet monthly with (regional co-leads) and then the partners within our region. We also meet monthly without those individuals. We also have sub regional meetings where we work closely with (nearby institutions in the region), and then just general meetings with our CAHSI student club. I sometimes pop in and meet with (faculty advocate) as well as our student advocate. That’s mainly on my end.”

The communication infrastructure is evident, and the opportunity for local, regional, and sub-regional communication, as well as national communication by role. The coordinator is engaged with students as well through CAHSI club meetings, which is one way that CAHSI staff connect with students within the institution.

Another regional lead was describing how communication is going locally with the majority of partners, and how a transition to a new faculty advocate went smoothly.

“The communication is really good, and then when (faculty member went back to graduate school for a PhD), he switched. He went out of the University, and (new faculty member) started, we didn’t know what to expect. But (new advocate) has become a very good ally. He’s been excellent. He participates. He does whatever he is needed to do, and he has continued mentoring the students, so in that sense, the (institution) is still on board.”
Having a system in place for communicating with all partners may have supported the transition to a new faculty advocate. The communication structure and leadership is developing and solidifying in this third year of the CAHSI INCLUDES grant. As the infrastructure becomes more clear, regions are looking for ways to expand and scale.

**POTENTIAL FOR EXPANSION, SUSTAINABILITY AND SCALE: Broadening Participation Interventions**

Strategic actions, in the form of interventions to broaden participation in computing, are at the core of the work undertaken by CAHSI participants at the local and regional level. In order to expand, sustain and scale practices, they must be guided by a common vision across practitioners with a clear link to how the strategic action or practice will help to achieve CAHSI’s vision and goals. The recent expansion of the CAHSI network and the shift in focus beyond undergraduate education provide opportunities to expand the repertoire of practices and activities to support progress toward the vision.

**Expansion, Sustainability and Scale of Strategic Actions**

The Collective Impact survey mapped the strategic actions and priorities undertaken within the overall CAHSI network and within each region. The findings provide an asset map of CAHSI’s strengths in strategic initiatives regionally and nationally and highlights areas where there is currently less collective effort. In this way, the survey results show the current landscape of CAHSI initiatives and efforts within the network to advance its vision.

**Top Priorities**

Overall, undergraduate education has remained a core focus for the CAHSI community, at the institutional and regional levels. More than half of CAHSI participants listed undergraduate education as their top priority for strategic actions, although this was less than the nearly ¾ of participants who listed it as a top priority in recent years. Therefore, undergraduate education is still a strength and a central priority for the CAHSI community, but new participants have also brought new expertise and priorities to the network. Additionally, the focus on undergraduate education and some of the subsequent activities needed to achieve this goal have expanded and scaled to almost all CAHSI departments.

CAHSI has also continued to expand into other pivotal points along the computing educational and career pathway. Workforce development and career readiness are growing priorities within the CAHSI community. Nearly 1/3 of participants rated workforce development and career readiness initiatives as their #1 or #2 priorities to advance CAHSI’s vision. CAHSI has also had a smaller, core group of participants with expertise in K-12 education outreach and initiatives. Nearly 1/3 of participants rated K-12 education as their #1 or #2 priority. A smaller group of CAHSI participants has also prioritized graduate education initiatives and has brought
expertise in that area to the CAHSI community. Fewer participants listed faculty professional
development or policy initiatives, at the institutional/departmental or state-level, as top
priorities, indicating that these areas could be sectors of growth for CAHSI efforts.

Figure 20. Top Priorities of CAHSI Participants

Although there was a strong consensus that undergraduate education was a core focus of CAHSI efforts, there were some regional variations in participants’ priorities in the past year. For instance, all participants in the North region marked that undergraduate education was their top priority, demonstrating a strong commitment to the retention and advancement of undergraduate students in that region. On the other hand, the Southwest region demonstrated greater diversity in priorities and expertise, as about half of participants marked other priorities outside of undergraduate education, such as workforce development, graduate education, or K-12 education. Participants in the Southeast and West regions also marked graduate education as a top priority, highlighting that graduate education is an interest that spans regions within the CAHSI community and is an expanding priority in the CAHSI community.
The main differences in priorities were by region, rather than length of involvement in CAHSI or frequency of meeting attendance, suggesting that the regional model adopted by CAHSI is effective for focusing the activities and expertise within the network. Because regions have gelled around specific priorities, there can be more robust scaling and dissemination of activities within regions of like-minded CAHSI participants. In contrast, there were fewer differences in priorities based on length of involvement with CAHSI. Across the board, a fair number of both newcomers and veterans marked undergraduate education as their top priority. On the other hand, CAHSI veterans were more likely to mark K-12 education as a top priority and newcomers were more likely to mark graduate education. As CAHSI grows and expands, newer members are bringing their ideas and expertise to the larger community and disseminating their activities within their regions.

Unlike in previous years, there was little difference in the frequency of attendance at CAHSI meetings and participants’ top priorities. In past years, nearly all participants who regularly attended meetings reported that undergraduate education was their top priority. In contrast, in the past year, about half of regular attendees reported other priorities besides undergraduate education, such as K-12 education or graduate education. Therefore, different types of initiatives and activities are being scaled and spread throughout the regions as regular meeting attendees are either bringing different priorities with them or adopting different priorities.
Expansion, Sustainability, and Scale of Signature Practices

Adoption of CAHSI signature practices is similar to rates of previous years and is relatively high throughout the network, although some practices have been adopted at higher rates than others. The relatively high rate of adoption of some signature practices suggests that these practices have been sustained within some CAHSI departments. Still, the rate of implementation of signature practices fell from 83% of survey respondents to 62% of survey respondents, indicating that some departments may have struggled in the past year to sustain signature practices during the pandemic. For instance, the percentage of respondents who reported that they offered a problem-solving course in their department fell from about 67% to 58% of participants. Nevertheless, the most common signature practice continues to be the problem-solving courses, which has been facilitated by the Faculty-in-Residence program at Google and the community of practice that has been formed around the course. Peer-led team learning also fell slightly, from 50% of respondents to 43% of respondents who report that they are implementing peer-led team learning in their department. Additionally, participants who have adopted the ARG model in research group or courses fell slightly from 55% to 46% of survey respondents. The percentage of CAHSI participants who use Fellow-net rose remained steady at 20% of participants.

Figure 22. Implementation of Signature Practices, CAHSI Participants

There is some regional variation in the expansion and sustainability of signature practices. In general, adoption in the southwest of several practices, such as PLTL or ARG, seemed to be...
lower than other regions, but this is likely because—similar to previous years—the survey response rate was higher in the southwest and captured some CAHSI participants who have not yet taken up signature practices and are just becoming oriented to CAHSI. In contrast, the response rates from the north and southeast regions were lower and, therefore, only reflected the most highly involved and engaged participants who had greater longevity with the CAHSI network. Therefore, the uptake of signature practices in the Southeast and North was higher than in the Southwest. Respondents in the West were slightly less likely to be involved in ARG or to implement the problem-solving course(s).

There were few differences in adoption of CAHSI signature practices based on length of involvement in CAHSI or frequency of meeting attendance, indicating that newcomers are also beginning to engage in signature practices as they become integrated into the CAHSI community. Additionally, CAHSI practices have scaled to some participants who are less engaged in regular meetings but still implement practices such as problem-solving courses. On the other hand, participants who are more involved with their regions and attend meetings regularly were much more likely to implement peer-led team learning (69% as opposed to 50%) or ARG (62% as opposed to 25%) in contrast to their less-involved counterparts. There are some indications that newcomers are starting to more widely adopt signature practices beyond problem-solving courses. For instance, 44% of participants with less than 2 years of experience with CAHSI had adopted ARG and 40% had adopted peer-led team learning, indicating higher adoption rates for newcomers than in previous years. Therefore, CAHSI signature practices have begun to expand and scale to less-involved participants and newer participants and appear to be sustained in some areas.
Expanding, Sustaining and Scaling Student Support Activities

Despite the COVID-19 pandemic, CAHSI departments continued to offer multiple mechanisms for student support, such as research experiences, hack-a-thons, conferences, workshops, clubs, and leadership positions. Many departments rapidly shifted these opportunities to virtual formats during the pandemic, reporting that attendance was similar or even higher than previous attendance rates. The student advocate program continued to expand in the past year as almost all departments recruited and supported student advocates. The GMiS conference was also shifted to a virtual format and continued to provide an opportunity, albeit slightly more limited, for students and faculty to connect and interact. Nevertheless, nearly 75% of respondents reported that they had participated in the GMiS conference. Additionally, CAHSI departments sustained their high rate of student clubs and organizations (75% of departments reported sponsoring student clubs) during the pandemic. CAHSI participants also sustained previous rates of engagement in student skill-building activities, such as hack-a-thons, with 80% of participants reporting that they were involved with hack-a-thons during the pandemic. Finally, nearly ¾ of participants were also involved with professional development workshops or trainings for students in the past year. Therefore, despite the constraints of the COVID-19 pandemic, CAHSI participants remained highly engaged in student clubs and other student professional development activities, demonstrating that CAHSI expanded and sustained most of these activities.

Figure 24. Implementation of Student Support Activities, CAHSI Participants
There was almost no regional variation in the adoption of student support activities because almost all participants were highly engaged in these efforts across all regions. Participants in the Southwest region reported slightly lower rates of engagement, but this is likely because there was a higher response rate in the Southwest, representing a broader range of CAHSI participants than in the other regions which largely reflected the activities of more highly engaged participants. Still, involvement in student support activities was high across all of the regions, demonstrating that student support activities have expanded regionally. For instance, nearly 80% of participants in each region were involved with student advocates, attended the GMiS conference, and implemented skill-building activities, such as hack-a-thons.

Figure 25. Strategic Activity Established, by Region

<table>
<thead>
<tr>
<th>Strategic Activity</th>
<th>North</th>
<th>Southeast</th>
<th>West</th>
<th>Southwest</th>
<th>CAHSI Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>% reported “slight extent” &quot;some extent&quot; or &quot;great extent&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAHSI clubs/chapters</td>
<td>100%</td>
<td>80%</td>
<td>80%</td>
<td>69%</td>
<td>73%</td>
</tr>
<tr>
<td>Supervised or interacted with student advocates</td>
<td>100%</td>
<td>80%</td>
<td>80%</td>
<td>75%</td>
<td>79%</td>
</tr>
<tr>
<td>Professional development workshops</td>
<td>100%</td>
<td>80%</td>
<td>80%</td>
<td>62%</td>
<td>76%</td>
</tr>
<tr>
<td>Skill-building experiences (e.g. hack-a-thons, etc.)</td>
<td>100%</td>
<td>80%</td>
<td>80%</td>
<td>77%</td>
<td>76%</td>
</tr>
<tr>
<td>GMiS conference</td>
<td>80%</td>
<td>80%</td>
<td>60%</td>
<td>77%</td>
<td>73%</td>
</tr>
</tbody>
</table>

Expanding, Sustaining and Scaling Computing Pathways

Although undergraduate education remains a core focus of the CAHSI network, many participants have addressed other stages along the computing education and career pathway in recent years. For instance, a fair number of individual CAHSI participants and institutions rank K-12 education, graduate education, or workforce development as top priorities. In keeping with this commitment to addressing different stages of computing pathways, nearly 80% to 85% of survey respondents actively engaged in K-12 outreach or workforce development initiatives in the past year (rates similar to those of the previous year). This result also indicates that the COVID-19 pandemic did not deter CAHSI participants from sustaining their K-12 or workforce readiness activities. More than 50% of participants engaged in graduate education initiatives, an increase from the previous year. Similarly, more than half of respondents had worked on new computing degrees or certificates in the past year, also representing an expansion of degree pathways offerings from previous years. Therefore, CAHSI participants were able to successfully shift a wide array of activities to virtual formats during the pandemic.
Expertise and efforts to bolster different stages of the computing pathway was relatively well distributed across regions, as participants in each region reported at least some effort in developing new pathways and degree programs in the past year. All of the regions reported moderate to high involvement in K-12 outreach and workforce development initiatives, in keeping with their emphasis on these areas when determining priorities. With the exception of the West region, all other regions were involved in developing new degree or certificate pathways in computing. With the exception of the Southwest, all other regions also reported relatively high involvement in graduate education initiatives. Therefore, across all CAHSI regions, participants are actively creating new initiatives and pathways from K-12 through graduate education and the workforce.

<table>
<thead>
<tr>
<th>Activity</th>
<th>North</th>
<th>Southeast</th>
<th>West</th>
<th>Southwest</th>
<th>National Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provided/coordinated K-12 outreach activities</td>
<td>100%</td>
<td>80%</td>
<td>60%</td>
<td>85%</td>
<td>77%</td>
</tr>
<tr>
<td>Implemented workforce development initiatives</td>
<td>100%</td>
<td>60%</td>
<td>80%</td>
<td>69%</td>
<td>70%</td>
</tr>
<tr>
<td>Developed new degree/certificate programs</td>
<td>80%</td>
<td>60%</td>
<td>20%</td>
<td>62%</td>
<td>53%</td>
</tr>
<tr>
<td>Implemented graduate education initiatives</td>
<td>80%</td>
<td>60%</td>
<td>60%</td>
<td>38%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Participants with a deeper level of involvement with CAHSI (more frequent meeting attendance) were much more likely to be involved in non-undergraduate oriented initiatives, such as graduate education or K-12 education (averaging 80-90% of participants, as compared to 50-60% of participants who do not regularly attend meetings). Nevertheless, participants who infrequently attended meetings were slightly more involved with computing pathways initiatives than they have been in previous years. In contrast, there was no difference in participants’ length of involvement with CAHSI and the likelihood that they are involved with other types of initiatives beyond undergraduate education, suggesting that depth of involvement with CAHSI is important for expanding CAHSI’s reach into other stages of the computing pathway. On the other hand, newcomers, especially those who were deeply involved with CAHSI regional networks, were just as likely to spearhead new initiatives related to the computing pathway as veteran CAHSI participants. Therefore, depth of involvement and regular attendance at CAHSI meetings is critical for moving CAHSI’s agenda forward.

**Expanding, Sustaining and Scaling Faculty and K-12 Educator Support**

In addition to student support, CAHSI participants and departments continued to offer support for faculty and K-12 educator professional development, although the core focus of CAHSI remains on student development and advancement. Despite the pandemic, CAHSI participants maintained their research collaborations with each other, as nearly 2/3 of survey respondents reported a CAHSI-related research collaboration. The sustainability of CAHSI research collaborations may also be attributed to the emphasis on cross-CAHSI research activities through the mini-Ideas workshop. Additionally, nearly 60% of participants offered or were involved in faculty professional development offerings, similar to rates in previous years. There was also a slight expansion of CAHSI participants who offered K-12 teacher preparation trainings, from 40% in previous years to 50% in the past year. Therefore, CAHSI departments sustained and even slightly scaled their efforts in faculty and K-12 educator support in the midst of the COVID-19 pandemic.
Similar to previous years, strategic initiatives related to faculty and K-12 educator support varied by region. For instance, the North region was heavily involved in most aspects of faculty and K-12 teacher support, while fewer participants in the Southwest and West regions were directly involved in these efforts. Nevertheless, research collaborations were relatively robust across all regions, although members in the West were slightly less likely to be involved in research with other CAHSI participants. Faculty professional development efforts also varied, as participants in the West and Southwest were also slightly less likely to be directly involved in faculty training initiatives. Still, regional efforts did not decline from previous years, suggesting that each CAHSI region managed to sustain their faculty and K-12 educator support despite the constraints of the COVID-19 pandemic.
CAHSI participants’ involvement in faculty and K-12 educator support was highly dependent on their overall involvement in the CAHSI community. For instance, participants who infrequently attend CAHSI regional or all-hands meetings were not engaged in offering or participating in faculty or K-12 teacher trainings (rates of 20% or less) as opposed to those who regularly attend CAHSI meetings (participation rates of 70% or more). Therefore, depth of involvement in the CAHSI community is strongly connected to expansion of faculty support activities, though slightly less connected to student support. In other words, most CAHSI participants are involved in student support activities, but only those who are deeply involved in the CAHSI community are engaged in faculty support efforts. Similarly, participants’ length of involvement with CAHSI also highly influenced the extent to which they were involved in faculty or K-12 educator support. For instance, those with less than two years involvement with CAHSI were not likely to be involved in faculty or educator professional development (about 25% of newcomers), while veterans were highly likely to be involved with these initiatives (75% to 100% of veterans depending on the initiative). Therefore, depth of involvement and length of involvement in CAHSI contribute to expanded professional opportunities for participants, such as professional development and research collaborations.

Expanding, Sustaining and Scaling Policy and Systems-Level Change

To date, there has generally been less direct involvement in policy or systems-level change among CAHSI participants, as the CAHSI network has generally remained more focused on student programming and initiatives. Therefore, fewer CAHSI participants are engaged in policy initiatives, either at the institutional/departmental-level or state-level. However, the rates of engagement in policy-oriented change are similar to previous years. In general, CAHSI participants reported higher rates of engagement in policy initiatives, although about the same percentage of people were involved. For instance, while the same percentage of people reported that they were involved in changing institutional or departmental policies, the percentage who reported that they were involved to “a great extent” increased from 8% to 19%. Likewise, the percentage of CAHSI participants who were highly engaged in state-level policy doubled from 6%
to 12%. Therefore, engagement in policy or systems-level change is still not widespread across the CAHSI network, but those who are engaged in these endeavors increased their efforts in the past year, despite the pandemic.

There were a few differences related to involvement in systems-level or policy initiatives among regions. Across all regions, participants were engaged in changing institutional or departmental policies at equal rates, demonstrating that although policy work is somewhat limited compared to other activities, it has expanded across institutions and regions. However, participants in the North region were more engaged in state-level policy work than participants in other regions, most likely because of Kean University’s advocacy for K-12 teacher preparation and education in the state of New Jersey. Generally, CAHSI veterans were more involved with policy-level change than newcomers (60% to 100% of veterans depending on the initiative, compared to 25% to 40% of those with two years or less of experience with CAHSI). On the other hand, depth of involvement with CAHSI was strongly connected to working on policy-level change as nearly all participants who attend every meeting were engaged in some aspect of policy change, while participants who rarely attend meetings were not involved in policy change (20% or fewer). Therefore, highly committed CAHSI participants were also actively engaged in systems-level change.
Expanding, Sustaining and Scaling CAHSI Activities: Greatest Accomplishment

Throughout its history, CAHSI has had a strong emphasis on student support and professional development. In keeping with these values, more than half of survey respondents wrote in response to an open-ended question that their greatest accomplishment in the past year was to provide and expand student-centered activities, events, or opportunities, such as hack-a-thons, REUS or CAHSI Scholars. A greater percentage of respondents noted that successful regional collaborations were their greatest accomplishment (rising from 6% to 20% of written responses), indicating that the regional networks have continued to strengthen in the past year in the face of the pandemic. A few CAHSI participants noted that they had created new degree programs or certificates, expanding computing pathways to more students. Finally, a few participants had secured external grant funding to support their work with students or generated industry partnerships to sustain or scale support students’ career development.

Following are a sample of comments:

*We are involving more students in technology-related events and job opportunities. This is primarily due to a combination of CAHSI and our NSF Grant.*

*Starting a new programming degree.*

*Our organization’s most important accomplishment was to move forward in subregional collaborative activities. We want to continue to nurture these partnerships in hope of creating a small pipeline from undergrad to our graduate programs.*
Google sponsored Explore CSR conferences in person and virtually

Hosting a workshop for our region concerning women in CS. We had 9 female students from 4 CAHSI institutions participate as panelists, speakers, and discussion leaders. We are working on expanding our actions plans within the region that relate to this topic, based on the information shared at this meeting. We were also excited to be able to send 60 students to GMiS.

Mentorship of students on vREU and the organization of a Hackathon competition.

To continue our outreach to the K-12 schools, and not lose our contacts within the administration at each school we have been engaged with.

We were very excited to have hosted our first Hackathon - it had been pushed off multiple times due to health issues and then the COVID pandemic, but we finally hosted the Hackathon and are currently planning our next Hackathon to be held in April. It was a great success and we hope to continue these.

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Expansion, Sustainability and Scale- Qualitative Evidence
In a meeting with CAHSI stakeholders, one lead shared an update that brought up multiple ways in which the region in question was growing, scaling, and adapting its work:

“So we also realized we needed to document a greater variety of things (in the Engage Tool). And I’ve spoken about this before over the years. We benefit so much from seeing other regions and what they’re doing. And it dawns on us, "Hey, we're doing that." Or, "We could do that." Or, "Why didn’t we put that in when we did it?" And so forth. So that's been an enormous help to us, being inspired by the work that others are doing. ...We are growing our region leadership ... First of all, our leadership meets, but now we're doing more of a regional sweep... So our net is going wider this year, and we're getting more people in for monthly regional meetings. ...The advocates, we continue to do well. We’re growing that program. And any additional information we can get, for example, on student resources, for example. I admire the University of Houston downtown quite a bit. I became aware of some of the talented things they’re doing this summer with the recruitment for the graduate school, and just a variety of things that were held, even in the summer.”

In the passage above, a lead describes shifts in practices and practice adoption, as well as in documentation of practices. The lead also indicates growth in attendance at regional meetings as well as a modified structure for communicating with leadership and with participants on a regular basis. The lead describes the strength in collaboration in a collective impact initiative in describing a partner that is excelling with regard to student advocate work, and the intention to mimic the practices and utilize the resources already developed. This description illustrates the complexity of collaborative work as well as the opportunity to create “scaled impact” through resource sharing.

Another way in which regions described scale was through collective engagement with professional development.

“Because we had some leftover funds, we also partnered during the summer with the UVA Lighthouse group, to run an online professional development course for CAHSI faculty within the region. So we had faculty and staff from (2 year school), (four year school). we had them from our partner institutions in (state in region), I think we ended up having 22 different people participate in that six week-long online course. And they all had very positive things to say about that program after they took it.”
The example above indicates the way change efforts can scale and create a potential community of practice for those who engage in the professional development as a group. The ability for a region to find 22 faculty who interested in professional development and commit to a 6-week online course shows dedication to the CAHSI vision. Creating shared knowledge through training can support further pedagogical work in the region.

Another CAHSI lead describes some of the way the region is growing intentionally, and how the activities of CAHSI are spawning deeper relationships with newer members.

“So, we will try to reach out to some (regional campuses) and then try to give an initial introduction to some of the schools who haven't been to regional meetings. And we're also trying to reach out to (state college system), also, some of them—if I get a chance to talk to the chair lead, if I can see them somewhere. I just want to give them a head start to know what CAHSI's about... And, too, it seems like they enjoy what's happening. The research activity that they put with the NSF and the MSI workshop, that was very well-received. A lot of faculty members wanted to join. So, we had like four NSF plans sent out. Hopefully, if we get one or two of them, that would be great. And these are all related to CAHSI activities. Either for the research, or something relating to the high school teachers.”

In the quote above, the CAHSI lead describes how the work to expand the regional participation has been developing, and how CAHSI faculty development through an NSF/MSI collaborative proposal effort as well as a regional are of emphasis supported greater regional participation. Having specific added value for faculty may be key to sustained growth in CAHSI.

**Expansion, Sustainability and Scale Through Student Leadership- Scholars Case Study**

CAHSI Scholars were interviewed for the first time this year to serve as an in-depth case study of student capacity building. All Scholars were invited to participate in interviews, and all 11 Scholars were interviewed by an evaluation team member via telephone. Interviews were coded for themes that related to CAHSI participation.

**Practices**

**Student clubs**

Interviews with CAHSI Scholars in spring 2021 affirmed the progress of many CAHSI departments in creating student clubs and organizations to build community and professionally prepare students for careers and graduate schools. In interviews, almost all Scholars reported that they had been active in clubs in their departments. Scholars noted that they had organized hack-a-thons, interviewing workshops, and other professional activities through these student-led organizations. Institutions located in the same area or region are more likely to regularly collaborate. For example, because of their proximity, Merced College students have been able to
participate in UC-Merced student groups and help with hack-a-thon events. This is especially beneficial for students who plan to transfer, as noted by a CAHSI Scholar: “Even though I am not a UC Merced, I still participate. So I’m like already getting like, you know, experienced at using Marcell, even though I’m not a student there, but I’m still, I’m already like actually like getting to know everybody there.” In the past year, Scholars have also reported an expansion of events with industry representatives, such as career panels or events with companies such as Lyft or J.P. Morgan. Students also gain a sense of community from clubs, describing other students as “passionate” and “like-minded.”

Despite the success and expansion of CAHSI student clubs and organizations, participation in virtual clubs has been mixed during the pandemic. Some campuses report lower participation in virtual meetings and events, while others have experienced increased participation. Some students contrasted current low participation rates in departmental clubs with robust activities and events prior to the pandemic.

[before the pandemic] We had movie nights. We had all the other research activities going on at the same time. We had our workshops, we provided technical workshops for our members. So but that connection was missing with the pandemic.

Another Scholar commented that professional development offerings were not as well attended in the virtual format in his department:

And we hosted two companies to come to talk. One talked about developing web apps. And one talked about building your online brand. And both of those pretty much flopped. And we're spamming on emails, we're spamming on social media, we're talking to the research group leaders directly. But we really are missing why we can't connect to students.

On the other hand, attendance at some events increased in some departments during the pandemic. Scholars attributed it to the virtual nature of events which allowed for participation from students from other campuses. Another students commented that she thought that students were looking for community and that had influenced the higher attendance at club meetings and events during the pandemic.

I've noticed that this semester specifically, there's actually more people in it. I think they're really yearning that connection for sure. So I feel like people looking into like some sort of like club or activity that they can be a part of. Cause I didn't see this many people before.
cause it became virtual. We started with people from other States coming into our meetings. So yeah, so we, we, when we were on campus with 15 students show up to some events and then when we turned to workflow, we had like 40 to 30 sometimes. And we're like crazy. Like people are actually interested in what past casting, um, you know, the club, what they're doing.

**Outreach**

Through the expansion of K-12 outreach campuses at existing and new campuses, many CAHSI departments have created new pathways into computing for local youth. Multiple Scholars reported in interviews that they had first become involved with CAHSI in middle or high school through CAHSI outreach programs, such as research summer camps or Young Women in Computing.

I started participating in the YWiC camps during the summer, and then I transitioned to be a camp assistant, and then I transitioned to be a full time instructor and I started working with YWiC, and I worked with them for, I think it was the first three years in undergrad, I think.

Other Scholars who did not have previous experience with CAHSI prior to college first heard about CAHSI through student advocates in the department who informed students about activities and ways to be involved in the department.

**CAHSI Scholar Activities and Departmental Plans**

Despite the restrictions from the COVID-19 pandemic, CAHSI Scholars engaged in a variety of activities for their departmental plans, including developing and implementing workshops and career panels, creating websites, writing blogs, and hosting office hours. Many of the Scholars’ departmental plans focused on creating and expanding opportunities to increase access to computing careers—for instance, writing a blog about Google Tech Exchange that provides insights into the experience and encourages students to take advantage of the opportunity. Scholars also developed and hosted a variety of workshops, such as resume and interviewing techniques, entering graduate school, finding a research experience, hardware and technical issues, how to get involved in the department, how to prepare for GMiS interviews, and how to transfer from a community college to a university in computer science. Several Scholars gained presentation experience during these workshops and one had the opportunity to moderate a panel. One Scholar who had written blogs and hosted office hours during the pandemic because there were “no alternatives” noted that in the future he would engage in more active efforts to support students, such as a mentorship program.

A student who had created a website described how all departmental resources could now be located at one site. The student was pleased that people from outside the university had
found the website and used it to locate computer science opportunities. The student stated, “And just kind of making a resource basically for students to be able to just go there and find it. They don’t have to Google and try to find it, or try to go on Instagram, trying to find all these different resources. Just find them all in one place.”

Scholars were motivated by helping peers to succeed and become prepared for careers. Scholars were also motivated by the possibility of enacting change by promoting inclusivity and increasing the success of underrepresented students. Therefore, CAHSI Scholars reflected CAHSI values in their commitments and their departmental actions. One Scholar reflected on her desire to enact change in her department after her experience in the Google Tech Exchange program.

I was so excited because coming from the Google Tech Exchange program, I saw a lot of things that my university has the power to be able to change—To increase success and to be able to compete with a lot of the highly credited universities in terms of curriculum, rigor, student support that is often harder because we’re BIPOC. I just wanted to really enact change, so I applied [for the Scholar position].

Other Scholars were motivated to increase access to opportunities and student involvement in the department, as illustrated in this comment about motivation to apply for the Scholar position, “It was expanding access to opportunities and to knowledge that I had to find out on my own. So at my institution there was always this disparity of information and access to information.” And many Scholars were motivated by the opportunity to advance equity goals and increase the representation of Hispanics and women in computing, as mentioned by a Scholar: “So definitely advocating for Hispanics and women in STEM. That was the big yes for me. So that was the main reason why I was interested.” Finally, two Scholars commented on the desire to help students with mental health issues as the pandemic had been challenging in many ways, especially in terms of motivation, focus, and anxiety. For instance, a Scholar stated, “One thing that I’ve changed my gears is in the sense of being able to help students with their mental health in general.”

CAHSI Support/Impact

As already described, students benefited from the professional development opportunities in their department and the professional preparation and sense of community fostered by student clubs. The breadth of CAHSI activities collectively helped students to feel engaged with their departments and dramatically improved their academic performance for some. For instance, one Scholar noted that her GPA had increased from 2.5 to 3.5 as she became involved with CAHSI and became more connected to her department. Students improved their academic success through CAHSI because it provided an academic support network, as described by a Scholar: I turn to other CAHSI students [for help]. So I message a few students that are older than me. And I have the network with them that otherwise, I wouldn’t know.”
Students gained many other benefits from CAHSI programs and activities that they described in interviews. Career panel workshops and extended programs, such as Google Tech Exchange, provided insight into the different branches of computer science and the wide variety of career options in computing. A scholar noted: *Tech Exchange really opened my eyes to different opportunities in computer science that I didn't even know. I knew computer science was a big field. I couldn't know how big and what worlds were in it. So in Tech Exchange, I got introduced to human-computer interaction by UX design and product management, which are more of the softer parts of computer science where you still have to understand the technical, but you also have to have a lot more of those soft skills.*

Scholars also received internship and career opportunities through participation in CAHSI activities, such as GMiS or research experiences. One Scholar described how she received a full-time job offer based on a research talk that she had presented in the field of data science. In turn, some Scholars described conducting individual coaching with their peers to help them with their resume, interviewing, or job search skills to help them be more successful in securing an internship or career position. In particular, Scholars coached students to prepare for GMiS because of the critical interviews and job opportunities at the conference. Some of these workshops influenced students’ pathways and future opportunities. For instance, one Scholar described how a student who attended a career development workshop was motivated to apply for opportunities and was awarded a Google scholarship. Often students did not feel that they qualified or were experienced enough, so peer mentoring and workshops helped to encourage them and bolster their confidence, as described in the following statement from a Scholar.

*Through the years, I think one thing for sure that was a barrier was feeling unprepared. So currently, I was lucky enough to actually... I say lucky, but I got a job during the GMiS Conference. But one thing that at least prior to that, is I felt that I was unprepared, and that I either lacked practice with programming, or practice with interviewing, or just really understanding what the process was. And just being afraid in general. And so that ties back into some of my goals with CAHSI that I had was to help students fight that imposter syndrome, and help fight the idea that just because you have little experience, you can’t go out and at least try to do that....so luckily, my experiences and everything I’ve done really actually helped and made me a really strong candidate.*

Most of the Scholars also had participated in research experiences which influenced their career preparation, confidence and independence, and technical skills. Some students had contributed to research publications, while other presented their results to technical audiences. On the other hand, some scholars commented that they had gained “soft skills” from their participation in research. Scholars also gained these “soft skills” from the CAHSI Scholar position
itself, as they gained experience in coordinating, organizing, and leading workshops and other initiatives. A few Scholars noted that the position had taken them outside their comfort zone: “I’m introverted and just hosting workshops like this is very out of my comfort zone, and I’m hoping that by doing that, I’m going to become more confident and more comfortable talking to people, and also just hoping to learn from the other scholars, because at some of our weekly meetings, it’s just really incredible what everyone’s accomplishing.” One Scholar who had transitioned into a computing career credited her involvement with CAHSI for developing her leadership skills: “I was a CAHSI officer. I was the vice president for three semesters and so I kind of had to take charge with the president on what to do. I think that was extremely important because at work you kind of have to take charge of projects and that helped with leadership skills.”

Finally, CAHSI provided departmental support for women and community for some women, although the extent of community among women varied by department. For instance, one Scholar noted that in her department, women were more involved with extra-curricular opportunities than men. CAHSI provided leadership opportunities for women in computing and normalized the representation of women in these positions, in contrast to the broader field of computing in which women are still severely represented. She commented:

> I’ve gotten so used to seeing more females in certain areas like my club. When I ran my club, most of my officers were females. So that seemed kind of normal. When I’m in our meetings, and I see more females, it doesn’t seem weird to me until I remember, and I look at work, and the majority are males. And then I’m like, oh, wait. Right. Females are the minority in this field. So it’s a nice feeling to see a lot more representation out there for females, especially in scholars.”

Formative feedback

CAHSI Scholars offered some advice to improve the program and other opportunities in their department. Students were satisfied with the networking and communication opportunities through the CAHSI Scholars discord server and suggested that CAHSI Advocates should also have a discord channel. Other Scholars mentioned that they would have liked more clarification of the eligibility requirements based on major and educational stage (e.g., graduate student or undergraduate student). Scholars also wanted more cross-institutional collaborations and the opportunity to open up activities to the entire Alliance of departments. However, for the most part, all Scholars felt that they had received the support that they needed to be successful in their position, even though some felt that they had not had the attendance or impact that they would have liked.
Visibility/Awareness

Most students felt that they received visibility and recognition in their department for the CAHSI Scholars award, despite the virtual nature of interactions during the pandemic. One CAHSI Scholar who did not feel that he received visibility in the department also commented that CAHSI does not have a strong presence in the department. On the other hand, other Scholars mentioned that they had been acknowledged on departmental websites and in departmental communications. Scholars also commented that the position had opened opportunities for them and raised their profile with industry. One Scholar mentioned that she felt like “it really elevated me a lot more. It landed me some interviews.” The Scholar continued that an industry representative that she met during the awards ceremony had helped her to get an interview with Dell.

CAHSI Scholars network

Some students feel more connected to the national CAHSI Scholars network than others and students reported varying levels of interaction with other Scholars. Still, every Scholar had at least one other Scholar outside their home university that they had interacted with in the past year outside of regular meetings. Others reported higher levels of interaction and engagement with the Scholar community. Students spoke positively of the Discord server and mentioned that we “help each other out.” Some students commented that they hadn’t gotten to know other Scholars well through the Scholars program because all meetings have had to be virtual, while others commented that they already had relationships with some of the other Scholars through programs such as Google Tech Exchange. Since the pandemic increased students’ sense of disconnection in some departments, Scholars have blogged about how to network in a virtual environment. Overall, most of the Scholars were satisfied with the support and community they felt with other Scholars, although some were more disconnected from the community than others. For instance, one of the Scholars commented: “I’m still in the process of getting to know them, but I definitely think it’s getting there. I would feel comfortable enough to reach out to any of them if I had a question, or anything like that.” Scholars who were more engaged discussed the help and support they had received from other Scholars:

Yeah, it's been great. I feel like everyone has a lot of ideas and we're great at brainstorming. So it was great just to hear everyone's opinion and what's worked for someone that maybe work for somebody else. We were talking about how, just recently I was talking to another Scholar, like, "I haven't seen a lot of activity in my office hours." So he said, "I feel like people feel more confident via email." And I'm like, "Oh, that's a great idea. I would add the email to my office hours flyer, because maybe they want to reach out that way." So yeah, it's amazing.
Mentors and Supporters

CAHSI Scholars benefited from the support of mentors that they met through their involvement with CAHSI. Scholars noted that mentors had introduced them to research experiences and other professional opportunities. Scholars also reported that mentors in their department cared about their academic progress and were available for help and guidance when needed. Overall, many Scholars reflected that their mentors had allowed them to achieve goals that they might not have thought possible without the influence of mentorship or other CAHSI activities. For instance, a Scholar commented about her CAHSI mentor:

*And I think that for her, it helped me a lot too through college, if I wouldn't have met her, I think, um, you know, probably be pulled somewhere else. Cause I would think I wouldn't be able to present my research data many, but I thought the professors, really are deeply impact impacting their students. I think so. I think that [my CAHSI mentor] was a huge contribution to, what I'm doing it now.*

As a result of their experience with CAHSI mentorship, many Scholars now feel inspired to spread the word about CAHSI to their peers. For example, a Scholar credited her academic and professional success to her experience with CAHSI since she had first become acquainted with CAHSI in her K-12 education:

*And that’s something that I've kind of taken on as well is to spread the word and to show how impactful CAHSI is because it really has gotten me through college. Gotten me through middle school, elementary, to the point where I am now. I can confidently say that I would not be where I am now if I didn't have the support that I did.*

Expansion, Sustainability and Scale- Summary of 2021 Impact

This summary provides big picture impact statements related to CAHSI efforts at expansion, sustainability and scale in the 2020-2021 academic year. The data come from surveys and interviews across multiple sources and centered around new or expanding practices occurring in the network as well as a longitudinal study of a former program. For greater detail, please see appendices for each report.

Fem Prof Follow-Up

- Students from one of the 2 FemProf sites were tracked to the present. Students participated in FemProf from 2010-2016. Of the 35 we were able to locate in 2021, 10 (29%) completed their BS degree in their field (EE/CE), 16 (46%) had earned an MS degree, 1 (3%) began MS coursework, 4 (11%) had earned their PhDs, and 4 (11%) were currently enrolled in PhD programs. The following summary bullets are retrospective findings based on focus groups with 13 of the alumna.
• The explicit expectations of the program were seen as valuable to participants, who indicated they were unsure they would have advanced as far as they did without that expectation. For some, it kept graduate school in the back of their minds, for others, it set them up to apply directly to graduate school following undergraduate studies.
• Expecting 2 REUs was valuable from participants’ perspectives—some did not have a good experience in their first REU and stated they probably would not have applied for a second without that expectation. Others found that multiple REUs were valuable for learning which areas of the field were most of interest.
• The explicit emphasis of the program on equity and the development of a safe space for discussing gender equity in computing during workshops was valued—participants noted they did not always have female peers in their classes and so having dedicated time with women was of note.
• Including applications for REUs and graduate school as assignments with accountability supported students who stated they were unsure whether they would otherwise have applied for opportunities. For some, this created an opportunity for familial independence and new life experiences including spending time on the mainland for the summer.
• Workshop content focused on gender equity allowed for frank discussions about gender inequity in the field—students stated they had “forewarning” about what they might experience as women in a male dominated field.
• **Alumna have sought industry positions that have a healthy climate, and in which they are valued.** They describe jobs that left them feeling undervalued, silenced, or held back, and in many cases have arrived at different companies or in different positions where they feel more welcome.
• **Alumna described multiple ways in which they advocate for women and underrepresented youth in their current positions, through formal and informal means.** This includes recruiting women, advocating for interviewing women when they apply, advising women who are junior to them in industry, checking in on women as they join the company, and engaging in coaching for more junior women in their workplaces in strategies to advance their careers, including negotiating salary and time off when accepting a job offer. Many have joined groups for Hispanics and groups for women in their current positions as graduate students and professionals—for some, the pandemic has hampered such participation.

Great Minds in STEM conference
• Participation in GMiS blossomed to 368 registered students, of which 36% were women. Participation was most prevalent among upperclassmen, though some freshmen and sophomores as well as graduate students attended. Students registered represented 36
CAHSI schools. One hundred nineteen students participated in the survey - 69% were Hispanic and 45% were women.

- GMiS was effective in supporting student dedication, knowledge, and interest in computing careers. Nearly all students described the event as at least somewhat influencing their: knowledge of career pathways (94%), interest in an industry career (94%), dedication to the major (93%), knowledge of the job interview process (92%), opportunities to get career advice (90%).

- Students were asked to describe the activities they engaged in the conference. The majority of students met students from other institutions (82%) and met faculty members they did not know (53%) and nearly half applied for a technical position (46%). One in four had an internship interview at the conference.

- Students were most likely to edit or plan to edit their resumes following GMiS (85%), more than half had or planned to inquire about internships (56%) and nearly three quarters had or planned to inquire about career opportunities following their experience at GMiS. The conference was also effective in expanding student networks, providing additional social capital as they reach the work force. Nearly half of the students reported contacting or planning to contact a student met at the conference (47%), more than half had or planned to contact a professional from the conference, a third have or planned to contact a faculty member (33%).

**Virtual REU**

Faculty and students who participated in the vREU experience were asked to participate in surveys adapted from previous evaluation studies of the ARG model. Students' responses were compared with data from face-to-face ARG experiences to understand how the virtual implementation compared.

- Faculty reported that they had a “good understanding” of the ARG model following the vREU experience (71%), with one respondent (7%) indicating “a lot of understanding” and about 1 in 5 (21%) stating that they had “some understanding of the model.” Faculty found the model “highly effective” for developing undergraduate researchers (50%). The rest of the faculty noted they found it “mostly effective” (29%), somewhat effective (14%) and “a little effective” (7%).

- Students were asked to indicate the “top 3” gains they experienced following the vREU. Responses indicate that more than half of the respondents grew the most in research skills (89%), communication skills (66%), technical knowledge (64%) and personal growth, including confidence (57%). We find it notable that the online only REU produced the sense of growing communication skills and wonder if professional online communication in particular was an area of growth for students.
• Students responded in overwhelmingly positive ways about the way the vREU prepared them for a career in computing (38% strongly agree, 49% agree) and nearly all students said they had a greater knowledge of career and education options following their vREU experience (43% strongly agree, 47% agree). To a lesser extent, students felt more prepared for advanced coursework (34% strongly agree, 47% agree) and nearly 2/3 felt more prepared for graduate school (21% strongly agree, 43% agree).

• The collaboration scale was developed especially for ARG projects as a means for understanding whether and how the cooperative learning elements of ARG are influencing the interactions among group members. Results are primarily positive, with agreement between 81-94% for most items. The highest rated item related to participants receiving feedback on their work (61% SA, 33% A).

• Students who experienced the vREU were compared on the survey instrument items with participants who engaged in ARG in person before the pandemic. T-tests indicate no statistically significant differences in results. These findings provide evidence that the virtual experience can be just as effective as a face to face research experience when faculty are supported in the delivery of workshops, individual and group scaffolding, and deliberate skill building of students.

Mini-Ideas Lab

• According to faculty who participated in the NSF Mini Ideas lab, the most useful activities were: NSF program officers description of research funding (3.42 out of 4, useful to very useful), small group discussions following the workshop that happened “off-line” (3.21 out of 4, useful to very useful), presentation of ideas to the larger group November 20th (3.16 out of 4, useful to very useful) and individual generation of ideas during workshop time (3.05 out of 4, useful to very useful).

• Faculty described capacity building that occurred during the Mini Ideas Lab, specifically in the following areas: proposal writing, grant ideation, targeting a grant solicitation, expanding a collaborative network of researchers, implementing new knowledge into current research, introducing new communication strategies, introducing brainstorming into research group practices.

• In follow up surveys in early spring, the majority (77%) of mini-IDEAs workshop attendees indicated that the workshop series was at least “somewhat effective” in developing new research collaborations with colleagues, while over half of participants found it to be “effective” or “highly effective.” Overwhelmingly, workshop attendees (85%) reported that it was at least somewhat effective in generating research ideas, while almost all of these participants marked that it was “effective” or “highly effective” for developing research ideas.
Most attendees (61%) reported that the workshop had improved their ability to write competitive research proposals. Most attendees (71%) also found the mentoring and support they received in proposal development to be at least somewhat effective. Almost all attendees (92%) reported that the workshop had facilitated the development of cross-institutional research collaborations.

**Research Experiences for Women - Virtual Events**

CAHSI faculty held virtual workshops to support students interested in graduate school and research career pathways. Thirty-four participants completed surveys across the two events—82% were women and 85% were Hispanic/LatinX. They provided data regarding their experience as well as the steps they have taken since the research event to further their research careers in computing.

- Nearly all student participants said the events provided information about getting involved in research (93% stated it provided at least “a good deal” of information). Eighty percent felt the event increased knowledge of the career pathways available, while 73% stated the event increased dedication to the major, made participants feel more connected to faculty, and made participants feel more connected to peers.
- Students received the survey at least a week following the research event, providing time for students to act upon what they learned in the events. Students were most likely to inquire about internships (84%), update their resumes (81%) and inquire about virtual research opportunities (81%) or in person ones (76%), or plan to do these tasks, following the research event. To a lesser degree, they have contacted faculty (67%), contacted students from the event (59%), contacted a professional they met at the event (51%), or planned to do these tasks.

**Recommendations**

CAHSI has developed and strengthened communication strategies over the course of the CAHSI INCLUDES grant cycle. For the most part, communication processes exist to share important information and deadlines. In the past year, CAHSI has also shown progress in creating communication networks among students. For instance, a discord server was set up for CAHSI Scholars which has been enthusiastically received. Likewise, CAHSI advocates requested a discord so that they could communicate easily and share ideas across campuses. Additionally, one of the most prominent suggestions in response to an open-ended question on the faculty and staff survey was to increase opportunities for sharing and collaboration across regions.

Regional communication and collaborative processes have been strengthened, but fewer formalized opportunities exist for cross-regional sharing and collaboration, in some ways exacerbated by the pandemic. CAHSI leadership could consider offering opportunities for cross-
regional collaboration during all-hands meetings. Continued development of communities of practice that focus on an activity rather than a region, and more structured offerings, such as mini-IDEAS workshops, could also strengthen cross-regional collaboration among CAHSI members.

For some CAHSI departments, signature practices have yet to be institutionalized, and the lack of department level resources for CAHSI-related direct curricular and support services has shifted action towards co-curricular and extra-curricular activity. While these types of community building and inclusive practice are important, they are not sufficient for creating inclusive learning environments within the major. Gathering departmental climate feedback is vital to understanding the departmental change that could support inclusivity in computer science, and movement towards curricular and pedagogical change across more CAHSI departments is needed.

The CAHSI backbone has been instrumental in coaching and providing expertise in large-scale grant writing assistance to CAHSI partners, and multiple collaborative proposals have been submitted to date for research and for educational aims. In some cases, departments need guidance and support with more small-scale funding opportunities—one example is finding funds to implement PLTL across departments in a subregion of CAHSI. Two ways CAHSI might drive uptake and creation of new signature practices could be a) holding smaller scale workshops on grant writing for internal grants and small-scale grants with adequate lead time (e.g., 3 months before submission) with a follow-up component closer to the time of submission, or b) developing a mini-grant model with industry support to fund pilot efforts that may be scaled with sufficient evidence of effectiveness.

CAHSI Partners are supportive of the Engage Tool, are becoming used to the documentation of activity in the tool and see the value of looking across time and across regions at the work of CAHSI. The links CAHSI stakeholders are making between action and strategy are uneven—for some, the strategic plans are more evident in the Engage Tool documentation than for others. Solidifying these connections through large group discussion, modeling from the backbone, and sample sharing through the backbone-approved submissions may support accurate, meaningful Engage Tool use.
Appendix A: Mini Ideas Faculty Survey Report 2021

The Mini-Ideas lab was the most substantial professional development and capacity building effort that CAHSI undertook in the academic year. The lab engaged faculty who self-identify as Hispanic along with faculty who can influence Hispanic students in the development of research proposals. Members met for brainstorming sessions virtually, used technical tools to build out different ideas, met with NSF program officers to discuss the calls for proposals, then developed brief documents for review among the teams as well as with NSF program officers for feedback. New potential research groups developed from these proposals, which were submitted in the spring of 2021. This report summarizes findings from an initial survey as well as a follow set of questions integrated into the collective impact survey in early spring of 2021.

Quantitative data – Mini Ideas Experience

According to faculty who participated in the NSF Mini Ideas lab, the most useful activities were: NSF program officers description of research funding (3.42 out of 4, useful to very useful), small group discussions following the workshop that happened “offline” (3.21 out of 4, useful to very useful), presentation of ideas to the larger group November 20th (3.16 out of 4, useful to very useful) and individual generation of ideas during workshop time (3.05 out of 4, useful to very useful). To a lesser extent, the following activities were found useful: small group discussions during the workshop time (2.95 out of 4, somewhat useful to useful) and brainstorming in the large group to refine problem statements (2.84 out of 4, somewhat useful to useful). Averages remain closest to “useful” on a 4-point scale, where 1 = not at all useful and 4 = very useful.

Figure 33. Usefulness of each element of the Mini Ideas lab structure

Please rate the usefulness of each element of the Mini Ideas lab structure:
Mini ideas participants had positive regard for the Mini Ideas lab experience—questions related to satisfaction had 84% to 89% agreement. Specifically, participants said the overall quality was satisfactory (84%), amount of resources available was satisfactory (84%), facilitators presented clearly (84%) and facilitators created an interactive experience (84%). Nine of ten participants would recommend the experience to a colleague (89%).

**Figure 34. Satisfaction with the Mini Ideas Lab**

For the most part, mini ideas participants were satisfied with the Mini Ideas lab—32% rated it “excellent”, 31% stated it was “good” 16% rated it average and one in five described it as “fair.” Some of the concerns from participants were: a) the number of technical tools used, b) difficulty learning about and from groups that met in different time periods, c) exclusivity of groups once formed through use of alternative technologies once “offline” collaboration commenced.
Qualitative data regarding collaborative infrastructure elements - how did Mini Ideas support collective impact?

Participants responded to several open-ended items related to the Mini Ideas workshop—these open-ended responses were collapsed across the survey, and the collaborative infrastructure themes were utilized as key codes to interpret the responses- 3 of the 5 were generative as a way of framing the results, and they appear below.

**Network**

Faculty from across multiple CAHSI institutions participated in Mini-Ideas—they found dedicated time to collaborate with their peers to be very valuable. In some cases, it was deepening relationships that existed previously and in other cases, faculty were meeting new peers. When asked about the “greatest strength” of Mini Ideas, multiple participants noted this faculty engagement:

*Opportunity to interact with faculty from different institutions.*

*I found people to work together on NSF proposals.*

*Meeting different people and trying to merge ideas.*

Faculty also noted the way in which the Mini Ideas expanded their networks—in the Mini-Ideas lab, they gained access to multiple NSF officers who described their CFPs from their own perspectives, and also provided direct feedback to Mini Ideas Proposals following short flash
talks about their plans. This added social capital to faculty at HSIs, who are often not positioned to be successful with grant funding because they are underresourced, have less robust research support networks, and lack staffing for research support at their institutions. Multiple respondents note the access to NSF officers was the greatest strength of Mini Ideas. They note “face time with NSF P.O.s” and “the availability of the program directors” in this open-ended item.

**Leadership and Communication**

Most participants described the structure developed by the backbone for the Mini Ideas Lab as a great strength and one of the best parts of the collaboration, as of the late November 2020 survey timeline. In open ended items, they highlight the use of technical tools to engage in collaborative effort, the facilitation, and the time taken to plan and support interaction among faculty beyond initial meetings.

> I liked the use of the different software to make a more collaborative online experience.

> The sessions were an appropriate length of time and structured in such a way to allow all to participate, through small group discussions and synchronous and asynchronous electronic platforms. The way these were facilitated was very impressive. The time was used well.

> Providing structure about what to do and how to do. Reaching out to us from time to time to make sure we were aware of the next stages.

The collaboration initiation across faculty from different institutions.

At the same time, one participant noted a gap in structure—at the level of proposal writing. This began towards the end of November and had a due date of January—it is unclear if the timing of the survey led to this response, or whether the respondent would have shared the same sentiment in the spring 2021 semester.

> (A need I experienced was) a more structured process for the execution of getting faculty to collaborate to formulating the proposal.

**Expansion, Sustainability, and Scale**

The Mini Ideas lab engaged faculty from 24 institutions—participants either were Hispanic/LatinX researchers themselves or serve students at H.S.I.s, including but not limited to past CAHSI participants. Of those in the list, 17 institutions have become engaged in CAHSI only since the CAHSI INCLUDES funding began, indicating great expansion. Many of the faculty on the list overlap with the VREU faculty professional development and programming which ended in fall 2020—this may indicate sustainable relationships between CAHSI and the emerging computing faculty leaders.

One goal of the Mini Ideas Lab was to elevate the work of CAHSI researchers at HSIs through capacity building, an important element of expansion, sustainability and scale. Participants
described ways in which the experience has developed their research capacity (or has potential to build this capacity). Quotes appear below.

Proposal writing: I have learned to write out my ideas better and in a more organized way.

Grant ideation: in terms of understanding the process of structuring a grant.

Targeting grant solicitations: Collaborating with some colleagues to better target specific solicitations

Expanding collaborators: I am using everything I learn toward the NSF proposal that we will submit in 2021. Without Mini Ideation workshop, we wouldn't have the team and the proposal.

Improving current research: I have brought back some of the machine learning-related concepts back into my own research; to extend it in new ways.

Integrating new communication strategies: Watched two different groups work; used constructive collaboration strategies from one group with the other group. Reached out to others in CAHSI to see if they are interested in collaborating.

Integrating brainstorming into research: I haven't yet used anything but I might use the structure for generating ideas in my research group.
Appendix B: Virtual REU

Introduction
CAHSI received RAPID NSF funding to develop and implement a virtual REU program that utilized the elements of the Affinity Research Group model (citations) to provide students with a research opportunity during the COVID-19 global pandemic. The REU was held during late summer and early fall of 2020 and served students and faculty. Participants completed a survey following the GMIS conference to describe their experiences in the program.

In the meetings, we always have space to comment about the feelings and personal stuff that they want to share. Also, we have a space to talk about the logistics of the V REU program. And finally, each one presents the advances and challenges that they have during the week.

Students were asked to indicate the “top 3” gains they experienced following the vREU. Responses indicate that more than half of the respondents grew the most in research skills (89%), communication skills (66%), technical knowledge (64%) and personal growth, including confidence (57%). We find it notable that the online only REU produced the sense of growing communication skills and wonder if professional online communication in particular was an area of growth for students.
Students were asked to describe the activities they had accomplished in the past year in relation to dissemination of research findings. As the vREU included participation in the GMiS conference, most of the students described attendance at a conference and preparation of a poster for a conference. The survey was
distributed following the conference. However, students had plans to attend professional meetings (93%), prepare a poster (50%), author a journal article (32%) and author a conference paper (32%).

Figure 38: Activities students plan to do because of the virtual REU

![Bar chart showing plans after virtual REU]

Figure 39 ARG: Intellectual gains/knowledge development

ARG: Intellectual gains/knowledge development
In my research experience, or because of my research experience:

- I understand the process of computer science research.
- My knowledge from computing courses seems more relevant.
- My ability to identify the limitations of research methods and designs has improved.
- My understanding of the theory and concepts underlying my research project has improved.
- I have gained general problem-solving skills.

![Survey responses chart]
Participants who completed the survey were nearly all in agreement regarding their intellectual gains and knowledge development following the vREU, with responses for strongly agree and agree over 92% in each case. The item with the most “strongly agree” responses related to understanding the theory and concepts underlying computer science research (57% SA). Nearly half of students strongly agreed that their computing knowledge seemed more relevant (48%) and their ability to critique research in their field had improved (47%).

Similarly, nearly all students agreed or strongly agreed with statements related to confidence and interest in computer science research, with each item receiving at least 90% agreement/strong agreement. Nearly half of students strongly agreed that they were more interested in computer science in general (49%), while slightly fewer strongly agreed they were more confident in their ability to do research (43% SA).

Figure 40: ARG: Computer science research interest/confidence

ARG: Computer science research interest/confidence In my research experience, or because of my research experience:

- I have improved my ability to work independently.
- I became more confident in my ability to do research.
- I became more interested in computer science in general.
- I have gained confidence in my ability to do well in future computing courses.
- I have gained confidence in my ability to contribute to the field of computing.
Overall, students were slightly less positive about their skill development, yet the majority of students agreed with each statement. This could be due to the limited timeframe of the vREU. The least favorably rated item related to time management—77% agreed that their time management skills had improved. This may be related to the timeframe of the vREU, which was expected in the summer, coinciding with fall semester start dates for most students. All other items showed 87% or more agreement, yet the proportion of “strongly agree” responses is slightly lower than previous reported scales.

Figure 41 ARG Skill development
The collaboration scale was developed especially for ARG projects as a means for understanding whether and how the cooperative learning elements of ARG are influencing the interactions among group members. Results are primarily positive, with agreement between 81-94% for most items. For some, disagreeing with a faculty mentor is uncomfortable (66% are comfortable, 34% are uncomfortable disagreeing with faculty mentors). The highest rated item related to participants receiving feedback on their work (61% SA, 33% A).
Students responded in overwhelmingly positive ways about the way the vREU prepared them for a career in computing (38% strongly agree, 49% agree) and nearly all students said they had a greater knowledge of career and education options following their vREU experience (43% strongly agree, 47% agree). To a lesser extent, students felt more prepared for advanced coursework (34% strongly agree, 47% agree) and nearly 2/3 felt more prepared for graduate school (21% strongly agree, 43% agree).

Students were asked more specifically about what influenced students’ ideas about graduate school- two thirds of respondents to the item regarding the choice to go to graduate school said their research experience influenced their decision (68%) and more than half credited their research mentor (55%). Thirty nine percent said their undergraduate peers and the same proportion noted family members helped them make a decision about graduate school.
Students were asked about their access to a formal or informal mentor. Responses were reviewed across both items, to understand mentorship at the student level. Twelve of the 47 who responded to these items said they did not have a mentor in their lives, though nearly 3/4ths reported they were part of either an informal or a formal mentorship with faculty or professionals in the field.

Students were predominantly upperclassmen, though some freshmen and sophomores participated.
The majority of students described their ethnicity as Hispanic/Latino/a (79%) with about 1 in 5 indicating they identify as white/Caucasian (17%). A small proportion identified as Black/African American (6%), Asian from Indian sub-continent (4%) and Asian, not from Indian sub-continent (6%).
Students were asked in open ended items about the difference between virtual and face to face opportunities in research, in terms of faculty and peer support. Responses were mixed, with 12 responses indicating negative impact of having the REU online, 14 indicating neutral or no impact of having the REU online, and 16 describing benefits of having the vREU online. Overall, those reporting negatively felt some discussions would have been better if in person, that the time lag waiting for email responses slowed progress, and that face to face communication would allow for more support. Some also mentioned technical issues they had in communicating based on inadequate WIFI. The neutral statements indicated they did not feel they were worse off than in a face to face experience, and in some cases indicated they were happy to do this project given the limitations of opportunities due to social distancing. Those who spoke positively about the virtual experience felt they had better access to peers and mentors via online communication, were pleased with access to REU without leaving home, and appreciated the 24/7 accessibility they had with their mentors and peers.
Students were asked how to improve the program. The bullets below are recommendations culled from their responses:

- Increase communication around expectations, due dates, and time commitments, particularly as they relate to synchronous events.
- Static informational resources for easy reference regarding expectations, due dates, and GMiS information.
- Increased organization, and in future years a summer timeline.
- Reconsider the use of Shindig and OneNote.
- Addition of events where students could a) mix socially across research groups, b) learn about one another personally through ice breaker activities, and c) share their research efforts with peers.
- Greater supervision of mentoring faculty, and opportunities to switch mentors and research subjects.
- Consider how to improve vREU student accessibility to resources, including improved internet and access to adequate hardware.
- Access to webinars after the fact through sharing of recordings.

**Faculty Survey Data**

Faculty were asked to engage with the survey as part of the obligations of the grant. Responses indicate faculty felt they had a “good understanding” of the ARG model following the vREU experience (71%), with one respondent (7%) indicating a “lot of understanding” and about 1 in 5 (21%) stating they had “some understanding” of the model. Some of the participants had already engaged in ARG in previous REU opportunities.
Faculty found the model “highly effective” for developing undergraduate researchers (50%). The rest of the faculty noted they found it “mostly effective” (29%), somewhat effective (14%) and “a little effective” (7%).
Regarding the online version of ARG, faculty were more likely to mark a response in the middle—43% said the online version was “somewhat effective” and 36% state it was “mostly effective”, with only 14% saying the virtual version was highly effective. Faculty were most likely to state they implemented ARG “to a moderate extent” (57%) than they were to state implementation was “to a great extent” (21%).
Faculty Preparation
In open ended items, faculty described how the preparation influenced their work in the vREU. Faculty appreciated the initial workshop and the weekly meetings with peers, as well as the Slack channel. Those who had already worked in an ARG model saw the initial workshop as a good refresher, and for those new to ARG the weekly meetings were important points of contact.

Faculty Engagement with ARG
Faculty indicated satisfaction with the workshops and the weekly meetings. They found the most useful concepts to introduce to students were a) the ways to provide constructive feedback and b) the skill of asking probing questions. Others were thankful for the resources (e.g., materials to learn about elevator speeches) and the technical structure (e.g., use of notebooks and journals structured for student use). Multiple faculty noted how they integrated what they already do with students with the ideas of the ARG model—an example is the introduction of a storyboard as a tool for communication within the research experience.
Research formats differed by mentor, with some meeting daily with all students and others sharing the meeting responsibilities with graduate students to a greater degree. Most appeared to meet 2-3 times per week for extended time, often with other peers with whom the vREU students engaged. Many described structured set ups, such as the first meeting of the week would allow student presentations of progress with group feedback and the second meeting would allow for skill building. Faculty specified tools to use to keep on task and to keep the group informed. Mentors appeared to differ regarding the extent to which communication was encouraged across group members and with the mentor beyond the meeting times—some indicated very regular email and text communications while others did not. Some faculty mentioned forming personal relationships while others did not.

I had a group of two students. We had two weekly meetings of 2 hours each. The first meeting each week started with a research paper presentation done by one of the students, over a paper related to the research project assigned by me a week in advance. The second student would have to ask probing questions and provide constructive feedback at the end of the presentation. After this part we would go over a professional development session based on the CAHSI provided materials. This presentation/workshop would be led by me. The final part of the meeting would be a brief chat to determine if the weekly assignments were clear and see if there were any issues to be addressed by me. The second meeting of the week would be split evenly with each student having one hour to work on his project, while the other student would be part of the conversation for feedback and suggestions. We would go over the assigned work for the week and go over questions and potential issues. As the research progressed, we used this meeting also for the students to review their abstracts, elevator pitch, poster and presentation with the other student contributing with questions and feedback.

**Shifting Online**

Faculty described how the online REU model compared to the face to face model. For most it was the first time they facilitated research groups fully remotely, and there were adjustments made to support student development at a distance. This section summarizes main points from faculty open-ended responses.

**Benefits of online format:**

- Creates access for more students to learn from faculty members and peers from other computing departments
- Can be run from any location, cutting down on commute time and making time and place flexible for faculty and students alike.
- The formality of meetings online made for more polished products by students and faculty—time together was more structured than in a more fluid in-person lab setting.
Drawbacks of the online format:

• Lack of hardware
• Onboarding students with software was slower, more difficult
• Troubleshooting was more difficult at a distance
• Non-verbal communication cues are lacking
• Internet connectivity for some students/faculty mentors was problematic
• Ability of students to anonymize self/avoid face to face connection with video—this influenced relationship building with faculty and peers.

Suggestions for future efforts with vREU

Many of the suggestions may be naturally addressed as the program moves into year 2. Specifically, the program was developed for online use as the program progressed- this rapid, in real time development meant that resources were not always provided early in the experience, such as the template for student posters at GMIS, but rather just in time for use. Next year, providing faculty with the materials in the beginning will support their use and re-development of materials as needed. Also, having a more traditional summer schedule in 2021 will alleviate the time management negotiations that many students faced when the end of the experience coincided with midterms for fall semester.

Faculty would appreciate if their shared materials were modified as needed and provided to the next set of VREU mentors. They expressed interest in building the resource base. Timelines for vREU expected metrics and outcomes provided early in the program would help alleviate the stress of preparing for the GMiS virtual poster session in late September—faculty were not always sure about what was expected from their undergraduates and when.

Faculty encourage multimedia resource development and use to supplement skill-building workshops. Some faculty mentioned they did not have time to adequately prepare their lessons for students related to skill building, and in some cases relied on their previous methods for skill development rather than using materials with which they did not get a chance to become familiar. A faculty member noted that adding in opportunities to quantitatively or qualitatively measure growth in a structured way would be beneficial- the faculty member mentions asking students to complete an elevator pitch in early, mid and later weeks of the program as a potential model for all to adopt. One faculty member mentioned misunderstanding that (he or she) would be expected to organize the skill building sessions—there was an assumption that
the organizers would pool students to accomplish that task. Clarity in recruitment of faculty would benefit the program.

**Summary**
Overall, students and faculty were positive about the VREU program—its structure, sense of collective action, sense of support for the majority of faculty and students, and student self-reported outcomes indicate the VREU is a viable option for student growth and research advancement.
Appendix C: Supporting Hispanic women in computing (Fem Prof)
This brief document serves as a summary of findings from 4 focus groups in fall of 2020 with 13 Fem Prof alumna from the University of Puerto Rico Mayaguez. The purpose of the document is to highlight benefits of the Fem Prof program according to alumna, programmatic elements that Fem Prof participants found most valuable, the programmatic approaches appreciated by the alumna. They also describe potential additions to Fem Prof that could bolster the program. The interview protocol and a summary of the Fem Prof program is provided as appendices to provide context.

FemProf- Advocacy and Empowerment

- Alumna have sought industry positions that have a healthy climate, and in which they are valued. They describe jobs that left them feeling undervalued, silenced, or held back, and in many cases have arrived at different companies or in different positions where they feel more welcome.
- Alumna described multiple ways in which they advocate for women and underrepresented youth in their current positions, through formal and informal means. This includes recruiting women, advocating for interviewing women when they apply, advising women who are junior to them in industry, checking in on women as they join the company, and engaging in coaching for more junior women in their workplaces in strategies to advance their careers, including negotiating salary and time off when accepting a job offer. Many have joined groups for Hispanics and groups for women in their current positions as graduate students and professionals—for some, the pandemic has hampered such participation.

Vital FemProf Programmatic Elements to be Cultivated in Future Programs
The bullets in this section describe the format of the program that Fem Prof alumna found beneficial, the details and structure of participation—the “what” of the program. The expectations for FemProf participants were clearly delineated—participants should do 2 REUs, apply for scholarships, apply for graduate school, and participate in school year research when possible. In addition, they were expected to attend workshops on gender equity, workshops
that supported developing applications, and should participate in Grace Hopper conferences when possible.

- The explicit expectations of the program were seen as valuable to participants, who indicated they were unsure they would have advanced as far as they did without that expectation. For some, it kept graduate school in the back of their minds, for others, it set them up to apply directly to graduate school following undergraduate studies.

- Expecting 2 REUs was valuable from participants’ perspectives—some did not have a good experience in their first REU and stated they probably would not have applied for a second without that expectation. Others found that multiple REUs were valuable for learning which areas of the field were most of interest.

- The explicit emphasis of the program on equity and the development of a safe space for discussing gender equity in computing during workshops was valued—participants noted they did not always have female peers in their classes and so having dedicated time with women was of note.

- Including applications for REUs and graduate school as assignments with accountability supported students who stated they were unsure whether they would otherwise have applied for opportunities. For some, this created an opportunity for familial independence and new life experiences including spending time on the mainland for the summer.

- Workshop content focused on gender equity allowed for frank discussions about gender inequity in the field—students stated they had “forewarning” about what they might experience as women in a male dominated field.

Details of the Fem Prof Approach to be Cultivated in Future Programs

The following section is focused on how the program was implemented—specific characteristics of the ways in which participants interacted that were described as valuable—the “how” of the program.

- Nearly all participants described the high level of mentorship they received in FemProf—they described the care faculty took in mentoring them. Many mentioned a friendship as
well as a professional bond, and described the fact that mentors checked in with them regularly, rather than the other way around.

- While the aims of the program were deliberate and explicit, alumna said their personal interests and situations were accounted for in their mentoring conversations. For example, some chose to delay graduate school, and others were motivated to seek industry positions and internships as well as REUs. Fem Prof alumna mentioned these decisions were treated with respect by faculty leads and mentors.

- Fem Prof messaging included “normalizing the struggle” of engineering education programs. A common theme was the message they received from Fem Prof—“this is hard but we can do it together.”

- In some cases, students had poor experiences in REU programs on the mainland. The program leads never made assumptions about the participants’ skills in these cases—they focused on how to make sure students had good experiences in the future. When possible more vetting of research groups was attempted—the message received was that this research group was “a bad fit” not that the researcher was less capable. This attitude came through in the focus groups, in the ways Fem Prof alumna spoke about their experiences in REUs.

- A theme that emerged from the data was the notion that Fem Prof was about giving back—the value of serving those who come after you was introduced in Fem Prof, perhaps implicitly, and some of the women described that as a value and practice they continued.

- Fem Prof participants who started as 3rd year students and continued at least 5 years described how the expectations built from one another, and how the application process became easier with time. Messages they received were about how they could tweak an essay they had already worked on for an REU, or how their previous application text could be modified to better fit the graduate school documentation. Alumna had little anxiety about graduate school applications once they were at that step. For those who joined the program in the first years, when they were further along than the target student group, the graduate school application felt much more daunting.
Additional Elements that Would Bolster the Success of Related Programming Moving Forward

- Assigning near peer mentors to Hispanic Women in Computing participants would boost sense of belonging and commitment to the programmatic goals.
- Participation should extend beyond BS graduation—while many FemProf alumna continued relationships informally with their peers, multiple alumna suggested some formal way to stay connected would be beneficial. Some note they would imagine serving as mentors for students as part of that membership in Hispanic Women in Computing.
- Create authentic opportunities to connect across institutions—networking events to further interests and expertise, development of collaborative research, or friendly competitions could support building community across campuses. In a CAHSI-related project, two students who met at a conference from different institutions formed a collaboration on a side project to build their technical portfolios—these collaborations could be seeded with programmatic support.
- The Hispanic Women in Computing would benefit from taking a long view of graduate school aspirations, and to include more examples of successful women who entered the PhD at differing timelines, to support the notion that the “traditional” pathway towards the professoriate is not the only successful path. To that end, learning about the BS-industry-graduate school pathway from those who accomplished it would be helpful.
- Programming should focus additional seminars on the financial elements of graduate school, including assistantships, national scholarships that are not tied to institutions, related graduate fellowships and NSF programs (e.g., NSF LSAMP bridge to the doctorate).
- Specific skills were needed for women to succeed in their computing careers—one specific need was to focus attention to the need for negotiation and the skills to negotiate well for salary, benefits, time off, and other more holistic elements of an offer.
Supplemental FemProf Materials- overview of Fem Prof and Questionnaire

Fem Prof 2020 Focus Group: Background, related work, and proposed questions

Collaborative Research: BPC-DP: Paving the Road to Professorship for Female Students, called “Fem Prof,” was the NSF-funded program that mentored undergraduate women towards academic degrees from 2008 to 2012. University of Houston-Downtown and UPR Mayaguez collaborated on this project. Scholars attended conferences, participated in retreats related to gender equity and to professional skill development, met regularly, and participated in outreach and student support efforts on their campuses. At CAHSI conferences, the women developed and presented workshops to their peers regarding gender equity, REU experiences, conference presentations, and graduate school.

Since then, women from the program have developed their careers in computing and tech industry, academia, and beyond. The purpose of gathering with UPR Fem Prof alumna is to a) gather retrospective data regarding how FemProf scholars benefited from the program; b) understand whether and how Fem Prof reached its goals of empowering women in computing, c) understand how Fem Prof shaped scholars’ careers, d) understand how Fem Prof shaped scholars’ academic lives, e) learn how the FemProf program influenced their developing identities as technical women. In addition, we hope to understand whether and how the Fem Prof Alumna would like to engage with current undergraduate students who participate in CAHSI’s growing Hispanic Women in Computing effort.

For reference, the following publications relate to this project:


Script for the focus group:

Sarah: Thank you so much for joining me to talk about your experiences with FemProf. I had to look up the dates - the program ran from 2008 through 2012 if you can believe it - I imagine we all have experienced a lot since then, but I hope everyone can share some of their experiences of the program and how it influenced their lives through the present. I hope to discover more about your careers as we go, but I thought we could start by going around the virtual room and saying our names, when you graduated and with what degree, and what you are doing now. I’ll go first. I’m Sarah Hug, I graduated with my PhD in 2007 and was the program evaluator for FemProf from 2008 to 2012. I am still involved with CAHSI as the evaluator of the CAHSI INCLUDES Alliance. I run my own business doing social science research and educational program evaluation.

Let’s see, [name] why don’t you go first, and call on someone to go next when you are finished.

Women in Tech Identities

FemProf aimed to increase participant’s awareness of gender inequities and bias in technical fields, as well as provide strategies for self-advocacy.

a) Can you recall a time when you became aware of gender bias or gender inequity in your field?

   What did you notice, and how did you react? (probe for influence of FP program)

[(if applicable) would you react differently now, as a professional in the field with more experience?]

b) Can you recall a time when you chose to advocate for yourself or for another woman in your field?

   Tell us about that experience. (probe for influence of FP program)

c) What did you learn from FemProf regarding gender bias?

   about empowerment?

   about advocacy for women in computing?

Experiences to Further Careers

FemProf participants were expected to apply for REUs as members of the program.

a) Tell me about your experience applying for REUs.
b) Did REUs change your understanding of your field? if so, how?

c) Did REUs change your interest in your field? if so, how?

d) How are you applying what you learned from REUs to your work life?

**Sense of Belonging**

a) Tell me what it was like to be a member of FemProf as an undergraduate.

b) Now, do you have opportunities to connect with other women in your field? [How/when/with whom?]

c) Now, do you have opportunities to connect with other LatinX professionals in your field? [How/when/with whom?]

**Academic Pathways**

a) FemProf focused on preparing undergraduate women for the professoriate. How did that programmatic goal influence your academic decision making, if at all?

b) If FemProf influenced your ideas about graduate school, how?

c) If FemProf influenced your ideas about teaching, how?

d) If FemProf influenced your ideas about research, how?

**There is a new effort to engage undergraduate Hispanic women in mentoring, career development and goal setting throughout CAHSI. So far, the women have participated virtually in 2 webinars, had access to mentors during “office hours” to develop academic plans, and met with women in industry and academia to learn about their experiences.**

a) What should we consider when planning events for the Hispanic Women in Computing cohort?

b) Which elements of FemProf should we try to recreate? Which elements should we leave out?

c) How can we increase engagement of Hispanic women in CAHSI efforts, in particular those focused specifically on females?

d) What recommendations do you have for building community with students across different institutions?
e) If your schedule allows, would you want to connect in some way with the newest cohort of undergraduate women in computing? (what could that look like? How would you prefer to engage?)
Appendix D: Google ECR Events- Post Survey Results

In fall and spring of the 2020-2021 school year, CAHSI faculty held virtual workshops to support students interested in graduate school and research career pathways. While Google collected initial data during the event, the evaluation team collaborated with Kean and the Puerto Rico faculty who developed events for women interested in computer science research in a post-event follow up survey. Thirty-four participants completed surveys across the two events—82% were women and 85% were Hispanic/LatinX. They provided data regarding their experience as well as the steps they have taken since the research event to further their research careers in computing.

Responses are reported when participants state the event provided “a good deal” or a “great deal” of the element described in the survey item. Nearly all student participants said the events provided information about getting involved in research (93% stated it provided at least “a good deal” of information). Eighty percent felt the event increased knowledge of the career pathways available, while 73% stated the event increased dedication to the major, made participants feel more connected to faculty, and made participants feel more connected to peers. Slightly fewer felt the event increased knowledge of computing (71%), or increased interest in a particular area of computing (69%). See object below.
Figure 51: Participant Benefits for Research Event

**Participating in the Research Event:**

- made me feel more connected to faculty: 8% not at all, 20% somewhat, 25% good deal, 48% great deal
- made me feel more connected to my peers: 8% not at all, 23% somewhat, 25% good deal, 48% great deal
- increased my interest in a particular area of computing: 8% not at all, 23% somewhat, 31% good deal, 38% great deal
- provided information about getting into research: 4% not at all, 23% somewhat, 45% good deal, 48% great deal
- increased my knowledge of career pathways in my field: 3% not at all, 18% somewhat, 25% good deal, 55% great deal
- increased my knowledge of computing: 8% not at all, 23% somewhat, 23% good deal, 48% great deal
- increased my dedication to my major: 8% not at all, 23% somewhat, 25% good deal, 48% great deal

Figure 52: Activities performed or planned following research event

**Since the Research Event:**

- I have updated my resume since attending ERWC: 51% yes, 30% plan to do this, 19% no
- I have inquired about virtual research opportunities based on my experience at ERWC: 53% yes, 28% plan to do this, 19% no
- I have inquired about internships based on my experience at ERWC: 55% yes, 29% plan to do this, 16% no
- I have inquired about research opportunities based on my experience at ERWC: 47% yes, 29% plan to do this, 24% no
- I have contacted a professional that I met at ERWC: 20% yes, 31% plan to do this, 49% no
- I have contacted a faculty member that I met at ERWC: 39% yes, 28% plan to do this, 33% no
- I have contacted a student I met at ERWC: 28% yes, 31% plan to do this, 42% no

Legend:
- Yes
- PLAN to do this
- No
Students received the survey at least a week following the research event, providing time for students to act upon what they learned in the events. Students were most likely to inquire about internships (84%), update their resumes (81%) and inquire about virtual research opportunities (81%) or in person ones (76%), or plan to do these tasks, following the research event. To a lesser degree, they have contacted faculty (67%), contacted students from the event (59%), contacted a professional they met at the event (51%), or planned to do these tasks.

COVID has interrupted access for students in virtual environments to some degree—students in Puerto Rico were asked whether and how technology had interrupted their experience of the virtual event. For most with a technical issue, unreliable internet and wifi service was described (13) followed by difficulty accessing private space to engage in the event (6), lack of internet where they live (4), difficulty accessing new tools (3), and difficulty logging into the website or portal (2).

**Figure 53 technical difficulties in research events**
Appendix E: GMiS report fall 2020

In fall of 2020, the GMiS conference was moved to an online event because of the ongoing global pandemic. The event took place over two weeks. Registration data was used to indicate expanded reach, and evaluation survey data is reported to indicate impact of the event for the subset of attendees who completed the instrument (119 of 368, 32%).

The majority of students were seniors (37%), and juniors (24%) followed by sophomores (15%), fifth year seniors (8%), and freshmen (4%). There were also a number of graduate students who attended through CAHSI and CAHSI-related funding (7% Masters’ students, 2% PhD students). One hundred thirty three of the students were women (36%) 226 of the students were men (61%) while 9 (2%) chose not to disclose gender. Students represented 36 schools across the US and its territories. The list below shows the students’ schools. Students were nearly all computer science and related majors (e.g., cyber security) (74%), while 16% were in electrical or computer engineering and 7% identified Information technology major areas of study.

Demographic data- survey respondents
One hundred nineteen participants took the survey. 45% of them indicated they were women. Seventy nine percent stated they were Hispanic. Students were primarily 3rd and 4th year students, though there was some variety in the student level- see object.

<table>
<thead>
<tr>
<th>GMIS CAHSI Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>California State University, Dominguez Hills</td>
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<tr>
<td>California State University, East Bay</td>
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<tr>
<td>California State University, Fresno</td>
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<tr>
<td>California State University, Long Beach</td>
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<tr>
<td>California State University, Los Angeles</td>
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<tr>
<td>California State University, San Marcos</td>
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<tr>
<td>California State University, Stanislaus</td>
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<tr>
<td>Chandler-Gilbert Community College</td>
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<tr>
<td>Del Mar College</td>
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<tr>
<td>El Camino College</td>
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<tr>
<td>El Paso Community College</td>
</tr>
<tr>
<td>Florida International University</td>
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<tr>
<td>Inter American University of Puerto Rico</td>
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<tr>
<td>Inter American University of Puerto Rico – Bayamon</td>
</tr>
<tr>
<td>Kean University</td>
</tr>
<tr>
<td>Lonestar College</td>
</tr>
<tr>
<td>Merced Community College</td>
</tr>
<tr>
<td>New Mexico Institute of Mining and Technology</td>
</tr>
<tr>
<td>New Mexico State University</td>
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<tr>
<td>Northeastern Illinois University</td>
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<tr>
<td>Phoenix College</td>
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<tr>
<td>Polytechnic University of Puerto Rico</td>
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<tr>
<td>San Francisco State University</td>
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<td>San Jose State University</td>
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<td>Texas A&amp;M University - Corpus Christi</td>
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<tr>
<td>University of California, Merced</td>
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<td>University of Houston - Clear Lake</td>
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<td>University of Houston - Downtown</td>
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<tr>
<td>University of Houston - Victoria</td>
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<tr>
<td>University of Puerto Rico at Arecibo</td>
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<td>University of Puerto Rico at Bayamon</td>
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<tr>
<td>University of Puerto Rico at Mayaguez</td>
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<tr>
<td>University of Puerto Rico at Rio Piedras</td>
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<tr>
<td>University of Texas at El Paso</td>
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<tr>
<td>University of Texas Rio Grande Valley</td>
</tr>
</tbody>
</table>
Figure 54: GMiS Student Standing

I am a:

- Doctoral student: 1%
- Master's student: 7%
- Fifth year or more undergraduate student: 13%
- Fourth-year undergraduate student: 24%
- Third-year undergraduate student: 20%
- Second-year undergraduate student: 15%
- First-year undergraduate student: 6%

Responses: 33%
Sixty percent of participants stated the events and talks at GMiS helped or greatly helped their career development, while a third (34%) said it somewhat helped their development. Six percent did not believe the conference influenced their career development.
GMiS was effective in supporting student dedication, knowledge, and interest in computing careers. Nearly all students described the event as at least somewhat influencing their: knowledge of career pathways (94%), interest in an industry career (94%), dedication to the major (93%), knowledge of the job interview process (92%), opportunities to get career advice (90%). To a lesser degree, the conference increased student interest in a particular area of computing (86%), increased knowledge of computing (86%) and helped students find a mentor (50%). The low mentor rate may have had to do with the virtual nature of the conference and the relatively quick transition time to a virtual event. It will be important to discover deliberate ways to connect students with mentors in the 2021 conference.

Figure 57: Benefits of GMiS Attendance

Students were asked to describe the activities they engaged in the conference. The majority of students met students from other institutions (82%) and met faculty members they did not know (53%) and nearly half applied for a technical position (46%). One in four had an internship interview at the conference. By the time students had responded to the survey a month later, a small number had received an internship or job offer (7%).

Figure 58: Activities At GMiS

<table>
<thead>
<tr>
<th>Please list the activities you engaged in at the GMiS conference</th>
<th>Yes</th>
<th>No</th>
<th>N.A.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I met students from other institutions at the conference.</td>
<td>82%</td>
<td>86</td>
<td>16%</td>
<td>2%</td>
</tr>
<tr>
<td>I met faculty members that I did not already know at the conference.</td>
<td>53%</td>
<td>56</td>
<td>38%</td>
<td>9%</td>
</tr>
<tr>
<td>I applied for a technical position at the conference.</td>
<td>46%</td>
<td>48</td>
<td>44%</td>
<td>10%</td>
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</tbody>
</table>
Students were most likely to edit or plan to edit their resumes following GMiS (85%), more than half had or planned to inquire about internships (56%) and nearly three quarters had or planned to inquire about career opportunities following their experience at GMiS. The conference was also effective in expanding student networks, providing additional social capital as they reach the work force. Nearly half of the students reported contacting or planning to contact a student met at the conference (47%), more than half had or planned to contact a professional from the conference, a third have or planned to contact a faculty member (33%).

Nearly half of the GMiS student respondents are interested in graduate school opportunities-13% had applied to graduate school, 34% planned to do so, and 53% did not have plans to apply to graduate school.
Students described their experiences with the technical sessions—here we asked specifically about the AI, data analytics, cybersecurity workshops, and hackathon. CAHSI designed workshops with intention to create inclusive learning spaces—because of this, the survey addressed the session and its implementation as well as student gains. Sessions encouraged active participation (91%) and created a sense of community (79%). In addition, sessions provided preparation for students to succeed (79%) and emphasized growth and improvement (92%). In these learning environments, students developed confidence during the technical sessions (86%), and developed technical skill and knowledge (84%).
Anecdotally, we found that some students had less opportunity to engage with recruiters than others—the online format had scheduling capability, but students said that if you were unable to join sessions at the beginning, the interview spots were filled, and students were unable to connect, in some cases, with professionals in the field. This may have led to the finding regarding the career and graduate fair—more than a third did not communicate with any recruiters one on one, thirty four percent communicated with one or two recruiters one on one, and less than a third communicated with 3 or more (30%).
Figure 62: Career/Graduate Fair Interaction

During the career/graduate school fair, I:

- Did not communicate with any specific recruiters one-on-one (30.14%)
- Communicated with one or two recruiters one-on-one (35.62%)
- Communicated with three or more recruiters one-on-one (34.25%)

Students were asked about their greatest accomplishments at GMiS and the biggest benefit of the conference. Many noted similar experiences in these responses, and so the coding table below is combined across the two items. Example responses are included in the table to illustrate each theme.

Figure 63: Student Accomplishments at GMiS

<table>
<thead>
<tr>
<th>Code</th>
<th>Accomplishment</th>
<th>Benefit</th>
</tr>
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</table>
| Networking                | 11 responses   | 25 responses  
Networking was definitely what I enjoyed the most about the conference. Shindig was definitively a great tool to accomplish this! |
| General Participation/Access | 3 responses  | 3 responses  
I was able to attend without having to miss my classes. |
| Job offers/opportunities  | 2 responses   | 10 responses  
I received a job offer and had interview opportunities and garnered the attention of several hiring managers. |
<table>
<thead>
<tr>
<th>Category</th>
<th>Responses</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Career/Job preparation</td>
<td>4 responses</td>
<td>I learned a lot about how to arrange my resume and interview for jobs in tech which will benefit me greatly in the coming years.</td>
</tr>
<tr>
<td>Competition experience</td>
<td>18 responses</td>
<td>I was able to participate in the Hackathon which solidified my area of interest (cybersecurity). My major is Computer Science.</td>
</tr>
<tr>
<td>Research communication/presentation</td>
<td>13 responses</td>
<td>A professor was very intrigued about my work and contacted my mentor to get involved with my research.</td>
</tr>
<tr>
<td>Women in computing session impact</td>
<td>1 response</td>
<td>I really benefited from listening to other female experiences in STEM. I especially enjoyed getting advice from PhD students. As a master’s student, I am considering my PhD, so I really appreciated getting a perspective from those who have gotten or are currently working on their PhD.</td>
</tr>
<tr>
<td>Graduate school support</td>
<td>NA</td>
<td>Getting a few waivers from certain graduate institutions</td>
</tr>
<tr>
<td>Knowledge of the field</td>
<td>NA</td>
<td>Someone recorded a machine learning workshop for me since it was full. That helped me get more info on the industry I’m most passionate about.</td>
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</tbody>
</table>