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Executive Summary
The CAHSI Executive Summary for the 2022 report focuses on four themes: growth and change, building welcoming graduate student communities through collaborative research, student leadership and development, and best practices in communication.

Growth and Change
One of the most impactful aspects of CAHSI has been the transformation in values and practices among members. Through their participation in CAHSI, many members have reinforced or even transformed their values and approaches to students and learning. Some of these shifts involved formal and informal changes to classroom practices. As an example of an informal change, many CAHSI faculty mentioned that they are now much more likely to discuss career paths, graduate school preparation, and professional opportunities in their courses. In this way, CAHSI faculty make the “hidden curriculum” of academic success and future pathways more explicit. Faculty have also ensured that their approach to teaching and learning aligns with CAHSI values. Most importantly, many veteran CAHSI participants talked about shifts in values and how CAHSI values have become ingrained in their practices over time, as a typical comment: “By now [CAHSI Values] are really ingrained in what we do. We are influenced by CAHSI principles, CAHSI practices and all that. The department continues to be that way. It’s just become part of life.”

CAHSI members have also expanded their adoption of strategic actions that align with CAHSI values. On the Collective Impact survey, almost all survey respondents (86%) had planned or developed strategic actions during the past year at varying levels of effort; many of these participants reported “some” or “great” effort. In the past year, About 2/3 of CAHSI participants submitted grant proposals related to CAHSI’s mission. Although newcomers are still just beginning to understand CAHSI values and practices, 100% of those who had been involved with CAHSI for less than two years (i.e., the new members from R1 institutions) were at least somewhat engaged in activities to advance CAHSI’s mission.

Despite the addition of many new participants in the past year, the adoption of CAHSI signature practices is relatively high throughout the network. The percentage of survey respondents who were implementing at least one signature practice in their department rose from 62% (in 2020-21) to 90% in the past year. This finding indicates that departments that may have discontinued or modified signature practices due to the pandemic have reinstated these student-centered practices in their departments. Peer-led team learning increased most dramatically: the percentage of CAHSI participants implementing PLTL rose from 43% to 72%. The level of engagement in policy change has held steady from previous years, with about half to
2/3 of CAHSI participants working towards or advocating for policy change in their institutions or departments.

**Building welcoming graduate student communities for CAHSI students through collaborative research**

CAHSI has always prioritized undergraduate research through its Affinity Research Group model but there has been a renewed emphasis on research through initiatives such as the Virtual REU and Local REU programs. Several campuses engage in exemplary ARG practices and are developing new ARG models such as the research partnership between EPCC and UTEP which provides a research and academic pathway from community college to the university. Some faculty have found the local REU model has provided flexibility to include additional elements into the research experience. For instance, Merced College has integrated field trips to a farm during the local REU since the research focus is on agricultural technology which is also a significant issue in their local area. CAHSI and its larger network have created graduate school opportunities for students. For example, four Calbridge students seeking doctorates at University of California campuses came from CSU-Stanislaus as a result of its participation in CAHSI. Additionally, two Latina FemProf alumna just received their doctorates and a Hispanic student who received the Google dissertation award just received his doctorate. Therefore, despite strong headwinds, CAHSI is creating pathways to graduate degrees that are being utilized by students. More importantly, these pathways involve collaborations that ensure that CAHSI students will study in departments that share CAHSI student-centered values.

Graduate climate study results indicate that continuing CAHSI schools may have expertise in the area of developing a welcoming community for graduate students—comparative data indicate continuing CAHSI schools’ respondents were more likely to report positive faculty engagement (p = 0.002), valuable advisor relationships (p = 0.0008), fewer average feelings of exclusion (p = 0.00016) and greater growth in graduate student skills (p = 0.019)

CAHSI instituted the local REU model in the past year that paired CAHSI students and faculty in localized research experiences. Faculty mentors received virtual training in the Affinity Research Group (ARG) model. Mentors displayed significant growth from pre- to post survey in their knowledge of effective research mentoring practices (t = -2.259, df = 38, p = .030) and their understanding of the ARG model (t = -3.639, df = 37, p < .001). Likewise, the percentage of mentors who were knowledgeable or had extensive knowledge of effective mentoring practices for underrepresented students rose from 39% prior to the REU to 83% at the end of the experience. Mentors reported that students’ strongest learning gains were in understanding the research process, developing independence, and understanding the research literature. Student pre- to post survey results show great growth in research skills (t = 2.38, df = 34, p = .023), ARG development
(t=4.39, df=32, p.0001), computing interest and confidence (t= 3.99, df= 34, p.0003), and problem solving skills (t= 3.28, df =34, p.0024).

Student Leadership and Development

CAHSI has created multiple pathways to student leadership. These pathways include Student Advocates, CAHSI Scholars, CAHSI clubs, Peer Leaders, and the new Allyship program. Professional development trainings, such as interviewing workshops, remained common activities to support students’ competitiveness in the computing workforce (69% of departments). CAHSI participants were slightly less engaged in student clubs or organizations (57% of departments compared to 75% in the previous year), although this is likely due to the expansion of new members and the challenges of maintaining student organizations during the pandemic.

CAHSI campuses have become more involved in formally preparing students to be successful at the Great Minds in STEM conference. This preparation has augmented students’ outcomes and contributed to a more successful student experience at the conference. UHD, in particular, has led this innovation. Their preparation activities have focused on showing students how to make connections and be successful in interacting with industry representatives.

Originally launched at CSU-DH, hack-a-thons have expanded across the Alliance. The majority of CAHSI departments (72%) sponsored or co-sponsored hack-a-thons or other events in the past year. For instance, NMSU has done an in-person coding challenge that CAHSI Advocates helped to coordinate. UHD and TAMU-CC have collaborated on hack-a-thons. They had over a hundred students participate across two competitions that involved 10 different campuses in South Texas. The Southwest region in Puerto Rico has also developed successful hack-a-thons.

In addition to expanding signature leadership practices, CAHSI campuses have innovated several programs and offerings in the past year. Kean University has created a CAHSI resource center for students to assist them with information and provide guidance about pursuing graduate school, preparing for job interviews, and other professional opportunities. UTEP and UPRM have launched the Allyship program to support first year students in introductory courses by pairing them with a student ally. The initiative was initially for women and has been expanded to men with sponsorship by Google. UTEP has also launched a leadership class that could serve as a pilot to be scaled across the Alliance. A faculty member commented on the opportunities within CAHSI for leadership development: “What CAHSI has done well is with connections. …. When you connect students with someone and they can see themselves as a computer scientist, I think that is really good and CAHSI has been doing that.”

Best Practices in Communication
Regional relationships continued to be the focus of CAHSI collaborations in the past year. Regions progressed their partnerships and continued to develop activities and events that benefited students across the regions. Regional meetings promoted sharing of best practices and recent innovations. A new member from the North region stated, “It was great that I actually got to know some of my colleagues in this network. And I also had a collaborator who works in the Southwest region. I feel like it's a great network that could help all of us to do research and collaborate with people from across the country.” As CAHSI has expanded to include more research-extensive universities, new opportunities have opened for research collaborations. A member stated, “I think that CAHSI has become a community where faculty with similar goals are getting together, sharing information and working together, and there are several proposals. The subgroups have been submitting [proposals] and the information sharing is really beneficial to each other.” Many departments noted that there is much greater awareness of CAHSI among faculty and students than in previous years. In particular, departments that were first funded through the INCLUDES DDLP project all noted that they had made substantial progress in the past year in raising general awareness of CAHSI’s mission and activities in their department.

In interviews, CAHSI veterans and newcomers emphasized the importance of regular meetings and communications on multiple levels within the network to share information and foster collaboration. CAHSI members noted the importance of regional meetings, sub-regional meetings, all-hands meetings, and regular communication with the backbone. Members expressed a desire to return to periodic in-person all-hands meetings. CAHSI members identified the following benefits/best practices of the regular regional meetings:

1. Building relationships and developing trust amongst CAHSI members
2. Developing and facilitating collaborations
3. Sharing information and resources
4. Sharing student and faculty opportunities
5. Trouble-shooting/problem-solving, and seeking advice about challenges
6. Sharing promising practices
7. Setting goals and coordinating strategies
8. Providing access to outside expertise through guest speakers and other sources
9. Affirming, promoting, and reflecting on CAHSI’s vision
10. Encouraging and motivating CAHSI participants
11. Orienting and integrating newcomers into the region and the broader CAHSI community
12. Connecting the region to the backbone through the attendance of a backbone member at the regional meeting
Introduction to the Full Report
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. 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, with individualized requests later in the data collection window. This year, 33 CAHSI staff and leaders took the survey out of a possible 43 who were asked to do so. Four 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. In this new year for research-intensive institutions, the evaluation sampled five new institution teams. The data from these new members led to a formative report to support onboarding training held in July. In addition, interviews were used for the case study that appears in this report. 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.

Graduate Climate Study
All CAHSI institutions with a graduate program were provided a graduate climate survey link specific to their institution, along with a sample email message to send out to graduate students, and reminders at regular intervals. Following data collection, results were analyzed at the scale and item level. Comparison studies were also conducted, with comparative groups selected based on research regarding STEM bias, stereotypes, and issues of access. Comparative study utilized independent sample t-tests, given the relatively small sample of responses, at 198. Implications of results are suggested in the report.

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. Evaluators attended the July onboarding meeting for new members held at Snowbird.

**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 the report covering GMiS, the virtual REU follow-up, ARG Exemplar study, and the local REU program. The impact of these initiatives is described 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 always conducted because they were not always appropriate given the data. Although inferential statistics were not computed in all cases, 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.” Componential 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. The first dataset to utilize the headers are that of the social network analysis study. Following this, the Collective Impact survey data are reported with the same collaborative infrastructure headers. Multiple initiatives are reported regarding Expansion, Sustainability and Scale. Relevant data are described and discussed within each section. The report includes an executive summary and final recommendations for future consideration as CAHSI continues to scale its efforts and expand its reach.

**Shared Vision: Social Network Analysis**

In the social network survey, participants are asked how they contribute to the shared vision of CAHSI. The most common responses included a 5-way tie: “my time for recruiting underrepresented students to participate in CAHSI events” (26), “my advocacy for CAHSI students to earn research opportunities” (26), “my facilitation/leadership skills” (26), “my local/regional connections to academic institutions” (26), and “my advocacy for Hispanics in computing” (26). The next most common response was “my administration/coordination of activities (24) followed by “my advocacy for CAHSI students to gain technical jobs” (22), and “my time for implementing initiatives” (20). Half or nearly half of the respondents gave their time to direct student support or sharing of expertise: my time to organizes student activities (18), my specific knowledge/expertise of educational practices in HSI settings (18), my time mentoring students (17), my specific technical knowledge/expertise (17), and my time reviewing student work (15). About a third gave their time training others in initiatives (13). Industry contributions were not particularly common—5 mentioned connections to national industry, though 16 shared their connections to regional/local connections to industry.
When asked to describe the most important contribution each participant made towards the CAHSI Shared Vision, responses were dispersed across 11 of 16 options. The most common were administration/coordination of CAHSI activities (9), my advocacy for Hispanics in computing (5) and my time recruiting underrepresented students to participate in CAHSI events (4). See chart below.
Social network survey respondents described the benefits of collective impact (the form of collaborative infrastructure used by CAHSI) to the work of the shared vision. In the first item, like in the previous set, survey respondents list ALL of the ways collective impact improves the work of diversifying computing. In the second item, respondents replied regarding the most important way collective impact improves the work.

The most common response in both items was “improved resource sharing across CAHSI members and partners” (29). About two thirds said that communication and community were important benefits, specifically: improved communication among computer science stakeholders (22), increased sense of belonging among those who influence Hispanics in computing (22), and improved community support across sectors (20). Three received 19 responses, specifically: increased opportunities to lead CAHSI INCLUDES efforts (19), increase local/regional awareness of computing as a viable career option (19), and improved sense of local/regional ownership for CAHSI initiatives (19). The least common responses were selected by at least a third of
respondents: improved recruitment of new partners (18), increased sense of urgency to make change (16), increased ability to measure change (15), and improved decision making at the local/regional level (14).

Figure 3: Benefits of Collective Impact to CAHSI

![Benefits of Collective Impact Approach](image)

Just in the previous set of items, the distribution of those benefits deemed most valuable were well distributed—9 of the 11 concepts received at least one vote. The most common were improved resource sharing across CAHSI includes members and partners (9), and a three-way tie between increased sense of urgency to make change (4), increased local/regional awareness of computing as a viable career option (4), and increased sense of belonging/community among those who influence Hispanics in computing (4). See chart.
Respondents were asked to describe the extent to which CAHSI has been successful at reaching its goals. One in four described CAHSI as “very successful” (23%), while half described the network as “successful” (52%) and another quarter, “somewhat successful” (22%) while 3% state the network is not successful.
In addition, social network respondents describe the elements of collaboration they think has led to the collaborative’s success. The most common response was “exchanging information/knowledge” (28), with three more elements tied for next popular—having a shared mission/goals (23), sharing resources (23), and meeting regularly (23). Three more elements were selected by about half—using data to make decisions (18), bringing together diverse stakeholders (17) and selecting research-based educational practices (16). Fifteen participants selected informal relationships created, and fourteen participants stated collective decision-making. In these ways, CAHSI network members perceive progress made towards the shared vision of CAHSI.

Partnerships- Social Network Analysis
Partnerships are vital to growth and expansion in CAHSI. The social network maps from the PARTNER tool shows us visually how the network is changing over time, and how regional differences and differences by time in the network influence CAHSI. In the first map, labeled “monthly communication network map, only continuing CAHSI institutions,” the connections for schools that were a part of CAHSI for over a year are documented. This map of frequency shows a dense collection of connections with the backbone in blue dispersing from the center and out. Each node has at least three arrows, or connections, leading towards it. Not all nodes have arrows radiating out, because not all members responded to the survey.
When new members are added, there are isolates in the network—these are all new members to the CAHSI network, and many are part of a region with staff turnover at the time of the introduction of new members.
To understand partnership frequency more completely, the map below shows weekly connections through CAHSI continuing institutions. Nearly all have at least regional connections with other CAHSI members at least weekly.

Figure 9: Weekly communication network map, only continuing CAHSI institutions

At the “weekly communication” mark, there are more isolates when considering new members and continuing members.
As CAHSI is focused on partnerships that lead to transformation, the depth of the collaboration is of interest. The PARTNER tool used for this element of evaluation defines the depth of collaboration in terms of cooperative, coordinated, and integrated activities—the evaluation team redefined these levels in terms relatable to CAHSI members, and these definitions appear in the survey as written in the figure below.

**Figure 11: Activity definitions**

<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>

| Integrated Activities: 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.) |
As in past years, each region was plotted based on the types of activities each participant engaged in with the other members of the region, with the members of the backbone also included. This year, the new research-intensive members were included in the regions, and this addition has changed the pattern of regional collaboration. This is most noticeable in the images of region+backbone at the highest activity level, that of integrated activities. There are multiple isolates, and in most cases, the isolates are new members. See images below.

Figure 12: Integrated activities maps for regions and backbone

When mapped at the level of multiple kinds of activities, the isolates are no longer visible, yet lack of participation in the survey and lack of participation in regular meetings has created some relationships that are tenuous to date, particularly for the West, which included a high number of new members. Since this data was collected, an onboarding event occurred at Snowbird that may influence relationships moving forward.
Partnerships can also be analyzed at the level of the network itself, through average metrics over time. We expected in this new year to see a decrease in network centralization, density, and trust, and those did occur. The density of the network declined—only 18.49% of the possible links were realized across the network. While the drop in network connections declined, it is clear that 100% would not be ideal, and so developing a target for density might be appropriate, and that might be different by role in the network. For example, it might be ideal for a region member to connect directly to all of the regional members, and perhaps to one or two backbone members and one or two other region members through signature practice participation. At the same time, a connector might be expected to connect to all backbone members, all
coordinators/connectors, and all network members. This differentiation by role is not captured in the average density.

As the network grows, it is advantageous for degree centralization to decline so that membership and connections even out across the network. This should spread the work with the partnerships in the network, across staff and leaders. Trust of members remains high, though it did decline from 2021 to 2022. The introduction of new members may have lessened the overall trust within the network, yet this year’s 91.76% is similar to the 2020 score of 91.6%.

![Figure 14: Table of Network Scores Over Time](image)

<table>
<thead>
<tr>
<th>Network Scores</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density: Percentage of ties present in the network in relation to the total number of possible ties in the entire network.</strong></td>
<td>32.50%</td>
<td>33.80%</td>
<td>26.70%</td>
<td>18.49%</td>
</tr>
<tr>
<td><strong>Degree Centralization: The lower the centralization score, the more similar the members are in terms of their number of connections to others (e.g. more decentralized).</strong></td>
<td>72.60%</td>
<td>67.20%</td>
<td>39.7%</td>
<td>27.91%</td>
</tr>
<tr>
<td><strong>Trust: The percentage of how much members trust one another. A 100% occurs when all members trust others at the highest level.</strong></td>
<td>86.00%</td>
<td>91.60%</td>
<td>97.21%</td>
<td>91.76%</td>
</tr>
</tbody>
</table>

The set of data in the partnerships section describes how the network connections shift with the growth through a new grant opportunity in CISE BPC. In this first year with new members, there is a lack of deep collaborative connection between new members and continuing members, though the network is robust at the more superficial level of cooperative activity. Regions differ in the ways they have built connections, and the uneven distribution of new members may play a role.

**Goals and Metrics - Social Network Analysis**

No applicable data was collected on the social network survey that relates to this element of collaborative infrastructure—see Collective Impact Survey section.

**Leadership and Communication - Social Network Analysis**

Communication practices differ by region and by role in the network- in this section network scores are explored across regional affiliation and across role types. The evaluation team hypothesized that regions with larger numbers and greater longevity would rate one another more positively. The evaluation team also hypothesized that the backbone would have the
greatest connectivity, and would be rated the highest in measures of trust and value. We note that while the longest running and largest regions score slightly higher than the newer, smaller regions in some instances, the pattern was slight and did not hold across all items. The backbone scores did however surpass the regional counterparts in all but one item: “open to discussion.”

**Figure 15: Network Scores by Region**

<table>
<thead>
<tr>
<th></th>
<th>CAHSI BB</th>
<th>North</th>
<th>West</th>
<th>Southwest</th>
<th>Southeast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Degree Centrality</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>51.98%</td>
<td>24.28%</td>
<td>19.05%</td>
<td>29.67%</td>
<td>22%</td>
</tr>
<tr>
<td><strong>In-Degree Centrality (Max 43)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14.33</td>
<td>6.20</td>
<td>6.17</td>
<td>7.46</td>
<td>6.57</td>
</tr>
<tr>
<td><strong>Out-Degree Centrality (Max 43)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15.50</td>
<td>7.00</td>
<td>3.67</td>
<td>9.77</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>Total Value (1-4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.64</td>
<td>2.96</td>
<td>3.10</td>
<td>3.06</td>
<td>3.20</td>
</tr>
<tr>
<td><strong>Power / Influence (1-4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.57</td>
<td>3.09</td>
<td>3.12</td>
<td>2.85</td>
<td>3.20</td>
</tr>
<tr>
<td><strong>Level of Involvement (1-4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.72</td>
<td>3.08</td>
<td>3.16</td>
<td>3.23</td>
<td>3.36</td>
</tr>
<tr>
<td><strong>Resource Contribution (1-4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.64</td>
<td>2.71</td>
<td>3.02</td>
<td>3.12</td>
<td>3.05</td>
</tr>
<tr>
<td><strong>Total Trust (1-4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.74</td>
<td>3.43</td>
<td>3.69</td>
<td>3.30</td>
<td>3.55</td>
</tr>
<tr>
<td><strong>Reliability (1-4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.78</td>
<td>3.23</td>
<td>3.55</td>
<td>3.22</td>
<td>3.59</td>
</tr>
<tr>
<td><strong>In Support of Mission (1-4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.93</td>
<td>3.68</td>
<td>3.90</td>
<td>3.36</td>
<td>3.59</td>
</tr>
<tr>
<td><strong>Open to Discussion (1-4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.52</td>
<td>2.87</td>
<td>3.89</td>
<td>3.33</td>
<td>3.46</td>
</tr>
</tbody>
</table>
The backbone members as well as the connectors and coordinators are paid members of the CAHSI network—they are staff funded at least part time by CAHSI to support the work of leads, co-leads, and affiliate faculty. As such, the evaluation team hypothesized that they would have more connections than their counterparts, that they would have higher degree centrality in the network and would have higher trust and value scores. As in past years, the connector and coordinator score line up between backbone members and other members, except for the item related to power in the network. This perceived lack of power of staff may be important to consider across the network—particularly as an organization that emphasizes the importance of staff in serving students at H.S.I.s.

### Figure 16: Network Scores by Role

<table>
<thead>
<tr>
<th>Organization Name</th>
<th>Backbone averages</th>
<th>Connectors &amp; Coordinators averages</th>
<th>BB/CC averages</th>
<th>All others averages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Degree Centrality</strong></td>
<td>51.98%</td>
<td>30.16%</td>
<td>37.43%</td>
<td>21.05%</td>
</tr>
<tr>
<td>In-Degree Centrality (Max 43)</td>
<td>14.33</td>
<td>7.83</td>
<td>10.00</td>
<td>6.16</td>
</tr>
<tr>
<td>Out-Degree Centrality (Max 43)</td>
<td>15.50</td>
<td>8.83</td>
<td>11.06</td>
<td>5.40</td>
</tr>
<tr>
<td>Total Value (1-4)</td>
<td>3.64</td>
<td>3.22</td>
<td>3.36</td>
<td>3.03</td>
</tr>
<tr>
<td>Power / Influence (1-4)</td>
<td>3.57</td>
<td>2.98</td>
<td>3.18</td>
<td>3.06</td>
</tr>
<tr>
<td>Level of Involvement (1-4)</td>
<td>3.72</td>
<td>3.42</td>
<td>3.52</td>
<td>3.11</td>
</tr>
<tr>
<td>Resource Contribution (1-4)</td>
<td>3.64</td>
<td>3.24</td>
<td>3.37</td>
<td>2.91</td>
</tr>
<tr>
<td>Total Trust (1-4)</td>
<td>3.74</td>
<td>3.72</td>
<td>3.73</td>
<td>3.38</td>
</tr>
<tr>
<td>Reliability (1-4)</td>
<td>3.78</td>
<td>3.63</td>
<td>3.68</td>
<td>3.29</td>
</tr>
<tr>
<td>In Support of Mission (1-4)</td>
<td>3.93</td>
<td>3.79</td>
<td>3.84</td>
<td>3.07</td>
</tr>
<tr>
<td>Open to Discussion (1-4)</td>
<td>3.52</td>
<td>3.74</td>
<td>3.67</td>
<td>2.88</td>
</tr>
</tbody>
</table>

### Expansion, Sustainability and Scale: Social Network Analysis

No applicable data was collected on the social network survey that relates to this element of collaborative infrastructure—see Collective Impact Survey section.
**Shared Vision - Collective Impact Survey**

CAHSI participants, including new members for the most part, continued to advance CAHSI’s mission through strategic planning, action, and partnership. Almost all survey respondents (86%) had planned or developed strategic actions during the past year at varying levels of effort; many of these participants extended “some” or “great” effort. Even though regions have already solidified their strategic plans, individual CAHSI participants continued to develop strategic actions within their institutions, sub-regions, and regions. Nearly the same number of survey respondents moved beyond planning and implemented strategic activities (69%), a higher rate than in the beginning of the CAHSI expansion, but similar to the rate of the previous grant year. About 2/3 of CAHSI participants submitted grant proposals related to CAHSI’s mission. About a quarter of CAHSI participants reported that they spent “great” effort on CAHSI-related grant proposals. This is higher than in previous years when typically 40% of CAHSI participants submitted a grant proposal. The efforts to develop grant and research capacity within CAHSI departments has yielded a greater number of grant proposals.

![Figure 17. CAHSI Members’ Advancing Shared Vision, 2021-22](image-url)
There was some regional variation in activities related to implementing CAHSI’s vision. Overall, all regions were highly involved in planning strategic actions. Participants were also highly engaged in implementing strategic actions in all regions. The Southwest region was somewhat less engaged in developing cross-sector partnerships and submitting grant proposals, but there were also more survey respondents from the Southwest region so likely to be greater variation in engagement among respondents. Still, all regions displayed moderately strong engagement in advancing CAHSI’s common agenda.

<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>Planned strategic actions</td>
<td>87%</td>
<td>82%</td>
<td>88%</td>
<td>86%</td>
<td>86%</td>
</tr>
<tr>
<td>Implemented strategic actions</td>
<td>87%</td>
<td>68%</td>
<td>88%</td>
<td>86%</td>
<td>83%</td>
</tr>
<tr>
<td>Developed cross-sector partnerships</td>
<td>48%</td>
<td>60%</td>
<td>75%</td>
<td>60%</td>
<td>59%</td>
</tr>
<tr>
<td>Submitted grant proposals</td>
<td>53%</td>
<td>80%</td>
<td>75%</td>
<td>71%</td>
<td>65%</td>
</tr>
</tbody>
</table>

Participants’ length of affiliation with CAHSI was more important than regional affiliation for engaging in actions to advance CAHSI’s shared vision. Newcomers to CAHSI (those involved two years or less) were varied in their engagement, while veterans (6+ years) were strongly engaged in activities related to CAHSI’s mission. For example, 100% of those who had been involved for less than two years (i.e., the new members from R1 institutions) were at least somewhat engaged in activities to advance CAHSI’s mission, while only 57% of those involved with CAHSI for 3-5 years were engaged in strategic actions or grant proposals in the past year. On the other hand, 100% of veterans (6+ years involvement with CAHSI) were highly engaged in all aspects of advancing CAHSI’s mission, from strategic planning and implementation to grant submissions.

Barriers to Achieving CAHSI’s Shared 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 administrators/chairs and faculty colleagues. However, several CAHSI participants noted that their work for CAHSI is not rewarded in the tenure and promotion process or financially rewarded, making it more difficult to involve faculty colleagues. Some participants also noted that their administrators or chairs were not focused on diversity and equity issues, although at least one participant commented that recent changes in leadership may shift the values and priorities within their departments. Other barriers included a lack of funding, resources, or staff support to fully implement all strategic actions and signature practices within departments. A few participants noted a lack of time to be involved with CAHSI and commented
that this was a barrier to the participation of their faculty colleagues as well. Finally, a few participants noted that they faced no barriers at their institutions and were supported in their work with CAHSI.

**Figure 19: Barriers Faced by CAHSI Participants**

![Barriers Faced by CAHSI Participants](image)

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of faculty/administrator engagement</td>
<td>33%</td>
</tr>
<tr>
<td>Lack of funding/resources/staffing</td>
<td>33%</td>
</tr>
<tr>
<td>Lack of time</td>
<td>20%</td>
</tr>
<tr>
<td>No barriers</td>
<td>13%</td>
</tr>
</tbody>
</table>

**Partnerships- Collective Impact Survey**

No applicable data for this concept in the Collective Impact Survey

**Goals and Metrics- Collective Impact Survey**

A core component to the success of collective impact initiatives is the use of goals and metrics to track progress, inform decisions, and improve practice. 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 CAHSI’s progress in creating equitable, inclusive learning environments for students and faculty.

In the past year, CAHSI participants used data to improve programs at higher rates than in previous years (e.g., 88% of participants had used data to a “slight extent,” “some extent,” or “a great extent” compared to around 70% in previous years), which may reflect the increased number of federal grants within the CAHSI network. The percentage of CAHSI participants who used data “to a great extent” to improve programs or practice rose from 25% to 35% of survey
respondents. Similarly, the percentage of participants who used data “to a great extent” for decision-making purposes rose from 25% to 41% of survey respondents. The percentage of participants who had used data to track organizational progress toward CAHSI’s goals rose slightly from 65% to 79% of survey respondents. The percentage of participants who had used data in the past year to identify regional or local needs remained steady (about 75%). To a lesser extent, CAHSI participants have used the ENGAGE tool to make decisions or for strategic planning purposes (about half of respondents).

There were no regional variations in the use of data for planning, decision-making, or tracking progress. Therefore, there has been some growth in the use of data in all regions since the beginning of the grant. However, there were substantial differences between CAHSI newcomers and veterans in the use of data to advance CAHSI’s vision. For instance, only 29% of newcomers reported that they had used data to identify local or regional needs, while 100% of veterans had done so in the past year. Likewise, 43% of newcomers had used data for decision-making purposes in the past year, while 100% of veterans had done so. Overall, survey respondents reported greater use of data in the past year for strategic planning and to improve practice, although CAHSI veterans (6+ years involvement with CAHSI) were much more likely to
use data to support their work than CAHSI newcomers with less than two years affiliation with CAHSI.

**Leadership and communication- Collective Impact Survey**

The Backbone organization provides the coordination and coherence within any collective impact effort, and is central to the understanding of leadership and 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. Due to the inclusion of new members in the past year, CAHSI participants reported slightly more support from the backbone organization than in the previous year. The support received by members also related to communicating strategy and vision, suggesting that this type of support is pivotal for new members. For instance, nearly half of survey respondents reported that they had received support from the backbone in the form of communication and coordination about vision and strategy. Nearly two in five respondents received support in understanding CAHSI’s mission/vision, an increase from previous years. About a third of participants also received support in adopting CAHSI signature practices, also reflecting an increase from previous years. The percentage of participants who received assistance in securing external funding increased from 6% to 27%. In interviews, multiple CAHSI leaders noted that members of the backbone had reviewed grant proposals and offered advice in securing funding. To a lesser extent, participants reported support in data use and advocacy or policy, slightly lower levels than in previous years. In all, CAHSI participants reported more support in onboarding in the past year which might be expected given the inclusion of new institutions in the Alliance.
Overall, regions reported similar support from the backbone and placed the same amount of value on the support received. Therefore, there were no regional differences in support received from the backbone, indicating that the backbone 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 the backbone organization. For example, only 14% of veterans received support in understanding their role in achieving CAHSI’s mission/vision, while 57% of newcomers reported the same. Newcomers received less support in adopting CAHSI signature practices (16%) compared to those who had participated in CAHSI for 3-5 years (75%). This suggests a progression of participation where newcomers first must become oriented to CAHSI’s structure and vision and their role within the network. Due to the complexity of CAHSI, this task may take one to two years to achieve. Participants can then turn their attention to adopting signature practices and expanding their role within the network. In turn, veterans reported the most support from the backbone in coordinating strategies and securing funding, reflecting higher levels of engagement with CAHSI.
Support Needed from Backbone

In an open-ended question about how the backbone can better support local efforts, there was general consensus that the Backbone had provided important support for collective impact work. About two in five survey respondents had no suggestions. However, some respondents offered advice for ways that they could be supported by the backbone. The most frequent response (25%) was earlier and more detailed communication about initiatives, events, and opportunities. Respondents suggested that they needed greater detail for planning purposes and more lead time for events and opportunities. A few respondents requested more all-hands meetings since these meetings have been held virtually since the pandemic. This sentiment was echoed in interviews as regional and institutional leaders requested more in-person all-hands meetings and events. A few survey respondents requested that their departmental data be shared with them and that they could use more guidance in how to use Engage or other data for decision-making purposes.

![Support Needed from Backbone](image)

In addition to understanding leadership through backbone actions, a collaborative infrastructure depends upon continuous communication. The national CAHSI network, spearheaded by the efforts of the backbone organization, offers the opportunity for the regional and sub-regional networks to come together to build consensus on a common mission and goals, identify and align common strategies and activities, and to implement student support and skill-building activities. In keeping with its focus on regional networks, in the past year, the CAHSI network focused more on regional collaboration than national collaboration. All of the regions
met regularly to plan, strategize, and share practices and ideas. Members of the backbone organization attended these regional meetings to enhance communication between the backbone and the regional networks and to disseminate and share ideas and opportunities. Additionally, the backbone continued to host calls with the regional coordinators and connectors to disseminate information and problem solve.

Continuous communication also involves the dissemination of information, internally about events and opportunities, and externally about the mission and work of CAHSI. The most frequent communication practice reported on the collective impact survey was to identify and share student opportunities (reported by 91% of survey respondents, the same rate as in previous years). A similar percentage (84%) of survey respondents shared opportunities for faculty. Another common communication practice was to disseminate CAHSI’s achievements to the computing community (approximately ¾ of respondents had disseminated CAHSI’s accomplishments to a computing audience in the past year). The rate of dissemination to computing audiences was nearly the same as in previous years. About 2/3 of survey respondents had coordinated activities or events with the backbone organization, a rate similar to previous years. Connectors, coordinators, and regional leads and co-leads were the most likely to have coordinated with the backbone in the past year. Newcomers were less likely to have coordinated events with the backbone or with regional colleagues. Still, most survey respondents (79%) reported that they had coordinated regional activities or events in the past year.
All regions were equally likely to have coordinated regional events or shared opportunities with other CAHSI participants. The Southeast and West regions were slightly more likely to have disseminated to external audiences than the other regions, though the differences were not significant. However, CAHSI veterans were more likely to have engaged in continuous communication and coordination than CAHSI newcomers. For example, 33% of newcomers had coordinated events or actions with the backbone, while 89% of veterans had done so. This finding is expected since CAHSI veterans are leaders in the CAHSI network. Veterans are also more engaged in their regional networks: 100% of veterans had engaged in regional coordination or collaboration while 61% of newcomers had done so. Still, many newcomers seem to be integrating into CAHSI and becoming increasingly involved in regional activities. Overall, CAHSI participants maintained their communication practices and disseminated CAHSI’s accomplishments at similar rates to previous years.

**Expansion, Sustainability and Scale- Collective Impact Survey**

Strategic actions, in the form of mutually reinforcing activities or interventions to broaden participation in computing, are at the core of the work to expand, sustain and scale efforts at the local and regional level. Mutually reinforcing activities must be guided by the common agenda with a clear link to how the strategic action will help to achieve the vision and goals. The recent
expansion of the CAHSI network to include more research-intensive institutions and a renewed focus on graduate education provide opportunities to expand and refine the repertoire of practices to promote the advancement of Hispanics in computing.

Each year, the Collective Impact survey data is used to map 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.

**Undergraduate Education Remains a Top Priority for CAHSI Participants**

Overall, undergraduate education has remained a core focus for the CAHSI community, at the institutional and regional levels. All CAHSI participants marked undergraduate education as a #1, #2, or #3 priority for their work for CAHSI, with 66% of participants marking it as the most important priority. With the addition of more research-intensive institutions in the past, graduate education has become much more of a priority for many CAHSI participants. For instance, the same percentage of participants have marked graduate education as the first priority this year as in the past academic year, but the percentage of respondents marking graduate education as the second priority has risen from 15% to 45%. Workforce development and career readiness continue to be a strong focus of many CAHSI participants as more than half of participants ranked it as one of their top 3 priorities. To a lesser extent, CAHSI participants marked K-12 education, K-12 teacher preparation or faculty professional development as priorities. A very small number ranked institutional or departmental policies as a top priority. Therefore, undergraduate and graduate education are the main priorities for most CAHSI participants, with a strong focus on career development and workforce readiness.
Although there was consensus that undergraduate education was a core focus of CAHSI efforts, there were a few regional variations in participants’ priorities. For instance, all participants in the North region marked that undergraduate education was their top priority, which has been consistent throughout the life of the grant. In part, this reflects the composition of the campuses in the north region as largely bachelor’s granting institution. On the other hand, the Southwest region demonstrated greater diversity in priorities and expertise, as nearly 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 undergraduate education as a top priority, and to a lesser extent, graduate education and workforce development/career readiness. Overall, across all of the regions, undergraduate education is a core priority and strength of the CAHSI network.
Adoption of CAHSI Signature Practices has Increased

Adoption of CAHSI signature practices is similar to rates of previous years, although the proportion of CAHSI participants engaging in peer-led team learning has increased in the past year. Despite the addition of many new participants in the past year, the adoption of CAHSI signature practices has remained relatively stable and is high throughout the network. The percentage of survey respondents who were implementing at least one signature practice in their department rose from 62% (in 2020-21) to 90% in the past year. This finding indicates that departments that may have discontinued or modified signature practices due to the pandemic have reinstated these student-centered practices in their departments. Peer-led team learning increased most dramatically: the percentage of CAHSI participants implementing PLTL rose from 43% to 72%. Although several respondents indicated on the survey that they had been implementing PLTL in summer campus or out-of-class opportunities rather than in core, introductory computing courses. The implementation of problem-solving courses fell slightly, although 56% of participants are still implementing the course. Half of participants reported that they had implemented the Affinity Research Group model in a research group, REU, or computing course. Overall, the adoption of signature practices increased from the previous year.
There is some regional variation in the adoption of signature practices. In general, adoption in the West region of several practices, such as PLTL or problem-solving courses, seemed to be lower than other regions. The North region had high adoption rates of most practices, except for Fellow-net. Across the network, few respondents had participated in Fellow-net in the past year. On the other hand, the majority of CAHSI participants had implemented PLTL in their departments and implementation was high across all regions except the West region. Surprisingly, implementation of signature practices did not vary by length of involvement with CAHSI. While most veterans were highly involved in signature practices, many participants who had been involved with CAHSI for less than a year were also involved in PLTL in their departments.
CAHSI Departments Maintained Student Support Activities

CAHSI participants maintained their student support activities in CAHSI departments in the past year. Workforce development and career readiness initiatives were the most common activities, while graduate education initiatives were the least common. This latter finding highlights the need for the recent expansion of CAHSI to include more research-intensive institutions and a stronger focus on the pathway to graduate education. As shown in the asset mapping, CAHSI participants have begun to prioritize graduate education to a greater extent, but do not yet seem to be implementing strategic actions related to graduate education at a high level.

CAHSI participants are slightly less engaged in student clubs or organizations (57% of departments compared to 75% in the previous year), although this is likely due to the expansion of new members and the challenges of maintaining student organizations during the pandemic. Multiple CAHSI leaders noted during interviews that their CAHSI clubs or coding clubs had become defunct during the pandemic, and they were in the process of reviving those opportunities. The majority of CAHSI departments (72%) sponsored or co-sponsored hack-a-thons or other events in the past year. Professional development trainings, such as interviewing workshops, remained common activities to support students’ competitiveness in the computing workforce. Finally, about ¾ of departments engaged in K-12 outreach activities to recruit students into computing.
There was some regional variation in the implementation of student support activities. Mainly, regions with more established departments were somewhat more likely to implement support activities and to have a wider variety of activities in their departments. This finding shows that departments need some time to adopt and implement a variety of out-of-class CAHSI practices. Across the board, regions were heavily involved in workforce development, K-12 outreach and hack-a-thons. However, there was greater variation in the implementation of CAHSI or coding clubs and graduate education initiatives. There were also differences in involvement based on longevity with CAHSI. For the most part, newcomers (those with less than a year of experience with CAHSI) were not highly involved in student support activities (ranging from 0%-25% depending on the activity). On the other hand, most veterans (those with 6+ years of experience with CAHSI) were highly involved in a full range of student support activities.
CAHSI Participants are Moderately Involved in Professional Development Activities

In addition to student support, CAHSI participants and departments continued to offer some support for faculty and K-12 educator professional development, although the core mission of CAHSI remains focused on student development and advancement. The participation of CAHSI members in faculty and K-12 educator professional development remained steady from the previous year, although research collaborations fell slightly (from 66% of survey respondents to 56% of survey respondents). Participation in a community of practice also fell slightly (from 57% of survey respondents to 38% of survey respondents). On the other hand, the number of CAHSI participants who had participated in faculty professional development in the past year remained stable at roughly ¾ of CAHSI participants. Therefore, CAHSI participants maintained access to professional development opportunities and took advantage of them. The Local REU training provided by CAHSI was a significant source of professional development for many CAHSI faculty, including new members from research-intensive institutions.
There was little regional variation in faculty and K-12 educator professional development workshops or trainings. Across the board, participants from all regions attended CAHSI professional development in the past year. Many departments across all regions also provided professional development for faculty. Participants in the Southwest were less likely to engage in research collaborations with CAHSI colleagues compared to participants from other regions. This may be because there are a greater number of community colleges in the southwest region, and they are less likely to engage in research. Overall, participants across all regions were less likely to provide professional development trainings for K-12 educators, although about 2 in 5 participants had been involved in the implementation of such trainings in the past year. There is a relatively high level of involvement in professional development trainings across the regions. Additionally, newcomers to CAHSI (less than a year of participation) were highly likely to have participated in professional development in the past year (83%). Not surprisingly, they were less likely to have provided professional development for faculty in the past year (42%). They were also less likely to be engaged in a research collaboration with a CAHSI colleague (33%) or to participate in a CAHSI community of practice (16%). On the other hand, CAHSI veterans were more likely to have provided professional development for faculty in the past year (78%). They were also more likely to be involved in a CAHSI research collaboration (65%).
### Table

<table>
<thead>
<tr>
<th>Activity</th>
<th>North</th>
<th>CAHSI Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participated in professional development for faculty</td>
<td>86%</td>
<td>72%</td>
</tr>
<tr>
<td>Provided professional development for faculty</td>
<td>71%</td>
<td>69%</td>
</tr>
<tr>
<td>Engaged in research with other CAHSI members</td>
<td>71%</td>
<td>56%</td>
</tr>
<tr>
<td>Provided professional development for K-12 educators</td>
<td>57%</td>
<td>41%</td>
</tr>
<tr>
<td>Participated in a CAHSI community of practice</td>
<td>29%</td>
<td>38%</td>
</tr>
</tbody>
</table>

### CAHSI Participants are Working to Change Departmental or Institutional Policies

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. However, a majority of CAHSI participants are actively working to change departmental or institutional policies to be more conducive to student success. CAHSI participants report less involvement in working to change state-level or national policy. To a moderate extent, CAHSI participants have worked to change cross-institutional policies such as articulation agreements between their institutions. The level of engagement in policy change has held steady from previous years, with about half to 2/3 of CAHSI participants working towards or advocating for policy change in some form.
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 relatively equal rates. Participants in the Southwest region were less likely to report that they had been actively engaged in changing institutional or departmental policies (36%), while nearly 75% to 80% of participants in other regions were involved in changing departmental policies. Fewer participants in any region reported that they were involved in advocating for state-level or national policy change, although participants in the North region were slightly more likely to report involvement in this area. Finally, participants in the west (80%) were more likely to report that they were involved in cross-institutional policies than participants in other regions. Some newcomers (50%) were involved in advocating for departmental or institutional change, though they were less engaged in advocating for state-level policy change (17%) or cross-institutional policy (33%). In contrast, veterans were highly involved with departmental or institutional policy change (89%). In conclusion, CAHSI participants were more focused on changing local policies to augment student success and advancement, rather than changing state-level or national policy.

**CAHSI Participants’ Most Important Accomplishment**

Similar to previous years, CAHSI participants’ most important accomplishment for the past year was frequently in the area of student support and professional development. CAHSI members wrote about hack-a-thons, interviewing workshops, coding clubs, and CAHSI day events for students. Some participants also wrote about departmental growth, especially the expansion of CAHSI activities and awareness in their departments. These participants also noted an increase
in student diversity in their departments. Some highlighted the success of individual students, such as Hispanic Ph.D. students. Other CAHSI participants reported that grant awards or submissions were their most important accomplishment in the past year. Several participants all wrote about the submission of a collaborative NSF S-STEM grant across CAHSI institutions. Participants also mentioned the growth of regional networks and collaborations, especially the progress made in strategic planning within regions and hosting regional activities or events. Finally, a few participants wrote about the adoption of CAHSI signature practices, especially PLTL and ARG or REU activities.

**Expansion Sustainability and Scale- Experiential Surveys**

As CAHSI grows and continues to scale broadening participation efforts, the evaluation team continues to monitor promising practices and emerging activities. In this section, the report describes the following:

- Results from the GMiS participation survey, including recommendations for student preparation for the conference,
- Results from the ARG Exemplar survey, distributed to the mentees of key stakeholders who exemplify the values and practices of the Affinity Research Group model,
- Results from the virtual REU follow-up survey, distributed to 2020 and 2021 virtual REU participants to measure current interest for graduate school and research,
• Results from the local REU project, begun in 2022 to distribute REU practices across new and continuing CAHSI institutions. Results span faculty and student experiences of the program.

• Results of the graduate climate survey study, in which students were asked to describe the climate of their department in terms of professor engagement, advisor relationships, exclusion, and other variables.

• Results from interviews with new members, supplemented with a pre/post Snowbird onboarding event.

• Results from an interview case study of staff and faculty institution teams.

**Great Minds in STEM**

This section of the report is meant to support faculty and staff who are planning GMiS content in fall 2022, as well as for those who are recruiting students to attend the conference. Findings are summarized across all respondents to the fall virtual 2021 conference.

**Who participated in GMiS Virtually in 2021**

Registration data indicate that the majority of students identified as male (68%) about a third identify female (29%) while 2% said they preferred not to state or considered themselves non-binary. The Southwest region accounted for half of registrations for CAHSI (50%) with the West sending about a quarter of the registrants (26%), the Southeast accounting for 14% and the North 11%. Most of the students were upperclassmen, with 42% indicating they were seniors, 22% juniors, 15% sophomores, 11% Masters’ students, and 8% freshmen. A small number were PhD students (2%). There were 436 records in registration with demographic data. Registration results do not differ significantly from survey respondent results, below.

The following charts represent the demographic data obtained at the end of the GMiS survey. We purposefully add demographic at the end, to discourage stereotype threat that might arise when students are asked to describe aspects of their identities before answering questions about...
STEM (Steele, 1995). Most students were computer science students (87%), and the majority identify as male (71%). While just over half of respondents were of traditional college age (18-24, 51%) nearly the same proportion was in the 25-35 age group, indicating a large portion of non-traditional undergraduate students. Most students were US citizens (83%). The largest proportion of undergraduates were at least in their 5th year of undergraduate study (30%).

Figure 34, Figure 35, Figure 36: Demographic markers for GMIS survey respondents

More than half of the students who responded to the survey were Hispanic/LatinX/Mexican American (59%). Ten percent self-reported they were African American or black, and the same
proportion stated they were Eastern Asian. Seven percent indicated Native American ancestry. Five percent were Asian from the Indian subcontinent and nearly a quarter (22%) were white, while 2% chose not to state their race/ethnicity information.

Figure 37: Race/ethnicity descriptors for GMiS participants

**Overall impact of the event**

Nearly all respondents stated that the conference at least “somewhat” enhanced their career development (90%). Almost a quarter said the event “greatly enhanced their career development (24%), a third (32%) said it supported their career development, and another third said GMiS supported their career development “somewhat” (33%). See chart below.
The GMiS conference was perceived as most helpful in increasing interest in an industry career (95%), providing opportunities to get career advice (94%) increasing students’ knowledge of career pathways in the field (92%), and increasing students’ dedication to the major (91%).

Following those items, the following statements show at least 70% of students responded with “somewhat” “A good deal” or “A great deal”: increased my knowledge of the job application and interview process (90%), increased my knowledge of computing (88%) helped me feel more connected to peers in the CAHSI community (84%) increased my interest in a particular area of computing (83%) and increased my knowledge of graduate school pathways (74%).

The item with the least favorable response in the survey of online GMiS 2021 was “helped me to find a mentor (43%).” The online aspect of the conference may have led to this less favorable outcome.
Figure 39: Impact of Attending GMiS

<table>
<thead>
<tr>
<th>Impact</th>
<th>Not at all</th>
<th>Somewhat</th>
<th>A good deal</th>
<th>A great deal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased my interest in computing</td>
<td>17%</td>
<td>18%</td>
<td>36%</td>
<td>29%</td>
</tr>
<tr>
<td>Provided opportunities to get career advice</td>
<td>6%</td>
<td>28%</td>
<td>32%</td>
<td>33%</td>
</tr>
<tr>
<td>Helped me find a mentor</td>
<td>8%</td>
<td>30%</td>
<td>34%</td>
<td>29%</td>
</tr>
<tr>
<td>Increased my knowledge of graduate school pathways</td>
<td>26%</td>
<td>24%</td>
<td>27%</td>
<td>23%</td>
</tr>
<tr>
<td>Helped me feel more connected to peers in the CAHSI community</td>
<td>14%</td>
<td>29%</td>
<td>29%</td>
<td>27%</td>
</tr>
<tr>
<td>Increased my knowledge of computing</td>
<td>12%</td>
<td>26%</td>
<td>33%</td>
<td>29%</td>
</tr>
<tr>
<td>Increased my dedication to my major</td>
<td>9%</td>
<td>19%</td>
<td>35%</td>
<td>37%</td>
</tr>
<tr>
<td>Increased my knowledge of the job application/interview process</td>
<td>10%</td>
<td>26%</td>
<td>31%</td>
<td>33%</td>
</tr>
<tr>
<td>Increased my interest in an industry career</td>
<td>5%</td>
<td>27%</td>
<td>35%</td>
<td>33%</td>
</tr>
</tbody>
</table>

In open-ended items, many students described the benefit of hearing professionals’ stories regarding the career journey. Sample responses appear below.

“I benefited from listening to other peoples’ journeys and advice from their experiences.”

“The thing that benefited me the most was connecting with professionals and getting to know what they did to get where they are.”

“The conference helped me learn about people’s stories and inspired me.”

Others described the content and activities as the best part of the conference—specifically, the hackathon was mentioned multiple times. More generally, students said they got to know more about specific sub-fields of computer science.

“The hackathon and job fair provided me with skills and opportunities.”

“I gained a ton of knowledge about computing and what to expect in the software industry.”
Peers were also considered an asset following the GMiS conference.

“One of the greatest benefits of attending the GMiS conference was becoming connected with peers who are in the same position as I am. It was helpful to be able to hear their stories and struggles, as well as discuss tactics or approaches for them.”

**Action taken during/following GMiS**

More than half of attendees spoke with at least one job fair recruiter one on one at the online GMiS conference, with a third speaking with three or more (34%) and 21% speaking with one or two recruiters individually. In interviews with students who attended the conference, we learned anecdotally that the directions for meeting during the virtual career fair were unclear, and that for some who joined the career fair after the start time because of other commitments that the times were full before they were able to sign up. Responses were mixed regarding the ease and efficacy of the virtual career fair—some noted that recruiters were much less engaged online, while others had positive experiences.

![Fair Interactions](image)

**During the career/graduate school fair, I:**

DID NOT COMMUNICATE WITH ANY SPECIFIC RECRUITERS ONE-ON-ONE 45%
COMMUNICATED WITH ONE OR TWO RECRUITERS ONE-ON-ONE 21%
COMMUNICATED WITH THREE OR MORE RECRUITERS ONE-ON-ONE 34%

Nearly one in five of students (19%) who responded to our survey said they received at least one job offer, while nearly half (47%) stated the item was “not applicable,” because they had not applied for a position. Thirty five percent were waiting to hear back on a position at the time of their survey response, which occurred between November 2021 and early January 2022.
Since the conference, I

- received an offer for an opportunity (e.g., internship, part time, or full time job): 14%
- received multiple offers for opportunities: 5%
- am still waiting to hear back from contacts: 35%
- not applicable: 47%

Please list the activities you engaged in at the GMiS conference.
(76 responses)

- I met students from other institutions at the conference: 67%
- I did not already know at the conference: 28%
- I met faculty members that I did not already know at the conference: 50%
- I applied for a technical position at the conference: 53%
- I had a job or internship interview at the conference: 71%
- I received an internship offer at the conference: 77%
- I received a job offer at the conference: 79%
- Not applicable: 5%
Most students met peers in the online GMiS conference (67%), and half met faculty members they did not know at the conference (50%). One in three applied for a technical position at GMiS (33%) and only 19% had an interview during the conference. Nine percent received an internship offer, and 9% received a job offer at the conference. We imagine others had interviews following their experiences at the conference (e.g., a meeting scheduled the week following GMiS) and we will add to our survey to ensure we capture follow up interviews in our survey.

There were differences in student outcomes based on their preparation for the conference. Students who were prepared through webinars provided by students fared slightly better than their peers: they met others students more (77% versus 67%), met other faculty more (67% versus 50%) and applied for technical positions more often (50% versus 33%) than those who did not participate in a preparatory webinar.

Students who were prepared through meetings or webinars with faculty were even more effective participants at GMiS—they met other students more frequently (79% versus 67%) met faculty more frequently (67% versus 50%) and applied for technical positions more often (50% versus 33%). A quarter of them obtained interviews (25% versus 19%) and a greater proportion were successful earning a job (13% versus 9%).

Similarly, those who developed a goal for the conference were most likely to meet peers (77% versus 67%) and faculty (73% versus 50%) most likely to apply for technical positions (55% versus 33%) and most likely to earn an interview (27% versus 19%) compared with peers who did not state a goal.
Nearly three quarters of participants updated or planned to update their resume following GMiS (61%, 12% planned); more than half inquired or planned to inquire about career opportunities following GMiS (45%, 12% planned), and half inquired or planned to inquire about internships following the conference (38%, 12% planned). Fewer had contacted or planned to contact professionals (28%, 11% planned), faculty (8%, 9% planned), or student peers (22%, 9% planned) following GMiS online- these figures are quite different from in person GMiS conferences, where contacts are more typical following the conference.

**Barriers to online participation**

Nearly half of our GMiS survey respondents had difficulty with the quality of their cell coverage or internet access during the conference (48%), while 39% had difficulty finding private space free of distractions from which to engage in the online conference. Thirty percent had difficulty with the GMiS portal login, 26% had difficulty navigating the multiple conference applications, while basic internet access and technology access proved barriers for others’ participation—22% had a broken/old computer, and 17% had no internet or cell service where they reside.
Networking online compared with face to face

Student survey respondents commented on their experiences networking online—and as in previous face to face/online comparisons, responses were mixed. For those who responded to the open-ended item, 16 reported online network was worse, 6 saw positive and negative elements of the online networking, and 7 found online networking more beneficial.

For those who had negative responses, lack of engagement by recruiters, awkward online communication in small groups selected at random, feeling less personal, loss of non-verbal communication, lack of connection and lessened opportunity to sell oneself, and the tendency
to blend into the background in virtual networking were listed as reasons online networking was inferior to the face to face approach.

Those with positive responses indicating they preferred online networking said it lessened bias, it was easier, provided an opportunity to research the companies before engaging with their representatives, said that being at home made the individual feel more comfortable, in one case, and for another it was reported to be an easier medium for communication.

**Latin@s in Computing**

All of the survey respondents who attended the Latin@s in computing sessions were at least somewhat satisfied by the content and/or the approach within the sessions. Open-ended responses appear in the orange textbox, below.

*Figure 45: Latin@s in Computing Satisfaction*

<table>
<thead>
<tr>
<th>Rating</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Satisfied</td>
<td>69%</td>
</tr>
<tr>
<td>Somewhat Satisfied</td>
<td>31%</td>
</tr>
<tr>
<td>Somewhat Dissatisfied</td>
<td>0%</td>
</tr>
<tr>
<td>Very Dissatisfied</td>
<td>0%</td>
</tr>
<tr>
<td>N.A., Did Not Participate</td>
<td>0%</td>
</tr>
</tbody>
</table>

- That it is more than how we look and where we come from. **Our intelligence** should greatly outweigh all the odds and allow people to share ideas and become leaders as they were destined to be.
- The sessions were focused on empowering women in a workforce which is led by a majority of men and gave advice regarding how can supportive.
- (It reinforced that) women are capable of achieving great things in STEM.
- Community is really important, and it is good to lean on one another. This is a requirement to grow the female presence in STEM.
- I like to hear from people that look somewhat like me that it is possible to achieve things.
- I believe my greatest takeaway form the sessions was that there are so many opportunities and resources for latin@s that I was not aware of.
- Women are coming together and it’s benefiting companies rapidly
- I am enough, I am strong, I HAVE SUPPORT.
Participants unilaterally agreed with 4 of the 6 statements, with two statements receiving slight “disagree” responses. Specifically, 20% did not learn about office hours that they could utilize in between sessions to build their plans for advancing their careers in computing. At the same time, 13% did not develop plans for advancing their careers. It is possible that these respondents arrived during the final of three sessions without participating earlier—this would account for their lack of knowledge of office hours and their disagreement regarding building a career advancement plan, an action they were encouraged to take during the conference with guidance from the facilitators.

The CAHSI approach in workshops
CAHSI has a well developed set of shared values, vision of students from HSIs as having great potential for excellence, and communicates the need for equity and inclusion to occur together in computing education and practice. Given that platform, we asked student survey respondents whether they thought more CAHSI-specific activities would be beneficial at the GMiS conference. More than a quarter would prefer a lot more CAHSI content. 39% would prefer a little more CAHSI content, and one third (33%) said the conference was OK as it was in the 2021 online iteration.
Most students who participated in CAHSI content stayed they competed in the hackathon (58%) with cybersecurity workshops the next most common activity (47%), followed by Machine learning (37%) and the data analytics challenge (13%). Numbers are greater than 100% because most students participated in multiple activities at GMiS 2021.

Care was taken by members of the backbone and regional leadership to ensure that the CAHSI vision, socially relevant pedagogical practices, and shared values were utilized in the development and facilitation of CAHSI technical content. A scale related to these concepts was developed to understand whether and how CAHSI facilitators maintained these values and pedagogical practices.
Eighty five percent or more of participants responded positively (agreed a little, agreed, or agreed strongly) to all of the statements. Highest rated items were the following: session leaders emphasized growth and improvement over previous knowledge (92%), I developed confidence in my abilities during the technical sessions (89%) and the session leaders gave us ways to actively participate throughout the sessions (89%). We consider these aspects of CAHSI workshops an example of servingness that is exemplified in the national activity of conference content and will highlight this concept in other areas of the annual report.

Grad school preparation
A relatively small portion of students had applied for graduate school when they filled out the survey in November 2021 through January 2022 (15%) However, nearly half had plans to apply to graduate school (43%). It is unclear what students’ timelines would be for this milestone, though we are aware that their standings in the university creates multiple timelines based on progressions in the department. More than half of the students who responded do not plan on applying to graduate school—this figure may relate to the emphasis of GMiS on industry pathways than academic pathways. It might be beneficial to increase conference content on academic pathways via CAHSI workshops and panels.
Preparation activities

Students prepared through communal activity as well as individualistic activity before attending GMiS. Of those who received or took on some kind of preparation, most students worked on their resumes before attending GMiS (84%), while about half developed a goal for the conference (51%), half asked permission to miss class to attend the conference online (51%), and slightly fewer asked permission to miss work to attend GMiS virtually (42%). Others had access to CAHSI-related content and local networks to prepare for GMiS—this included meeting with CAHSI club members prior to attendance (42%), attending faculty-led webinars or meetings to prepare for the conference (49%), or attending CAHSI student led webinars or meetings about the conference (43%). These preparations appear to influence outcomes (see outcomes section above).
ARG Exemplar Study - Affinity Research Groups in Practice

As CAHSI continues to grow and disseminate practices beyond initial CAHSI faculty and institutions, signature practices continue to be a driver of change. Faculty who were known to the evaluators as having robust Affinity Group research teams were asked to forward an ARG survey to their students. Two faculty asked if they could also send the survey to alumni, and so the survey was expanded to also include past students. The survey was sent to 6 faculty, and responses were obtained from 48 students across 5 total faculty teams.

Student population

Students represented all levels, though sophomores accounted for 27% of survey respondents, followed by seniors continuing for an additional year (22%) and juniors (20%). While 11% of survey respondents intended to graduate in spring of 2022 (and presumably did so), a smaller proportion were graduate students (7%) and alumni (7%).
Research activities
Participants were asked about their recent dissemination practices, and 93% of those who responded stated they attended a professional conference in the past year, 45% prepared a poster, while a smaller number had worked on a conference paper (7%) or journal paper (7%). Students aspired to create more posters in the near future (59% plan to do this, compared with 45% who had), write conference papers at a greater rate (26% planned to do so, compared with 7% who had), and write journal articles at a greater rate (37% planned to do so, compared with 7% who had).
Research skills technical knowledge, and team skills were the top 3 skills noted most commonly across all student respondents. Personal growth (55%), communication skills (52%) and clarification of a career path (45%) were similar in receiving responses from about half of students. The least cited response was intellectual skills (36%).

Students were asked to describe whether and how they learned to collaborate with their ARG teams. The ARG model emphasizes cooperative learning, and the scale developed by the CAHSI evaluation team emphasizes team communication, trust, and positive interdependence through
task distribution. Students who participate in research with ARG leaders nearly all agree with each statement related to team support—90%-100% of respondents agreed with each of the items. The strongest agreement was related to having a problem and talking with a mentor about it (73% strongly agree) and the amount of guidance mentors provide (70% strongly agree). Students also report their peers give them feedback on their work (45% strongly agree).

Responses related to the interconnectedness of group work also had strong responses—94-97% of ARG students working with ARG exemplar faculty say they understand how their tasks relate to those of the group (67% strongly agree), understand fully the goals they have for the semester (55% strongly agree) and they feel they contribute to the decisions of the group (48% strongly agree).

Power is a dynamic in research groups that the ARG model intends to spread more evenly across group members—this idea is addressed in three items in the scale, and students responded favorably to these items between 76% and 94% of the time. Students feel equal to other students in the group, whether they are undergraduate or graduate students (61% strongly agree). Students are slightly less likely to feel equally comfortable with all mentors, when there was more than one (53% strongly agree). While the power structure is addressed in ARG< some students still do not feel comfortable disagreeing with faculty and/or senior group members (33% strongly agree they are comfortable, 42% agree, and 24% disagree with the statement of comfort). Overall students feel challenged by the work in the research group (100% positive, 61% strongly agree).
Nearly all students report positively regarding their intellectual gains and knowledge development in ARG groups—responses range from 85-100% positive. Students are least likely to report understanding the process of computer science research (12% “don’t know,” 3% disagree). Some students have not yet developed the ability to identify research limitations (9% disagree, 3% report “I don’t know).
Students overwhelmingly report increased interest and confidence in computing—90-100% of students agree with items related to interest and confidence in the field. The greatest growth area is in becoming more interested in computer science in general (100% positive, 64% strongly agree). A handful of students did NOT experience greater confidence in their ability to do research (9%).
Students describe growth in ARG Skill development. Approximately 80% of students see growth in each area, with time management skills seeing the most positive responses (84%), understanding of journal articles next (81%), and the rest of the items show 78% agreement (scientific poster development, oral presentation, and scientific report writing).
The ARG program improved nearly all students’ preparation for a career in computing (97% agree), preparation for advanced coursework (94% agree), and knowledge about career and education options (88%).

Figure 59: ARG Academic Program/Career Readiness

Students describe having faculty with whom they could speak about graduate school (91%), and peers with whom to speak about graduate school (85%). Most students feel more prepared for graduate school (72%), and 2 in 3 see themselves as a “good fit” for graduate school (66%). Less than half will or have applied for graduate school (48%), and less than half understood graduate school funding (41%).
Students were asked to describe what influenced their decision to go to graduate school—67% said their research experience motivated graduate school application, and 47% said they were influenced by their faculty research mentor. A third were influenced by graduate students and a third by undergraduate students (33%, 33%). A slightly smaller proportion said that a faculty member influenced them (27%) and one in five had a family member influence graduate school attendance (20%).
In the summer of 2022, the CAHSI evaluation team sent a survey to all students who had participated in the 2020 and the 2021 virtual REU experiences. Twenty-two participants responded to the survey out of the 66 who received the invitation. Four reminders were sent during the summer to improve survey responses. A small number of students were current local REU students as well as virtual REU respondents—when students fell into both groups, they received the follow up survey and were removed from the Local REU survey. Responses to the follow-up survey for virtual REU participants appear in the following pages.

**vREU Follow-up Survey**

In the summer of 2022, the CAHSI evaluation team sent a survey to all students who had participated in the 2020 and the 2021 virtual REU experiences. Twenty-two participants responded to the survey out of the 66 who received the invitation. Four reminders were sent during the summer to improve survey responses. A small number of students were current local REU students as well as virtual REU respondents—when students fell into both groups, they received the follow up survey and were removed from the Local REU survey. Responses to the follow-up survey for virtual REU participants appear in the following pages.

**Student growth**

When asked to describe the top 3 areas of growth, respondents were most likely to select research skills (88%) communication skills (81%) and technical knowledge (56%) followed by personal growth (38%), team skills (31%), intellectual skills (31%) and clarification of an intended career path (31%).
Career development since the vREU
Two thirds of the vREU students who responded to the survey had attended the GMiS conference and participated in a presentation of their work virtually since the research experience (67%, 67%). Nearly half had also progressed to doing research with a new mentor (40%), while a smaller proportion presented work in person (13%), applied to graduate school (13%), or held an internship (7%).
Research gains and knowledge development

All of the respondents improved their theoretical understanding of concepts about their research area (69% strongly agree, 31% agree), and all have gained general problem solving skills (63% strongly agree, 38% agree). Nearly all respondents say they understand the process of computer science research based on the vREU (69% strongly agree, 25% agree, 6% I don't know). Most respondents describe their computing courses as more relevant since research (44% strongly agree, 50% agree, and 6% disagree). Four out of five say they are better able to identify limitations of research methods (56% strongly agree, 25% agree, 13% I don’t know, and 6% disagree).
Nearly all students say their poster preparation skills have improved (56% strongly agree, 31% agree, 6% disagree, 6% I don’t know) A similar proportion of students stated their ability to understand journal articles has improved (50% strongly agree, 38% agree, 13% disagree). Respondents also describe growth in oral presentation skills (38% strongly agree, 50% agree, 13% disagree) and the ability to write scientific papers (38% strongly agree, 50% agree, 13% disagree). Students were slightly less likely to report time management skill improvement (38% strongly agree, 44% agree, 19% disagree)—it is possible that research work brought to light the need for strong time management skills in research.
Graduate School Preparation, Interest and Readiness

Nearly all students had access to at least one faculty member supportive of graduate school pathways (44% strongly agree, 50% agree, 6% disagree) or had a peer they could speak with about graduate school (19% strongly agree, 56% agree, 13% disagree, 6% strongly disagree). Just over half have an understanding of graduate school funding (19% strongly agree, 38% agree, 6% I don’t know, 19% disagree, 19% strongly agree). Two out of three feel more prepared for graduate school because of a virtual REU experience (25% strongly agree, 44% agree, 31% I don’t know). A smaller proportion feel they “fit in” regarding graduate school (25% strongly agree, 38% agree, 31% I don’t know, 6% disagree). Four in ten have applied or will apply to graduate school (33% strongly agree, 7% agree, 27% I don’t know, 27% disagree, and 7% strongly disagree). Overall, the majority of students have gained access to graduate school supportive faculty, supportive peers, but about a third are not sure they fit or believe they are prepared for graduate school.
Most of the vREU respondents were not directly advised about graduate school pathways. Only one in four had deliberate advising regarding additional study beyond the Bachelor's degree.
To date, vREU participants who are considering graduate school or are already enrolled, faculty mentors (75%) research experiences (63%) and additional faculty members who are not research mentors (63%) have been influential in supporting graduate school aspirations, while undergraduate peers (38%) graduate students (25%) and family members (13%) have been less influential.

(For participants who are in graduate school or plan to go to graduate school) My decision to go to graduate school was most influenced by (mark all that apply):

Two out of three (66%) students who responded to the survey were students in the spring of 2022, while 20% were alumni and 13% were already graduate students. It is unclear how many of the students planning on graduating in 2022 graduated in the spring or summer of 2022 and how many remain in the fall semester.
Two thirds of the respondents self-identify as male while 33% self-identify female.

Figure 70: Self-reported Gender
Nearly all students identified as Hispanic (93%) while 13% identify as Asian and 13% identify as Caucasian. Respondents were able to select more than one race/ethnicity. Most students who responded have a job beyond schoolwork (60%).
Surveys were developed in a pre/post format for faculty and for students engaged in the local REU. Faculty data are reported first, followed by student data.

**Mentor Survey Methodology**

To assess mentors’ knowledge of effective practices for mentoring diverse students using the Affinity Research Group model, a pre-post survey was administered in spring 2022. The survey contained several questions related to mentor’s knowledge of how to be an effective research mentor and their use of professional development practices within their research groups. The post-survey also asked mentors to select the top three gains of their research students from the experience. The survey was administered electronically to all faculty who had signed up to be a mentor for the CAHSI Local REU program. The survey was sent directly to faculty emails. Three reminders were sent at four-day intervals to faculty who had not completed the survey. In all, 23 faculty completed the pre-survey and 21 faculty completed the post-survey.

**Background of Local REU Mentors**

Most mentors had prior experience in advising or working with undergraduate researchers. In fact, 96% of mentors reported prior experience in advising undergraduates in their research groups. Some mentors had extensive experience, 22% of mentors had over 10 years of previous experience in mentoring undergraduate researchers. However, the majority (52%) of Local REU faculty had one to four years of research mentoring experience. The figure below details the prior mentoring experience of the CAHSI Local REU faculty.

![Figure 73: Previous Research Mentoring Experience](image)

Given that many faculty had only a few years of experience in research mentoring, the most common career position of CAHSI Local REU faculty was assistant professor (44%). Associate
professors (28%) and full Professors (22%) were also well represented. The remainder of Local REU faculty were in non-tenure-track positions. Therefore, almost all Local REU faculty were in tenured positions and had prior research mentoring experience. However, only about a quarter of faculty had used the ARG model in their research groups prior to the Local REU program.

**Mentors’ Gained Knowledge of Effective Research Mentoring Practices and the ARG Model**

Local REU mentors reported gains in knowledge about how to mentor students from underrepresented groups and how to effectively employ the Affinity Research Group model in their research groups. In fact, mentors displayed significant growth from pre- to post in their knowledge of effective research mentoring practices \( (t=-2.259, \text{ df}=38, \ p=.030) \) and their understanding of the ARG model \( (t=-3.639, \text{ df}=37, \ p<.001) \). Mentors began the REU with a strong belief in the efficacy of the ARG model for mentoring research students, although their beliefs about the efficacy of the model still increased over the course of the REU experience. The figure below outlines the item means on the pre- and post-survey for items related to research mentoring knowledge and skills.

![Figure 74: Changes in Knowledge and Practice. Local REU Mentors](image)

Local REU mentors reported strong growth in their knowledge of effective practices to mentor diverse students in research experiences. The percentage of mentors who were knowledgeable or had extensive knowledge of effective practices for underrepresented students rose from 39% prior to the REU to 83% at the end of the experience. Likewise, the percentage of mentors who only had “some” or “a little knowledge” in this area declined. Therefore, almost all mentors reported strong gains in their ability to mentor research students from diverse backgrounds.
Mentors Gained Understanding and Experience in the ARG Model

Mentors gained substantive understanding of the underlying framework of the ARG model and how to implement it in practice. Local REU mentors entered the experience with limited understanding of the ARG model; 63% reported “little” or “understanding” of the model. At the end of the experience, 88% of the mentors reported at least some understanding of the model. The percentage of mentors who reported “good” or “extensive” understanding of the ARG model increased from 23% to 59%. Therefore, local REU mentors reported significant growth in their knowledge of the ARG model for research groups.
Local REU mentors demonstrated their growth in understanding of the ARG model in their response to an open-ended question that asked survey respondents to describe the ARG model. This question was on both the pre-survey and post-survey. On the pre-survey, 50% of respondents were unable to describe the model and stated that they did not know what it is. On the post-survey, all respondents were able to describe at least some aspects of the ARG model. On the post-survey, mentors were more likely to state that the model fostered inclusion. They were also more likely to note that the ARG model focuses on the deliberate development of students’ research and professional knowledge and skills. Further, mentors’ descriptions of the model on the pre-survey were general and vague, and were much more detailed and specific on the post-survey, highlighting specific components of the model, such as the distribution of expertise across the research group.
Following are some of the typical written comments prior to the ARG training. Participants had a general idea of the ARG model, but it was very vague. There were also a few comments that were somewhat incorrect, such as a mentor who thought the ARG model was a summer program.

A team framework to support minority undergraduate students for research

It is getting the students involved in a group and making progress towards full participation in research bit by bit.

It’s a summer program designed to provide best research experience to Hispanic youth

A structural model to guide undergraduate students for research.

In contrast, at the end of the REU, mentors offered more detailed and descriptive understanding of the ARG model. Their responses contained more specificity and examples and demonstrated a more comprehensive understanding of the underpinnings of the ARG model. Following are typical written comments on the post-survey.

The Affinity Research Group Model is a set of practices built on a cooperative team framework to support the creation and maintenance of dynamic and inclusive research groups.
It is a cooperative learning approach to involving students with diverse backgrounds. It can help to promote structured learning and research groups and measure student engagement. It focuses on skills development. Students learn and apply the knowledge and skills required for research and cooperative work in an ARG.

An evidence-based structure for conducting a research group with students. It provides scaffolding to enable students to learn the basics of doing research - tasks like reading and summarizing a research paper, elevator talks, research posters, critiques, brainstorming, posing questions. It provides a structure to make sure that all participants feel that they are part of the group, their voices are heard, and their participation matters.

ARG models uses structured activities supported by a team effort to create an engaging and inclusive environment for students to maximize their learning and experiences through their research projects.

If I were to explain ARG to a colleague I would tell them that it is a model that is built on best practices to assist us and our students while working together on a research project. It builds upon sharing a goal and utilizing everyone's skills equally and equitably. Such as building upon each student's skills and interests, and incorporating them into the project. ARG provides a model for collaboration so students can become better researchers.

The model creates a structure and set of practices to help a research team achieve a common goal and enable students to learn both about not only relevant content related to their projects but also receive formal training on good practices in research and in peer review. It also allows mentors to help tailor training to students' needs and to strengthen their own mentoring abilities. For all involved, both mentors, and students, the model helps establish a framework for building a strong and cohesive team.

Mentors Felt the ARG Model is Effective for Research Groups

As noted previously, mentors entered the research experience with strong beliefs about the efficacy of the model, but these beliefs still increased over the course of the REU. At the start of the experience, mentors were likely to think the ARG model was “somewhat” effective, while they were more likely to report that it is “mostly” or “highly” effective at the end of the experience. The percentage of mentors who reported that the ARG model is “mostly” or “highly” effective increased from 42% to 70%.
Mentors Reported that Students Gained Research Skills

Mentors reported that students gained an understanding of the scientific research process as well as an ability to work independently during the local REU experience. Mentors were asked to select the top three gains that they observed in their student(s) from a pre-defined list of research outcomes. The most frequently selected area of growth was understanding the research process (65%). Mentors also selected the ability to work independently (41%) and the ability to understand research literature (35%). Mentors also felt that their students gained confidence, technical communication skills, and teamwork skills (29% each). To a lesser extent, mentors selected preparation for graduate school and computational ability as outcomes from the experience.
In response to an open-ended question mentors provided more details about the learning and development that they observed in their research student(s). These comments echo their choices in the multiple-choice survey item, focusing on growth in understanding of the research process and ability to communicate research results. Following are some of the typical comments to the open-ended question about student learning and growth from the local REU.

I saw gains in my student's understanding of appropriate research design and his ability to understand research theory. He also learned about survey design. The student learned how to disseminate research via a poster presentation and how to engage in critical evaluation of other people's work.

I had only one student. I believe that the student learned how research could be started, from the simplest task (e.g., installation of a software package that the student is not familiar with) to the more complicated one (e.g., formalizing the research problem). The student also learned how to read a scientific paper.

The student was visibly engaged in the research and I believe his overall interest in research was piqued.

Students learned to explore different opportunities, customize the research scope, and learn knowledge/skills not taught in the classes. There are differences among students. Some students have a strong foundation and some students do not. It is very important to customize the research scope and required skills for each student.
One mentor provided particularly detailed descriptions of her students’ career pathways that resulted from their participation in the local REU experience, including a better understanding of the career pathways in computing research. One of her students was trying to decide between an industry or research career and has decided to apply to the Cal-Bridge program to pursue a Ph.D. The other students are still contemplating whether research would be the right path for them, but both indicated a desire to continue with the research project. Therefore, professional development and clarification of career paths was another important student outcome from the local REU.

**Local REU Mentors Provided Trainings and Used CAHSI Materials**

Almost all mentors (85%) reported that they used CAHSI materials during their workshops or meetings with students. The remainder (15%) shared the materials with students but did not formally review them with students, representing more limited engagement with CAHSI materials and resources. Similarly, 65% of mentors stated that they had provided formal workshops or trainings to students in addition to regular research meetings.

In an open-ended question, mentors were asked about their use of CAHSI materials and whether they were effective in their research work with students. As stated previously, 85% of mentors reported extensive engagement with CAHSI resources and materials, while the other 15% reported limited engagement. Overall, all 85% of mentors who had extensively used CAHSI resources with their research students reported that they were highly beneficial to student development. Further, most mentors reported that they used multiple resources throughout the local REU experience. Some mentors commented that they tried to use the materials in the order suggested by CAHSI. One mentor noted approaching the materials with a flipped classroom.
approach to student development. Following are some of the typical written comments about the value of the CAHSI ARG resources.

*I used all of these materials and found them to be very helpful and effective. I even borrowed some of the materials to provide to other undergraduate research assistants that work in my lab.*

*I used resources such as elevator speech, research poster, abstract, and probing questions. All the resources were really helpful for my students.*  
*In addition, my student also used resources related to preparing applications for grad school (MS).*

*[I used] Research Poster, Probing Questions, and Poster Critique. Students were able to make better posters and respond to the questions well.*

*We went over the topics in the list of "Summary of ARG Skills Development" doc that was shared with the local REU participants. We did not cover Solid Writing, but did cover the other topics. It was good to have these resources as a starting point for our conversation and application of the skills with their own research project. I think it went well, and we used the topics like a flipped classroom. I would assign a topic and post the links for them to go over in their individual working time. When we would meet we would review and discuss the topics.*

*Yes, I went over a couple materials provided by CAHSI with the student, including the motivation behind CAHSI, the writing of an effective abstract, elevator speech, and the preparation of poster. This is was new for me as I did not systematically teach undergraduate students these useful skills in my past REU. The student in this program appreciated the materials that I shared with him and agreed that some of them would be useful in his future career.*

*Yes, we tried to use all the materials in order. This worked to bring the student along.*

**Challenges Faced by Local REU Mentors**

Mentors cited several challenges they faced during the local REU experience, largely related to program logistics or the background experience and knowledge of students. In response to an open-ended question, mentors wrote about the challenges they experienced during the REU. The most frequent response (33%) was challenges related to students’ background knowledge and experience. For instance, one mentor noted that a student who had struggled in CS 1, 2, and 3 was relatively unprepared for the research experience and had
difficulty with the research work. Another mentor noted, “It was somewhat challenging since the student does not have the background knowledge that was required for the project.” Some mentors commented that students had varying backgrounds and it was challenging to design tasks to meet such a wide range of background knowledge and experience. The second most frequent comments were related to the logistics of the program. Some mentors noted the short time span of the REU made it difficult to complete research tasks and fulfill all of the obligations of the REU. Some mentors also noted that they felt communication about the requirements and expectations of the experience, including detailed logistics of the meetings and other requirements for students, could have been improved. These mentors noted that more timely communication and more detailed communication about student expectations would have been helpful. Finally, a few mentors noted that students were unable to complete requirements due to other personal or external challenges or commitments.

Figure 81: Local REU Mentors’ Challenges

**Local REU Mentors’ Challenges**

- Lack of student background knowledge: 33%
- Communication about requirements and expectations from CAHSI: 27%
- Short time span for REU: 27%
- Students’ external challenges or commitments: 13%

% of mentors response to open-ended question

**Local REU Student data**

Students who participated in the local REU were asked to participate in the baseline survey in mid-spring and the post survey in early summer. Twenty-four students responded to the pre survey and 17 students responded to the post survey. Students responded regarding their perceived interest, skill level, and perceived readiness for graduate school. Pre-survey responses are presented alongside post-survey responses, and interpretations of changes over the course of the local REU are suggested. Pre and post surveys are not matched, as the response rate did
not allow for such analysis, yet independent samples t-tests were used to gauge changes in means as statistically different or not.

Figure 82: Pre-survey Research Skills

In the research skill scale, evaluation results show shifts from disagreement, a range from 12% to 29%, to more neutral and agree statements. The scale mean for research skills shifted from 4.94 in pre surveys to 5.81 out of 7 in post surveys, and this difference was statistically significant (p=0.0229 in a one-tailed test where α=0.05).
Figure 83: Post Survey Research Skills

Research Skills: Please indicate your agreement or disagreement with the following statements. BECAUSE OF THIS REU:

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither agree nor disagree
- Somewhat Agree
- Agree
- Strongly Agree

I HAVE STRONG PRESENTATION SKILLS.
I CAN PREPARE A SCIENTIFIC POSTER FOR PRESENTATION TO A TECHNICAL AUDIENCE.
I CAN UNDERSTAND JOURNAL ARTICLES IN MY FIELD.
I HAVE STRONG TIME MANAGEMENT SKILLS.
I CAN WRITE SCIENTIFIC REPORTS AND PAPERS FOR A TECHNICAL AUDIENCE.
Interest and confidence shifted during the local REU slightly—the few responses that show lack of confidence shifted to at least neutral responses. **Scale means shifted across items from pre to post, from 4.94 to 6.09 out of 7 in the post survey.** This difference was statistically significant ($p=0.0003$ in a one-tailed test where $\alpha=0.05$).
Computing interest/confidence: Please indicate your agreement or disagreement with the following statements. BECAUSE OF THIS REU:

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither agree nor disagree
- Somewhat Agree
- Agree
- Strongly Agree

- I have confidence in my ability to contribute to the field of computing.
- I have confidence in my ability to do well in future computing courses.
- I am interested in computer science in general.
- I am confident I would be able to do research in my field.
- I am confident in my ability to work independently.
In original planning for the Local REU, the problem solving coursework was to be integrated into the local REU, yet that did not occur in the first iteration. Given this change in plan, any shifts in problem solving ability reported would be due to indirect learning about problem solving through research work. **There was approximately a one-point average scale mean gain in problem solving, where the pre-survey scale mean was 4.93 out of 7 and the post survey scale mean was 5.98. This difference was statistically significant at** \( p=0.0024 \) **in a one-tailed test where** \( \alpha=0.05 \).
Problem Solving Skills Please indicate your agreement or disagreement with the following statements. "When I solve a problem:"

- Strongly Agree
- Agree
- Somewhat Agree
- Neither Disagree nor Agree
- Somewhat Disagree
- Disagree
- Strongly Disagree

1. I gather data from additional resources to inform my work.
2. I communicate a problem and solution in multiple ways.
3. I ask for feedback about my solution while, or before, I develop it.
4. I think about the problem context (whose problem, the setting of the problem).
5. I reflect on my thinking before designing a solution.
6. I consider multiple solutions.
7. I consider multiple variables.
8. I ask questions about the problem to be solved.
The Affinity Research Group Development scale saw the greatest gains from pre to post-specifically, the scale means shifted from 4.30 on a Likert scale of 7 to 5.95 out of 7. This difference of more than one and a half points was statistically significant (p=0.0001 in a one-tailed test where α=0.05).
ARG Development AFTER PARTICIPATING IN THIS REU:

- I KNOW THE PARTS OF A RESEARCH PAPER IN MY AREA OF INTEREST.
- I KNOW HOW TO ASK PROBING QUESTIONS.
- I HAVE STRONG GRAMMAR SKILLS IN MY WRITING.
- I KNOW WHAT IT TAKES TO IMPROVE A POSTER I AM REVIEWING.
- I KNOW THE ELEMENTS OF A RESEARCH POSTER.
- I KNOW HOW TO WRITE A HIGH QUALITY PERSONAL STATEMENT.
- I KNOW HOW TO WRITE CLEAR GOALS AND OBJECTIVES.
- I KNOW HOW TO GIVE AN "ELEVATOR SPEECH" DESCRIBING MY ACADEMIC INTERESTS.
- I KNOW HOW TO GIVE HELPFUL FEEDBACK TO MY PEERS.
- I KNOW HOW TO WRITE AN ABSTRACT FOR A RESEARCH AUDIENCE.
The graduate school preparation scale did not see as much growth as others—it may be related to the scale’s emphasis on identity development related to graduate school, such as feeling like a “good fit” for graduate school. The means did shift from 4.85 to 5.67, but this change was not statistically significant.
Pre-survey demographics are reported, and post survey demographics are described when the data differ. Pre-survey data involves approximately 1/3 sophomore, 1/3 junior, and 1/3 graduating seniors, with 13% seniors who did not plan to graduate in 2022. Post survey was somewhat different—50% were sophomores in the post survey.
Thirty eight percent of the pre-survey respondents self-identified as female, which is similar to the post-survey demographics (42% female).

Eighty three percent of the pre-survey respondents were Hispanic—and the same percent were Hispanic in the post survey. The pre-survey included more African American students than the post survey, which had more Asian students.
Students who took the pre survey were about half first generation and half continuing generation students. Students with parental figures with Master’s degrees were more common in the post survey than pre-survey.
What is your primary parental figure or guardian's highest level of education?

- Less than High School: 21%
- High School Diploma or G.E.D.: 17%
- Earned a 2-Year Degree: 8%
- Earned a 4-Year Degree: 13%
- Earned a Master's Level Degree (MA, MS, MBA): 8%
- Attended Some Graduate School: 13%
- Earned a Doctoral Level or Professional Degree (PhD, MD, DDS, JD): 4%
- Not applicable, no secondary parental figure/guardian: 0%
- Other (please specify): 4%

What is your secondary parental figure or guardian's highest level of education?

- Less than High School: 25%
- High School Diploma or G.E.D.: 17%
- Earned a 2-Year Degree: 17%
- Earned a 4-Year Degree: 21%
- Attended Some Graduate School: 25%
- Earned a Master's Level Degree (MA, MS, MBA): 13%
- Earned a Doctoral Level or Professional Degree (PhD, MD, DDS, JD): 4%
- Not applicable, no secondary parental figure/guardian: 0%
- Other (please specify): 0%
CAHSI Graduate Student Climate
The purpose of this study is to understand departmental climate for graduate students in computer science. In late spring of 2022, the CAHSI evaluation team coordinated with PIs, affiliates, co-leads, and leads to send out the graduate climate survey to their graduate students, with three reminder messages to each. Responses were collected from 17 institutions. Data is reported in the charts below with responses excluded casewise—all responses that exist for an item are included. For comparison analyses that appear in the tables, responses were excluded listwise—responses that did not meet a threshold of completeness were removed from the database.

Figure 97: Computing Interest/Value Survey Scale

On the whole, students see the value of computer science as a career field, view the work as of worth to society, and believe that others see the value in the field. All mean values were above 4.0, which corresponds to an “agree” response. The highest average relates to expectations of the career field (4.40).
Graduate students consider professors respectful (4.22, agree), feel comfortable asking questions (4.01, agree), and believe professors take their comments and questions seriously (4.13, agree). Graduate students were less likely to say their professors make positive comments about their work (3.85, neutral/agree) or to describe professors as inspirational (3.80, neutral/agree), or that their professors care about their learning of the material (3.74, neutral/agree). Professors were also less likely to give career advice (3.61, neutral/agree) or support collaboration in the classroom (3.51, neutral/agree). The negatively worded item garnered generally negative responses—only 17% stated they thought their professors believed the students had less academic ability than they had.
Students were in general confident about their ability to succeed in their graduate programs (4.15, agree/strongly agree), though slightly less confident in defending their work (3.94, neutral/agree) or developing a research proposal (3.73, neutral/agree).

Graduate students considering completing assigned work as most valuable to their learning (4.02, agree), while viewing meeting with professors only slightly less valuable to their learning (3.98, neutral/agree). Meeting with a thesis advisor was reportedly less valuable than meeting with professors—it is unclear if the term “thesis advisor” was understood across all student groups in the same way (3.80, neutral/agree). Students were more favorable than unfavorable regarding the value of extracurricular events in the department (3.60 neutral/agree) and professional conferences (3.93, neutral/agree).
The exclusion scale was added to the graduate climate survey to measure negative experiences students may have with fitting into a departmental culture or community. The scale is negatively oriented— in other words, a “perfect score” would be a mean of 1, in which students never feel excluded. Given these parameters, the “highest scoring” item was in fact the mean of 1.11, related to hearing faculty make negative remarks about specific races or ethnic groups, and the next relates to hearing faculty make negative remarks about women, at mean of 1.12. In all, up to 25% of student respondents have felt excluded at least “sometimes” from the department. Exclusion experiences span graduate cohorts, class, lab groups, and external activities related to the computing profession. Exclusion also includes hearing negative language about a subgroup of students, such as hearing peers speak negatively about women, or feeling excluded or discriminated against within a department. While the majority of students did not experience such exclusion, a goal for all departments could be to reduce the proportion of students who experience exclusion to close to zero.
Graduate students were asked to describe the ways in which their self-assessed skills and knowledge have shifted because of graduate school participation. While less than 10% regularly mention their skills have become worse, there is a significant proportion of students who mention their skills are remaining the same on each of the items, from 19-29% of respondents. Mean item responses span a narrow range from 3.79 (leadership) to 4.11 (understanding research literature).
Graduate advisor relationships are generally positive, according to survey results, with means trending positive and nearing or achieving a mean response that corresponds with “agree” near 4.0. Student mean ranges are lowest for the greatest amount of support, advocacy (3.82), as well as for emotional support, which some faculty view as unrelated to their role as an advisor (3.60).
The graduate program opportunity scale was one with which students had difficulty—in most cases the most common response was “neutral”—many students did not feel they had a good sense of how opportunities were distributed and requested a “not applicable/I don’t know” selection. In general, students agree more than they disagree to these items, with 50% of students saying they get what they need when they need it as graduate students, 50% saying they had as many opportunities as their peers, and 45% saying opportunities seem to be distributed equally among graduate students. It is possible this scale is most appropriate for PhD candidates who have had more time in the department and may have greater understanding of departmental policies and practices.
The social support scale was designed to understand how graduate students receive support from others in their endeavor to earn graduate degrees. The negatively worded items were added to understand whether and how others in the graduate student’s social circle feel about graduate school endeavors—this is hypothesized to be more pronounced in first generation students whose families might not understand the benefit of additional education beyond the BS degree, particularly when BS degrees in computing fields lend themselves to high salaries at the baccalaureate level. Students report high overall support from family and friends related to graduate school (4.33, 4.22, agree/strongly agree), yet they are less likely to report access to supportive peers (3.64, neutral/agree) or supportive professionals in the field (3.30, neutral/agree).
Graduate student respondents utilized peers, advisors, and faculty to support their learning within their departments, and were less likely to use institutional resources such as writing labs, graduate student groups at the institution, and tutoring services.
Students were more likely to state that they were working towards Master’s degrees, and most were full time students. Over half work in graduate student positions, while 1 in 5 do not work, 13% work in a job outside of computing, 12% work at the institution hourly, and 9% work in computing.

Students who completed the graduate climate survey were, on average, not particularly active in departmental events: 1/3 had never participated, 38% once or twice, 13% participated 3 or 4 times, and 16% participated more than 4 times.
Most students who participated in the survey were Asian—38% from the Indian subcontinent, and 14% from other areas of Asia. Twenty eight percent were white, 18% were Hispanic/LatinX, 4% African American/black, and 1% Pacific Islander.
The majority of students self-identified as male (64%), about a third female (32%), while some selected non-binary (2%) and others preferred not to state their gender (2%). Students spanned multiple stages in graduate school.

**What is your class standing?**

- **First Year Master’s Degree**: 30%
- **Second Year Master’s Degree**: 20%
- **Third Year + Master’s Degree**: 6%
- **PhD Student, Completed Coursework, Working on Research Proposal**: 8%
- **PhD Student, First Two Years Primarily Taking Courses**: 16%
- **PhD Student, Doctoral Candidate**: 15%
Data comparisons across groups

In an effort to understand differences in graduate student experiences, we compared item and scale means for each of the topics on the survey. The groups chosen for comparison are based on demographic information gleaned in the survey, and selected based on higher education research findings regarding differential access and experiences of STEM in college. Based on the low response rate, independent t-tests were the statistical tests appropriate for the data collected, with two-tailed alpha level set at 0.05. The groups are as follows:

- **Gender**: This variable was compared dichotomously as “men” and “women” as self-reported by survey respondents. Those who did not reply or who replied with an “other” response were not included in the comparison.
- **Hispanic ethnicity**: Respondents were able to select as many race and ethnicity descriptors as they deemed relevant for self-identification. Those who selected “Hispanic” were compared with all other respondents who completed the item.
- **Continuing/First generation**: For those students who responded to the “parental figure education” questions, respondents were hand-coded as first generation if none of the responses included a four year degree or higher. Those with a four-year degree or higher in either first or second parental figure responses were labeled “continuing generation college students.”
- **STEM mentor/no STEM mentor**: Respondents were asked if they had someone in their life while they were growing up that was engaged in science, technology, engineering, or math. Those who had such a mentor were compared with those who did not, according to their survey response.
- **Continuing CAHSI/new CAHSI**: The graduate student survey was extended to departments with past CAHSI involvement as well as new CAHSI members. The survey responses were compared at the level of survey “collector,” which defines which link was used to obtain the response.

The table below details all of the results of data comparisons. The first column includes which groups were compared. The second column lists the “scale” being compared, with the first use of each scale including the number of items that comprise the scale as well as the Likert options students had from which to choose. The third column includes the pattern observed across items and/or at the scale level. Patterns were reported if one group in the dichotomy consistently had higher scores than another, even if this difference was not statistically different. Column four indicates whether a statistical difference was discerned, though when statistical differences were close to an alpha level 0.05, or 95% confidence level, this was reported as well. Effect sizes were calculated using pooled standard deviations for both groups, as all group comparisons were unequal. Effect sizes were Cohen’s d values, and
reporting followed recommendations considering 0-0.39 as small, 0.40-0.70 as medium, and 0.71 and above as a large effect.

**Figure 114: Graduate Student Comparisons**

<table>
<thead>
<tr>
<th>Comparative groups</th>
<th>Scale</th>
<th>Patterns of item and scale responses</th>
<th>Statistical difference in scale means (Y/N)</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men/Women</td>
<td>Computing Interest/Value; 6 items, strongly disagree=1 and strongly agree=5</td>
<td>No clear pattern</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Hispanic/Hispanic</td>
<td>Computing Interest/Value</td>
<td>No clear pattern</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Continuing Generation/First Generation</td>
<td>Computing Interest/Value</td>
<td>“First generation” students respond slightly more favorably</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Mentor/No Mentor</td>
<td>Computing Interest/Value</td>
<td>No clear pattern</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Continuing CAHSI/new CAHSI research</td>
<td>Computing Interest/Value</td>
<td>Continuing CAHSI responded slightly more favorably</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Men/Women</td>
<td>Professor Engagement: 9 items, 1 negatively worded, strongly disagree=1 and strongly agree=5</td>
<td>Men responded slightly more favorably</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Hispanic/Hispanic</td>
<td>Professor Engagement</td>
<td>Hispanics respond moderately more favorably</td>
<td>N (but approaches significance at 0.09)</td>
<td>NA</td>
</tr>
<tr>
<td>Category</td>
<td>Measure</td>
<td>Description</td>
<td>p-value</td>
<td>Effect Size</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Continuing Generation/First Generation</strong></td>
<td>Professor Engagement</td>
<td>No real pattern</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Mentor/No Mentor</strong></td>
<td>Professor Engagement</td>
<td>“No Mentor” group respond slightly more favorably</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Continuing CAHSI/new CAHSI research</strong></td>
<td>Professor Engagement</td>
<td>Continuing CAHSI Institution students respond much more favorably</td>
<td>Y p=0.0027, one tailed t-test statistically significant when α =0.05</td>
<td>Effect size is 0.416, a moderate effect</td>
</tr>
<tr>
<td><strong>Men/Women</strong></td>
<td>Learning Opportunity</td>
<td>Women respond moderately more favorably</td>
<td>N (but approaches significance at 0.07)</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Non-Hispanic/Hispanic</strong></td>
<td>Learning Opportunity</td>
<td>No real pattern</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Continuing Generation/First Generation</strong></td>
<td>Learning Opportunity</td>
<td>“Continuing generation” responded slightly more favorably</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Mentor/No Mentor</strong></td>
<td>Learning Opportunity</td>
<td>“No mentor” group responded slightly more favorably</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Continuing CAHSI/new CAHSI research</strong></td>
<td>Learning Opportunity</td>
<td>Continuing CAHSI Institution students respond slightly more favorably</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Men/Women</td>
<td>Exclusion 12 items, 1= not at all and 3= frequently</td>
<td>No real pattern</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>---------------------------</td>
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</tr>
<tr>
<td>Non-Hispanic/Hispanic</td>
<td>Exclusion</td>
<td>Non-Hispanic students report more exclusion</td>
<td>Y, p=0.0209, significant in a two tailed test where α=0.05</td>
<td>Effect size is small (0.35)</td>
</tr>
<tr>
<td>Continuing Generation/First Generation</td>
<td>Exclusion</td>
<td>Continuing generation students report slightly more exclusion</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>STEM Mentor/No Mentor in childhood</td>
<td>Exclusion</td>
<td>“STEM mentor” group report moderately more exclusion</td>
<td>N (but approaches significance at 0.06)</td>
<td>NA</td>
</tr>
<tr>
<td>Continuing CAHSI/ new CAHSI research</td>
<td>Exclusion</td>
<td>New CAHSI Institution students report much more exclusion</td>
<td>Y, p=0.00017, statistically significant in a two tailed t-test where α=0.05</td>
<td>Effect size is moderate (0.44)</td>
</tr>
<tr>
<td>Men/Women</td>
<td>Graduate Student Skills 13 items, 1= much worse and 5= much better</td>
<td>Women respond with slightly more perceived growth</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Hispanic/Hispanic</td>
<td>Graduate Student Skills</td>
<td>No real pattern</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Category</td>
<td>Skills</td>
<td>Description</td>
<td>N</td>
<td>Effect Size</td>
</tr>
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</tr>
<tr>
<td>Continuing Generation/First Generation</td>
<td>Graduate Student Skills</td>
<td>First generation students respond with slightly more perceived growth</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Mentor/No Mentor</td>
<td>Graduate Student Skills</td>
<td>No real pattern</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Continuing CAHSI/new CAHSI research</td>
<td>Graduate Student Skills</td>
<td>Continuing CAHSI Institution students respond with a great deal more perceived growth</td>
<td>Y</td>
<td>Effect size is small (0.32)</td>
</tr>
<tr>
<td>Men/Women</td>
<td>Advisor Relationships</td>
<td>Women respond slightly more favorably</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic/Hispanic</td>
<td>Advisor Relationships</td>
<td>Hispanics respond slightly more favorably</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Continuing Generation/First Generation</td>
<td>Advisor Relationships</td>
<td>“First generation” students responded slightly more favorably</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Mentor/No Mentor</td>
<td>Advisor Relationships</td>
<td>“No mentor” group responded slightly</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advisor Relationships</td>
<td>Students from early CAHSI Institutions score much higher</td>
<td>$Y$ (p=0.00085), statistically significant in a two tailed t-test where (\alpha=0.05)</td>
<td>Effect size is moderate (0.46)</td>
</tr>
<tr>
<td>--------------------------------</td>
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</tr>
<tr>
<td><strong>Continuing CAHSI/ new CAHSI research</strong></td>
<td>bernard lucht gonzalez</td>
<td>more favorably</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Men/Women</strong></td>
<td><strong>Graduate Program Opportunity</strong> 5 items, 1=strongly disagree and 5=strongly agree</td>
<td>Men responded slightly more favorably</td>
<td><strong>N</strong></td>
<td><strong>NA</strong></td>
</tr>
<tr>
<td><strong>Non-Hispanic/Hispanic</strong></td>
<td><strong>Graduate Program Opportunity</strong></td>
<td>Hispanics responded slightly more favorably</td>
<td><strong>N</strong></td>
<td><strong>NA</strong></td>
</tr>
<tr>
<td><strong>Continuing Generation/ First Generation</strong></td>
<td><strong>Graduate Program Opportunity</strong></td>
<td>“First generation” students responded slightly more favorably</td>
<td><strong>N</strong></td>
<td><strong>NA</strong></td>
</tr>
<tr>
<td><strong>STEM Mentor/No Mentor</strong></td>
<td><strong>Graduate Program Opportunity</strong></td>
<td>“STEM Mentor” students responded moderately more favorably</td>
<td><strong>N (but p value approached significance at p=0.06)</strong></td>
<td><strong>NA</strong></td>
</tr>
<tr>
<td><strong>Continuing CAHSI/ new CAHSI research</strong></td>
<td><strong>Graduate Program Opportunity</strong></td>
<td>Students from early CAHSI Institutions respond moderately</td>
<td><strong>N (but p value approached significance at p=0.051)</strong></td>
<td><strong>NA</strong></td>
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</tr>
<tr>
<td>Men/Women</td>
<td>Social Support for Graduate school 6 items, 1=strongly disagree and 5= strongly agree 2 negative items removed for comparison</td>
<td>Women respond slightly more favorably</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Hispanic/Hispanic</td>
<td>Social Support for Graduate school</td>
<td>Hispanics respond slightly more favorably</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Continuing Generation/ First Generation</td>
<td>Social Support for Graduate school</td>
<td>No real pattern</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Mentor/No Mentor</td>
<td>Social Support for Graduate school</td>
<td>No real pattern</td>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>Continuing CAHSI/ new CAHSI research</td>
<td>Social Support for Graduate school</td>
<td>Students from early CAHSI Institutions respond slightly more favorably</td>
<td>N</td>
<td>NA</td>
</tr>
</tbody>
</table>

Graduate Climate Study Implications
The graduate climate study is an initial attempt to understand how graduate students perceive their learning environment. Scale means were compared across different student demographic markers as well as department type, and the most consistent variable that influenced climate was time in the CAHSI initiative—new research intensive departments scored statistically significantly lower in multiple categories.

CAHSI Members’ Voices: Network Strengths and Challenges
In spring 2022, CAHSI evaluators interviewed CAHSI departmental leaders, faculty, chairs, connectors and/or coordinators from 22 CAHSI departments. Many of these departments were
CAHSI veterans (members of 5+ years), although seven were newcomers who had been involved with CAHSI for two years or less. Interviews covered a range of topics including CAHSI’s common agenda/values, adoption of signature practices and other activities, the functioning of the backbone and network overall, communication practices, and student leadership development. Interviews typically lasted from 30 to 60 minutes. Following are some of the key themes that emerged from these wide-ranging interviews.

Changes in Values or Practices

One of the most impactful aspects of CAHSI has been the transformation in values and practices among members. Through their participation in CAHSI, many members have reinforced or even transformed their values and approaches to students and learning. Some of these shifts involved changes to classroom practices. For instance, many CAHSI faculty mentioned that they are now much more likely to discuss career paths, graduate school preparation, and professional opportunities in their courses. Many faculty view their classes as an important venue to communicate information and instill professional values to prepare students for the workforce or graduate education. Other faculty noted that they now make a more explicit connection between class content and career paths, as mentioned by a CAHSI faculty member: “I told them everything they learned and how it matched the research and the data scientists’ career paths. And I think they did that reflection [exercise] and it worked out well.”

Other faculty have ensured that their approach to teaching and learning aligns with CAHSI values. Several faculty members discussed trying to improve courses and course outcomes through revised curricula or teaching practices. Some campuses have worked to recruit Hispanic faculty to teach introductory courses. For instance, a Latina instructor at NEIU has taken the lead in creating modules to improve freshman-level courses. Other campuses have integrated Affinity Research Group principles into courses, especially capstone courses. UTEP and CSU-DH have a longstanding tradition of incorporating ARG into courses. UC Merced is in the process of incorporating ARG into their capstone courses which is already an experiential learning course that involves industry partners. UTEP has a leadership class that applies ARG principles and could serve as a model for the rest of the Alliance.
Most importantly, many veteran CAHSI participants talked about shifts in values and how CAHSI values have become **ingrained in their practices over time**. One faculty member described changes to her classroom practice to reflect CAHSI values: “So what I’ve been doing more in the classroom is that I have realized that one of the principles of CAHSI, is to meet the students where they’re at. To make education more accessible to the students. And we also try to advance them. We have to challenge them. The whole idea is to offer scaffolding, to challenge them to the next level. So I’ve been focusing this year on making my class more accessible to students [by using scaffolding].” Representatives from another department described how CAHSI is now embedded in all decision-making and practice within the department:

CAHSI members also seek inspiration and motivation related to values and practices from others in the network. A newer department also described changes in approach, perspective and decision making, and seeking inspiration from other CAHSI members: “I think we think a little higher, we think a little broader. We’re not likely to get discouraged as quickly. If someone says [another CAHSI department] is doing it, then maybe we can do it too. It’s helped our ambitions a little bit. We’ve been able to build on the momentum.” Another newer member contrasted the trust and values within CAHSI with other networks: “I’ve been involved with other alliances and things. I feel like CAHSI is here to do things for the right reasons. I do depend on them for that, and I truly trust people in CAHSI. So that means a lot to me.” Finally, a veteran member talked about the regional collaborations generated by CAHSI and how they have shifted the focus from competing for students to collaborating to increase students’ success: “I think the good thing is that we are not competing. We complement each other and that’s the good thing. It, it is not that we trying to say, okay, I have something I don’t you want to get. I say, I have something. Why don’t you try to get the same thing so we can get more students involved with that. It’s gonna be good for you, good for everybody. So I think that mentality has helped us, that we see that we are trying to help each other and just basically work together...So it’s been great to have a support system, you might call it a stronger support system, but now there are all these connections.”

New Pathways
CAHSI has been at the forefront of innovation in computing curriculum and degree pathways with the development of problem-solving courses, professional development courses, and accelerated master’s programs. In the past year, CAHSI departments continued to develop new courses and degree pathways on their campuses. Merced College developed an associate degree for transfer in computer science and created a computer programming certificate. The college also created new courses, such as a robotics programming course. Merced College and UC Merced are also working on developing a better articulation agreement for transfer. To this end, Merced College is revising its introductory programming courses to align better with UC Merced and its expectation that students will know C++. EPCC is also strengthening its already strong relationship with UTEP through an undergraduate research initiative in which EPCC students conduct research with UTEP faculty. The Instructional Assistant position at UTEP also serves as a pathway for entering EPCC students to become integrated into the department as developing leaders.

Many of the California campuses are involved in state initiatives, such as the Cal Bridge program which offers a pathway from the California State University System campuses to PhD programs in computer science. The program was modeled after the APS Bridge program in Physics and Astronomy to promote PhD recruitment among underrepresented populations of students. Notably, CSU-DH has also been working with CSU-LA, CSU Fresno, and SFSU to create a pathway from high school to community college to a California State University campus through the master’s degree program. Students could then enter the Cal Bridge program to continue their studies to pursue a PhD at a University of California campus. CSU-DH is also working on creating a certification for high school that will align with their master’s in cyber security. Two cohorts of teachers have already completed the CSU-DH certification program and currently 80 students are enrolled in the program. CSU-DH also has a certificate in cyber security and a master’s program in data science. They are working on creating a collaborative Bachelor of Science degree in systems and computer engineering.

Several campuses have developed accelerated master’s program in which students can co-enroll in upper-level undergraduate and graduate level courses and complete their master’s degree in one year after completing their bachelor’s degree. Kean has recently developed an accelerated master’s program and has observed more local students pursuing the fifth-year master’s degree on the Kean campus. NMSU has also recently instituted an accelerated master’s degree, but the enrollment has not been what they hoped because many students choose to immediately enter the workforce rather than pursue a graduate degree. Still, the renewed focus on graduate education within CAHSI will provide new pathways for accelerated master’s students to pursue a PhD at a CAHSI research-extensive institution.

Undergraduate Research and Graduate School Preparation
CAHSI has always prioritized undergraduate research through its Affinity Research Group model but there has been a renewed emphasis on research through initiatives such as the Virtual REU and Local REU programs. Several campuses engage in exemplary ARG practices and are developing new ARG models such as the research partnership between EPCC and UTEP which provides a research and academic pathway from community college to the university. Some faculty have found the local REU model has provided flexibility to include additional elements into the research experience. For instance, Merced College has integrated field trips to a farm during the local REU since the research focus is on agricultural technology which is also a significant issue in their local area.

In interviews, faculty expanded on the learning and development that they had observed in their students from the local REU. Faculty mentioned growth in scientific communication skills from the opportunity to develop and present a poster, even though the research experience itself was on a short timeline. Other faculty mentioned that some students have become more interested in graduate school. Some students in the western region plan to apply to the Cal bridge program. As one faculty member noted, “the REU will be important in the application.” Some campuses reported that they have seen an increase in research and graduate school interest among students. For example, faculty at UTEP have noticed increased interest in part because of special topics courses that are more research-oriented and more funding for research experiences within the department. Many campuses have begun to institutionalize research practices. As an example, NEIU has consistently had about three to four research groups in which more advanced undergraduate researchers mentor less advanced students. These research teams meet weekly. Students are encouraged to present their summer research work at symposia. Several campuses also noted the interdisciplinary nature of their research projects. For example, CSU-Stanislaus computing faculty work with faculty from the chemistry department on chemical and sensory wine data. Three CAHSI students participated in that research group through the local REU. Kean noted that the adoption of the “Affinity Research Group model has been terrific” and they now have more research projects in their department.

Research experiences at the CAHSI community colleges vary, with some colleges innovating research best practices and others struggling to find the resources and personnel to support research groups. Merced College has grown its involvement in research experiences and participated in the Local REU. EPCC has adopted the ARG model for community college research students. As a CAHSI participant noted, “We have to adopt [research experiences] based on the needs of the students….And the idea is to identify partners at UTEP or NMSU and start working in areas that might help the students.” While students complete their two-year degrees and prepare to transfer, they are propelled directly into research labs at partner universities. This student-focused model that emphasizes community college-university partnerships could be
used as a best practice to adopt across CAHSI to prepare students for transfer and to strengthen local institutional collaboration and relationships.

Despite the growth in research opportunities and involvement through the vREU and Local REU, some faculty expressed concern that students are not motivated to pursue graduate school because of the allure of an immediate, lucrative job. As noted, some faculty observed that their master’s enrollment has been weak and that students are not interested in pursuing a doctorate immediately out of college. A veteran CAHSI member commented, “We’re trying to get them into the graduate program, but it looks like it’s going to be a struggle because these are very, very active Hispanic leaders who are captured by industry so quickly. So we cannot compete. We tell them we’re going to give you a stipend and plus we pay for that tuition and all that. They still prefer to take the job.” Nevertheless, CAHSI and its larger network have created opportunities for students. For example, four Calbridge students seeking doctorates at University of California campuses came from CSU-Stanislaus as a result of its participation in CAHSI. Additionally, two Latina FemProf alumna just received their doctorates and a Hispanic student who received the Google dissertation award just received his doctorate. Therefore, despite strong headwinds, CAHSI is creating pathways to graduate degrees that are being utilized by students.

**Problem-Solving and Pre-CS 1 Courses**

While some campuses have not been able to implement problem-solving courses due to staffing problems (see section on challenges), others have continued to offer the course and adapted it to serve their students’ needs. NEIU has offered CS zero courses for dual enrollment students. The department also divided their CS zero course into two separate problem-solving courses. The goal is to “help students understand how computer programs work without teaching actual computer programming.” In other words, the courses focus on computational thinking and problem solving needed for computer science. The second course focuses on algorithms. Other campuses have used the problem-solving course to help students transition from community college to university. For instance, a NMSU faculty member commented “Problem solving is a clear instrument for the transition from two-year to four-year if we do it right.” Merced College is going to offer a style of course called spark seminars. They will be general education requirement courses. The college struggled to find faculty to be able to offer it due to understaffing but recently hired a lecturer who will offer the spark seminars. Therefore, CAHSI departments are continuing to innovate using the problem-solving and pre-CS 1 course model to offer similar content in different formats and to different populations.

**PLTL**

A few campuses have been able to sustain or expand PLTL offerings, despite difficulties from the pandemic. Previous reports (see 2020, 2021) have addressed the shift of PLTL to virtual formats. In the past year, a few campuses have been able to sustain significant investment in
PLTL, such as NEIU and UTEP. NEIU now has 25 peer leaders in multiple programming classes, such as Programming One and Programming Two. They also shifted the model to a remote implementation during the pandemic. Other faculty noted that peer leaders have been “very helpful. Students feel a lot more comfortable asking questions, reaching out to them for help.” Serving as a peer leader can also expand to other professional opportunities for students. A few CAHSI faculty noted that their peer leaders apply for every opportunity, such as scholarships and internships. Therefore, recruiting students as peer leaders can create a feedback loop where they then begin to engage in other opportunities and become more involved in the department and the profession.

Leadership Development and Graduate/Professional Preparation

CAHSI has created multiple pathways to student leadership. The Student Advocate program is one of those pathways. Departments vary in how they engage Student Advocates, but many Advocates lead or assist with departmental activities aimed to recruit or engage students. Some faculty noted that their Advocates have become more involved with outreach activities. Similar to peer leaders, faculty noted that students were more engaged and interested when Advocates were assisting with activities. One faculty member commented about an outreach activity with Advocates, “They just had kids talking to them. The kids weren’t asking us questions, they’re asking them. They were just busy, just nonstop. So it adds a lot.” Other campuses involve Advocates in planning, organizing and hosting professional development workshops or other events and activities. As an example, the Advocate at NMSU hosted a workshop about graduate school, specifically, applying for the GEM Fellowship. Advocates also hosted workshops about applying to an REU and hosted one prior to the deadline for the CAHSI REU.

CAHSI campuses have become more involved in formally preparing students to be successful at the Great Minds in STEM conference. This preparation has augmented students’ outcomes and contributed to a more successful student experience at the conference. UHD, in particular, has led this innovation. Their preparation activities have focused on showing students how to make connections and being successful in interacting with industry representatives. During the pandemic, in the past year, UHD shifted the focus to professional presentation for virtual environments. A CAHSI staff member commented, “The focus became, ‘how do we communicate? How do we make our best self through Zoom?’ We really wanted them to get a sense of what that could be and how they can present themselves. How to make that quick pitch.” UHD faculty also review students’ resumes and LinkedIn profiles in addition to helping them develop elevator speeches and prepare for interviews. Another aspect of the student preparation is to discuss all aspects of the conference and what to expect and how to behave and present oneself in a professional manner during different conference activities. Finally, UHD also offered a workshop series, including topics such as preparing abstracts and presenting research at conferences. They reported that the number of student attendees at their workshop series
has grown. Kean also mentioned a faculty member who has been highly successful in preparing students for GMiS. One member noted that it would be beneficial to institutionalize these practices across CAHSI, saying “*Maybe over time CAHSI could develop some videos or handouts or something that could be shared across campuses. That would be a primer on how to attend a conference and what is expected.*”

**In another recent innovation, Kean has created a CAHSI resource center for students.** Realizing that communication and connection with students is integral to their success, the resource center provides a place for students to get information, guidance, resources, and to make connections with CAHSI staff and other students. The resource center is available to assist students with information and guidance about pursuing graduate school, preparing for job interviews, and other professional opportunities. The resource center opened in the past year and will fully launch in fall 2022.

**Another recent innovation has been the Allyship program, a partnership between UTEP and UPRM.** The Allyship program is funded by Reboot and the goal is to support first year students in introductory courses by pairing them with a student ally. The initiative was initially for women and has been expanded to men with sponsorship by Google. The program is in its second year. Students (allies and protégées) attend trainings, panels and other professional development. As a faculty member reported, “*It’s beyond mentorship, it’s more like championship. We want to show them the resources that are available and, if necessary, work with them, to review the application that they submit for an internship.*”

Originally launched at CSU-DH, **hack-a-thons have expanded across the Alliance.** For instance, NMSU has done an in-person coding challenge that CAHSI Advocates helped to coordinate. UHD and TAMU-CC have collaborated on hack-a-thons. They had over a hundred students participate across two competitions that involved 10 different campuses in South Texas. The Southwest region in Puerto Rico has also developed successful hack-a-thons. CAHSI continues to provide a network-wide hack-a-thon at the Great Minds in STEM conference. Therefore, the hack-a-thon model has successfully scaled across CAHSI regions and sub-regions.
In all, CAHSI Student Advocates and leadership development opportunities have created connections and networks among students, faculty, and staff. These connections help students to navigate career and graduate school pathways and to be more successful in their majors. As one CAHSI faculty member stated:

**Partnerships**

Industry partnerships have been another area that has promoted innovation and augmented student support within CAHSI. Many veteran faculty members described significant local partnerships that have expanded student access to industry opportunities. On the other hand, several departments discussed challenges in identifying partners and developing relationships with industry. Developing industry partnerships has been an ongoing concern for some departments and they have frequently recommended more training or support in how to cultivate beneficial local industry partners.

Several faculty discussed the benefits of their local partnerships. One faculty member whose department has numerous industry partners commented: "**I've been focusing on partnerships with industry to work on students' identity so they can envision themselves in the workplace. So students can relate, find jobs, network.**" CSU-DH has relationships with Boeing and Northrup Grumman and has successfully recruited industry sponsors for its hack-a-thon. UC Merced is currently entering into a collaboration with AI for all, a nonprofit organization, to offer classes for students to learn various concepts in AI. UTEP has benefited from the Googler-in-residence program as well as partnerships with Lockheed Martin, Microsoft, Reboot and other organizations. UPRM has worked with JP Morgan related to their hack-a-thon and coding clubs. UPRM and the Southeast region also worked with Bloomberg to create an Accelerator program.

"**WHAT CAHSI HAS DONE WELL IS WITH CONNECTIONS. AND OF COURSE, THE RESOURCES AND FUNDING, BUT SOMETIMES THE CONNECTIONS ARE MORE IMPORTANT AND MORE IMPACTFUL.... WHEN YOU CONNECT STUDENTS WITH SOMEONE AND THEY CAN SEE THEMSELVES AS A COMPUTER SCIENTIST, I THINK THAT IS REALLY GOOD AND CAHSI HAS BEEN DOING THAT.**"

UPRM, in particular, has a host of other industry partnerships to support student development. Some campuses have involved industry in faculty development as well. Aside from the CAHSI-wide Google faculty-in-residence program, other campuses have developed local workshops that involve industry. As an example, NEIU has a Computer Science Summer Institute which trained students and faculty with industry involvement, although the heavy time commitment to run
local activities can be an obstacle to the sustainability of local initiatives and points to the need for continued national-level partnerships that can benefit all campuses.

On the other hand, several campuses reported that it was difficult to engage local industry partners, especially in regions with little computing industry present. However, even in more economically vibrant areas, some campuses still struggled to recruit industry and other partners to support their students and CAHSI activities. One veteran CAHSI member noted, “One of the things that we still have not really pulled off successfully here is the industry connection.... There are these things like Google and the problem solving and different things that happen at GMiS that involve industry that are really good. But on a sort of day-to-day level, we’re not really meaningfully integrating industry partners or nonprofit partners into our [local] world.” Overall, local campuses have made progress in establishing regional industry connections but there is still a strong need for national industry partnerships across the Alliance and leadership from the backbone in this area.

Grants

Many CAHSI departments have received grant funding in the past year to expand their support and offerings for students and faculty. Several network collaborations have submitted and received NSF S-STEM funding. CSU-DH has submitted a Scholarship for Service grant. The West region has also submitted a grant to better coordinate the pipeline in that region. UC-Merced is working on several grants that would help to integrate their campus activities to better align with CAHSI’s mission. They will also submit a RET grant to create a research experience for teachers involving the computer science department and school of education. They also plan to apply for an NSF IUSE grant. Kean has run several webinars with funding for Google. One webinar was co-hosted with Rutgers University and discussed opportunities for computer science research related to ocean ecology, marine biology and coastal communities. Grant funding has also spurred curricular innovation. NMSU has received a small BPC grant to integrate computational thinking into creative writing courses. UPRM has also been highly involved in multiple grants to advance CAHSI’s common agenda. UPRM has been successful in generating funding from industry partners, such as Raytheon, Bloomberg, General Motors and others, to support outreach and student development initiatives. UPRM and UTEP have received National Science Foundation funding for a research collaboration related to smart cities and smart
transportation. A CAHSI member described the importance of the network in generating collaborations that can be developed into proposals:

“I THINK THAT CAHSI HAS BECOME A COMMUNITY WHERE FACULTY WITH SIMILAR GOALS ARE GETTING TOGETHER, SHARING INFORMATION AND WORKING TOGETHER, AND THERE ARE SEVERAL PROPOSALS. THE SUBGROUPS HAVE BEEN SUBMITTING [PROPOSALS] AND THE INFORMATION SHARING IS REALLY BENEFICIAL TO EACH OTHER.”

Regional Collaborations

Regional relationships continued to be the focus of CAHSI collaborations in the past year. Regions progressed their partnerships and continued to develop activities and events that benefited students across the region. Regional meetings, particularly in the Southwest region, promoted sharing of best practices and recent innovations. A newer member in the Southwest region mentioned: “I really like the biweekly meetings. There’s so much information and I have learned a lot. Just by attending those meetings, just to get to know what other colleges are doing.” Another newer member mentioned of the Southwest region: “And you can feel so alone, and when I first started, I was just like, I’m just not sure what to do. So I couldn’t wait till the meetings cuz then it would give me ideas. That’s what they’re doing there. They’re definitely helping to guide us.” Another member from the Southwest region noted, “I think that’s a great venue that every other week we meet, we report, and we discuss. And I think that’s a very nice space to go and broadcast our ideas.” This member also commented that, through the regional meetings, he had been invited to give a talk on another CAHSI campus in the area. In this way, regional meetings are critical in communicating and reinforcing CAHSI’s vision and values and in generating ideas, connections, and activities to implement the vision. A member from the North region commented: “It was great that I actually got to know some of my colleagues in this network. And I also had a collaborator who works in the Southwest region. I feel like it’s a great network that could help all of us to do research and collaborate with people from across the country.”

Collaborations across campuses with a common vision have been essential to the productive growth of CAHSI. A member from the North region commented: “Before, we had collaboration and cooperation. But the collective impact approach goes a little bit further, because you have to have a common agenda. So that means having that strategic plan. So we all agree on a common agenda. You have to have open communication. You have to have meetings. And you also have to have strategic actions.” Therefore, the level of collaboration required by collective impact has been the impetus to plan and implement initiatives more strategically.
The regional focus of CAHSI has also strengthened local, or sub-regional, relationships. For example, UHD has strengthened its partnership with UH. A faculty member from UHD noted the mutually beneficial sub-regional relationship, “I think through this collaboration, [the partnership] can be even stronger. And it does not have to always be one direction from UHD to U of H, it can be from the other direction as well, from UH to UHD, where UH has a source for its PhD students. Many of these PhD students would like to have their career in academia. That means they need to have some experience in teaching. So if your student can come and teach here, one course, that is a win-win situation because with UHD being a teaching university, we are in need for adjuncts or lecturers.” In this way, regional partnerships are strengthened as, for example, UHD can send PhD students to UH who, in turn, can then come back and teach and contribute to UHD on a professional level. UHD has also strengthened its sub-regional partnership with TAMU-CC as they have offered joint events, such as hack-a-thons and other activities. The Merced region is another area with strong sub-regional partnerships among CSU Stanislaus, UC Merced and Merced College. A member of that sub-region commented, “I think it's really great that CAHSI has given us sort of this network of people so that when somebody wants to apply for a grant and they want a campus in each region, they have a way to reach out to us and get people like me who are like, "Sure, yeah, I'll recruit some people on my campus and we can form a team." So that's a huge thing right there.” In summing up the strengths of CAHSI, one participant commented, “The strengths of CAHSI are the community of people, people who are really committed, and there are many of those who really, really want Hispanics to be successful.”

Communication Practices

Targeted, frequent communication is one of the greatest strengths and challenges when networks of organizations work together. Clearly, there are many benefits to communication within CAHSI, especially the spread of ideas and information. As a veteran CAHSI member commented about his connector and the changes he has witnessed as CAHSI has expanded, “Now there's more opportunities. I love how she keeps us up to date on conferences submissions, paper submissions, scholarships, fellowships, or opportunities for professional developments for faculty and also for students. So, she has been bringing all those things together. And I think for me, that was fabulous. I see more awareness about the different opportunities that happens around the same ideology that CAHSI follows. So I think if I need to highlight something, that will be the most significant aspect that has changed through the years.” On the other hand, some CAHSI faculty referred to communication challenges that arise with such a large, complex network (see challenges section). Finally, other CAHSI faculty noted that there is more student communication and collaboration across campuses through the Student Advocate program, sharing information about Great Minds in STEM, and other events.

Expanding awareness of CAHSI
Raising the profile of CAHSI within participating departments is a perpetual challenge, yet many departments noted that there is much greater awareness of CAHSI among faculty and students than in previous years. In particular, departments that were first funded through the INCLUDES DDLP project all noted that they had made substantial progress in the past year in raising general awareness of CAHSI’s mission and activities in their department. Faculty generally credited the start of CAHSI clubs and student organizations with helping to raise the profile of CAHSI in the department. Additionally, faculty credited institutional co-leads and coordinators’ promotion of CAHSI within the department for the raised awareness. A CAHSI faculty member commented about her department, “I think CAHSI is finally growing here and it is now getting recognized by the faculty and some students. And now we have established the student organization. So I’d like to thank [the coordinator] for doing that, it makes a huge difference.” That faculty member continued, “I can see the structure and skeleton of how CAHSI can grow and I appreciate the backbone being very patient about it, without creating too much pressure, just to let us grow. And, just guiding and supporting us.” Kean also credited the burgeoning CAHSI resource center with raising the profile of CAHSI in the department. A staff member noted, “The space is very open and I’ve made it a point to have students come in. Some of them just need a moment to just relax before they have to go to a class. Others just come in and sit down and ask me about CAHSI, or ask me about Great Minds. And they’re constantly coming in asking questions, and this is something that I didn’t see when I first came along.” Therefore, having a physical space and personnel who are available has helped to raise awareness of CAHSI in the department and create another focal point for support. In sum, the longevity of CAHSI, increased staffing, student organizations, and faculty promotion were all integral in raising awareness and increasing involvement in CAHSI departments.

Challenges

Despite its successes, CAHSI departments and the network overall have faced several challenges. CAHSI members described ongoing challenges that resulted from the pandemic, as well as challenges related to network expansion and communication, and challenges related to the unique contexts of Hispanic-Serving Institutions.

Pandemic-related challenges and loss of student engagement:
Almost all participants expressed a strong preference for the return of in-person activities, including classroom-based, co-curricular and faculty-oriented activities and events. CAHSI participants reported that virtual events and remote courses were not as effective, especially when the goal is equity and inclusion. As an example, a CAHSI participant noted about asynchronous remote learning: “I just feel like the quality and all the work that we’ve been putting into doing equity and inclusion kind of gets lost when you just post a bunch of videos.” Many CAHSI participants reported that student engagement is down in their departments. In response to less student engagement, Kean opened up the resource center to restore the “atmosphere
that was lost during COVID.” Several departments noted that their CAHSI club or leadership had dissolved during COVID and they were working to restore former levels of student engagement. Many campuses reported that their club leaders have graduated, and it has been difficult to revive the club and recruit new leaders. Other departments reported that they have sustained student clubs but that “attendance is down.”

Other CAHSI participants noted that there has been a lingering student disengagement since the pandemic, even after the return to in-person classes, such as a CAHSI participant who commented, “The students do not seem as engaged because they’ve been online and you have to come to class in person and they kind of look hesitant.” Attendance has also been low at some workshops and events, such as faculty development trainings in some departments or online informational webinars about topics such as REU applications. Multiple interviewees also noted the lack of student engagement and attendance at virtual GMiS compared to in-person offerings. Finally, events where CAHSI members could engage with students and recruit leaders have been cancelled since the pandemic and have not been reinstated. Multiple departments mentioned that the cancellation of events had impacted their outreach and recruiting. As an example, Maricopa had actively recruited at a campus Hispanic Heritage Festival but it has been cancelled since 2020. Merced College noted their science fair used to attract 150 entries and has dropped to about 10 entries. Summing up the impact of the pandemic, one CAHSI participant commented, “And then COVID hit and it kind of stopped everything. Our Advocates have basically moved on.” Every CAHSI participant commented that they are working to address low attendance, revive CAHSI clubs, and foster stronger engagement among students but challenges remain as departments transition out of the pandemic.

Network expansion and communication:
Challenges related to network expansion and communication were about integrating new members into the larger CAHSI network and optimizing communication strategies across the network overall. CAHSI has expanded substantially in recent years, particularly in the past year, and veterans have, at times, struggled with expanding their regions and integrating newcomers into the network. One participant noted, “It’s like we are more scattered and I’m afraid perhaps we’re losing focus….The unity makes the force…but it’s still fragmented.” Other participants wondered if all of the new faculty adhere to CAHSI values as strongly as the veterans do. As one participant noted, “So we’re trying to communicate the values on a day-to-day basis, many get it right away, but a lot of the [new] faculty, I don’t think they’re quite there yet.” Other veterans expressed that the expectations for new institutions were not clear. Newer members concurred that they did not have a full understanding of CAHSI yet and were unclear about the expectations. Some of these feelings may have been addressed at the Snowbird meeting, which took place following the interviews with new members. In particular, participants expressed that expectations regarding the level of involvement and adoption of signature practices could be
clarified. Subsequently, most veterans noted that newcomers had varying levels of involvement with some who are highly involved and others less engaged. **Newcomers reported that CAHSI is a complex network and it has been challenging to understand the practices, values, and the structure of the network overall,** as seen in this comment from a newcomer, “I’m just new to the party. And it takes me a little while to get started and to know more about this, the initiatives, the visions and the goal of this organization and to know more people.” A final concern related to expansion was the possibility that a two-tiered system of institutions might be created with the integration of so many R1 institutions into CAHSI. The network has always thrived because there are many teaching comprehensive and other types of colleges with similar contexts. Interviewees worried the inclusion of multiple new R1 institutions might change that delicate balance and tip the weight toward institutions with more resources and status.

Even though CAHSI is expanding outward to incorporate new institutions, many participants still expressed challenges within their own departments or institutions at large. Several campuses, though they have noted progress in raising awareness in their departments about CAHSI, mentioned that they still have work to do to increase the profile of CAHSI. For instance, a participant commented, “Although a lot of us are implementing signature practices, but we never realize the connection between that and CAHSI. So that is something we really need to promote. So we can get more people involved in the CAHSI related network.” Other faculty members mentioned that their institution as a whole is not acting cohesively to meet the needs of Hispanic students. As an example, one veteran commented: “So I think we’ve got a lot of good things for Hispanic students going on here, including CAHSI, but I think it’s still all disjointed and we haven’t really found a way to bring everyone together to, to work collectively instead of working in silos.” This issue may be addressed with the potential Deans and Chairs engagement that CAHSI is seeking funding to provide for new and continuing CAHSI institutions.

Other challenges related to continuous communication across the network which has grown more complex in the past year. In particular, many faculty commented that they would like to see more timely and detailed communication from the backbone. Faculty reported that they would like to receive more communication about “what’s happening with the students,” such as meeting schedules, and responsibilities and expectations for Scholars, Advocates, and REU students. In this way, faculty can better support students and monitor their timely completion of requirements. Faculty acknowledged that they have received communication in these areas but, at times, there have been missing pieces. Some newer campuses would appreciate more communication about the “national direction of programs,” such as the goals of programs like the Student Advocate program as well as detailed information about how to best facilitate a beneficial experience for Advocates.
As the network has grown, members have more trouble keeping track of the expanded campuses and contacts, particularly outside their region. Several members noted that an updated contact list would be helpful. Related to this, some CAHSI participants noted that they weren’t aware of the responsibilities and division of labor within the backbone and were not sure who to contact with specific questions or concerns. These participants requested more clarity about the distribution of responsibilities and expertise within the backbone so they could appropriately target questions or requests. Several coordinators and connectors requested more time to learn from one another. A coordinator commented, “If one region is doing something then everyone can benefit, for instance with preparing students for GMiS, it would be helpful to have more time to have conversations and learn from each other.”

Other interviewees suggested more regular communication concerning logistics and details or initiatives and activities. For example, several participants suggested sending quarterly emails or newsletters with important deadlines and information and logistics and FAQs about ongoing programs, such as the local REU or Scholars or Advocates programs. For instance, some members expressed confusion about the GMiS scholarship and requirements, or confusion about the requirements to be eligible for the local REU, such as whether data structures was truly required as this could limit the participation of community colleges. Several members were not sure whether engineering departments could participate in the local REU. Other members raised questions about stipends and contracts for Advocates or research students. Some of the programmatic details have not always filtered down to the departments on the personnel on the ground running the programs. Other departments noted they have received conflicting information which has confused their faculty and made it difficult to plan. Therefore, a regular email or newsletter could clarify logistical details as well as continually reinforce CAHSI values and practices.

Interviewees also suggested that more lead time in communication is necessary for them to respond adequately and effectively participate in CAHSI. Interviewees noted that they need time to plan and respond to opportunities or requests. As an example, a participant commented, “We hear things very often at the last moment, which probably makes things a little bit harder than it should be. There is the perception that we can do things at the last moment, but we can’t because we are so short staffed that we need a little bit of lead time to get things done.” Another participant commented that they can receive big requests from the backbone with not quite enough lead time, “We need more time... in order for us to properly disseminate information or go through the proper avenues of obtaining information, it takes time.” Related to travel, other members also noted they would benefit from more details, as a participant commented, “And in order for me to generate a travel authorization, I need dates. I need a letter. I need hotels, I need an agenda. I need things.” Therefore, as the network has grown increasingly context, there is an
expanded need for frequent and consistent information about details and logistics of events and initiatives.

**HSI Contexts:**
A final set of challenges experienced by CAHSI participants related to the institutional contexts unique to Hispanic-Serving Institutions or other minority-serving institutions. Faculty mentioned limited resources and funding, understaffing, lack of discretionary funds, heavy teaching loads, over enrollment in key courses, student preparedness, and struggles in hiring faculty. All of these issues combine to create barriers to faculty involvement in CAHSI initiatives and adopting signature practices. One faculty member commented of the faculty in his department, “Our department is impacted, our faculty have very limited bandwidth to be able to do other things….Basically it’s hard to get them to agree to do anything other than their own work because of the teaching load and everything else.” Some departments have experienced extended hiring freezes and are understaffed with faculty. Corollary to hiring freezes, is lost knowledge in how to mentor to guide new faculty through the tenure and promotion process. Some campus leaders noted that CAHSI can play an even larger role in shepherding faculty through the tenure process.

CAHSI representatives from many departments talked about enrollment pressures and a lack of faculty to teach courses, such as problem solving. In a similar vein, multiple interviewees discussed a lack of time to do research and write proposals due to heavy teaching loads. Another faculty member talked about the challenges related to student preparedness, especially in an under-resourced environment, “I still struggle having students at very different levels of preparedness in the class... But once you face the reality and the resources that you have, I don’t even have a classroom that we should have... There are many things that you have to navigate. It requires different skills and understanding and mental mindset.” Outside of their departments, CAHSI participants also discussed a lack of infrastructure on their larger campuses, particularly related to grant administration and institutional data. Given these contexts, chairs and other leaders discussed the need to be very strategic about how to spend time and money given limited resources and staffing. Chairs talked about weighing the costs and benefits of initiatives to be strategic about what is most needed in the department.

**Recommendations**
The recommendations for this annual report appear below, with some specific recommendations for the move to GMiS in person, recommendations for regional and national communication practices, and recommendations from new members to support their development and integration. We also wanted to acknowledge some specific ways that CAHSI has been addressing concerns through formative feedback mechanisms:
• Informal and formal requests to provide feedback to the backbone regarding the local REU program, specifically through email to faculty who have participated in previous CAHSI ARG programs, and through discussion at the Snowbird convening in July 2022.
• Increased discussion and fact-finding regarding regional meeting styles among coordinators and connectors across regions in an effort to share promising practices.
• Continuous offers to meet with backbone staff to support coaching in the Engage Tool use by staff, faculty, and advocates.

Expanding Engagement with CAHSI- Roadmaps needed.
A) New members vary in the degree to which they have considered CAHSI implementation in their departments. Some expressed interest in coding clubs while others have incorporated problem solving into coursework already. All have basic efforts to increase graduate school participation and provide research opportunities to a select few students in their departments. New members need more concrete examples of how departments of varying sizes and levels of participation make CAHSI values and strategic plans a reality in computer science departments. Case studies of old-timer CAHSI departments could support new member adaptation of CAHSI practices and strategies. Expectations and accountability for change within new CAHSI members’ departments are needed as well.
B) New and returning faculty engaged in CAHSI expressed interest, to different degrees, in signature practices. While some seemed to want resources primarily, others wanted to learn about the practices from those implementing them. More clear dissemination and sharing of codified resources is needed across all CAHSI signature practices and partners. Clarity around the online module development plan and timelines for completion would support new member planning.

Making the Most of GMiS- planning, preparation and recruitment
The Great Minds in STEM conference is moving back to in-person in the fall of 2022, and for many new members, this is the first time they will experience the entirety of the conference and CAHSI’s influence within it. The loss of a valued staff member of CAHSI during this reporting year has complicated Backbone support of the conference, and the complexity of funding across multiple grants and subawards has made the messaging around GMiS difficult.

A) Currently, newer members report lack of understanding of whom to send to the conference and expressed lack of understanding whether faculty and staff should attend the meeting or only students. Communication regarding whom should attend the conference and how they might cover costs is needed as soon as possible so that faculty, staff and students can plan their attendance. Specific recommendations include: Who to send to the conference for professional development, How to get
funding for students to attend, The CAHSI content that will be available for faculty, staff, students, and Recruitment strategies to use when decisions are made during summer months.

B) Data from GMiS 2021 indicated great benefits that derived from explicit intentional preparation for the conference. While the preparation for an in-person meeting will differ from last year’s preparations, the following could support all students who plan to attend:

   a. **Highlight with students the benefits of engaging with professors, peers, and industry professionals.** Evidence from surveys as well as interviews suggest investing time with others at GMiS leads to strong supportive relationships, as well good job opportunities.

   b. **Students may need guidance in selecting an appropriate goal for the GmiS conference** - having a specific goal could help them make decisions about participation in differing content and focus their attention and effort. Making a goal could also include sharing participation expectations with conference attendees.

   c. **Consider sharing tips for all elements of the experience** - including what to wear during the different aspects of the conference, how to get through airline security, and the way to handle having a roommate you haven’t met.

**Addressing Communication challenges**

The COVID pandemic has shifted the ways we work, and the slow recovery has seemingly led to professional and student sense of exhaustion and apathy. The CAHSI structure exists to carry out the communication needed to support decision making, community building, and information sharing, but the collective impact approach has led to fewer “top-down” recommendations or requirements related to communication. Staff turnover has also been an issue in keeping connected within and across regions. New regions and new members could benefit from a list of “strongly recommended” practices for staff, leads, co-leads, and affiliates. Monthly or biweekly meetings among connectors and coordinators within the region and/or across regions could support CAHSI communication - the leading of these meetings could rotate through connectors and coordinators. Making an explicit expectation that co-leads and affiliates attend regional meetings and/or send a representative would support engagement, and reconsidering time conflicts to ensure all can participate would improve cohesion. Greater backbone engagement in regional meetings and/or follow-ups from backbone staff regarding the content of the regional meeting would support communication flow.
Modeling values/mindsets of CAHSI
There is concern among continuing CAHSI members that the new members, newly identified H.S.I.s, may not share the values of CAHSI and the emphasis on “servingness” that CAHSI upholds. One example of how this has been addressed by the CAHSI backbone is in the intentional use of respectful communication norms and continuous emphasis on Servingness during onboarding meetings. Another way CAHSI is addressing this concern is in the amplification of recent Hispanic graduates’ voices, such as through the reporting out of a postdoc working on the CAHSI grant at the Snowbird meeting among new member department chairs and faculty. At the same time, old timers may need support in instilling and intentionally verbalizing the values of CAHSI, and in acknowledging differing strengths among research-focused and teaching-focused colleges and universities. Creating time in national and regional meetings to learn more about one another’s contexts could support collaboration.

Making Industry partnership pathways a priority
Faculty and staff have little understanding regarding how to engage with local, regional, or national industry partners as CAHSI members. Not all industry opportunities are available to all CAHSI members, and it is unclear to smaller departments how to engage using the appropriate procedures. In some cases, industry leads go untapped, and in other cases, industry partnerships remain unaffiliated with CAHSI and remain localized with departments. Creating clear policies, procedures, timelines, and backbone liaisons to advise regarding industry partnerships would help CAHSI grow partnerships as well as local and regional investments.