CAHSI EVALUATION REPORT

2014-15

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Table of Contents

Executive Summary4
Section 1. Q4. Significant Results
Section1. Q5. Key Outcomes or Other Achievements 4
Section 1. Q7. How have the results been disseminated?
Section 4. Q2. What is the impact on other disciplines?
Section 4. Q3. What is the impact on the development of human resources?
Section 4. Q5. What is the impact on institutional resources that form infrastructure?7
Recommendations8
Enhancing technical trajectories for students8
CAHSI faculty need more networking time8
Mentoring a critical mass of students towards graduate school
Social Networking and Communication9
Introduction10
Common Core Indicator #1: Individual Participation and Outcomes10
Profile of CAHSI students 10
Profile of CAHSI students
Profile of CAHSI students
Profile of CAHSI students
Profile of CAHSI students 10
Profile of CAHSI students 10
Profile of CAHSI students 10
Profile of CAHSI students10
Profile of CAHSI students10

1

Academic Advancement21	
Growth in Students' Knowledge and Skills 21	
Identity and Belonging23	
Climate: Support, Networking, Clubs24	
Professional Activities25	
A case study of faculty development: CAHSI early-career professors	
Faculty pathways27	
Educators at Heart28	
Good mentoring28	
Benefits received from CAHSI28	
Recommendations for enhanced faculty support	
Common Core Indicator #2: CAHSI Organizational Capacity	
CAHSI Organizational Capacity rubric	
Healthy pipeline	
Faculty/staff engagement and training	
Funding Sustainability	
Common Core Indicator #3: Alliance Impact	
CAHSI Annual Meeting	
Social Science Network	
CAHSI Advocacy	
CAHSI dissemination	
Web dissemination	
Online Reach 40	
Education Funds	
Collaboration on Technical Efforts	
Leveraging CAHSI 42	
CAHSI's Within-Institution Visibility	
CAHSI in Policy	
CAHSI Growth in Adoption 44	
APPENDIX45	
Survey Data Collection Methods and Samples 45	

2

Table of Objects

Object 1. CAHSI Undergraduate CRA Survey Respondents	11
Object 2. CAHSI Graduate Student CRA Survey Respondents	11
Object 3. Course enrollment, CAHSI Initiatives, CAHSI Original Schools, 2014-15	12
Object 4. Course Enrollment, CAHSI Expanded Schools, AY 2014-15	13
Object 5. Number of CAHSI BS Graduates, 2002-2014	14
Object 6. Percent of 2002 BS Graduation Rates, CAHSI and National IPEDS data, 2002-2014	15
Object 7. Percent of Hispanic Computing BS Graduates, 2002-2014, CAHSI and National IPEDS Data	
(UPRM Excluded)	16
Object 8. Percent of Hispanic BS Graduation, CAHSI Departments and Institutions, 2004-2014 (UPRM	
Excluded)	17
Object 9. Number of CAHSI MS Graduates, 2002-2014	18
Object 10. Highest Degree Aspirations of CAHSI and CRA National Sample, Hispanic Students Only	
(n=414)	19
Object 11. Frequencies of Presentation and Conference Attendance, CAHSI ARG students and Nation	al
REU sample	20
Object 12. Research Gains, ARG Students, Modified URSSA survey (n=35)	22
Object 13. Research Gains of First-Generations College ARG Students	23
Object 14. Identity and Belonging in CS, CAHSI and CRA National Sample (n=414)	24
Object 15. Sources of Support, CAHSI and CRA National Sample, Hispanic Students Only (n=414)	25
Object 16. Professional Activities, CAHSI and CRA National Sample, Hispanic Students Only (n=414)	26
Object 17. Organizational Capacity Rubric, AY 2014-15	29
Object 18. CAHSI Alliance Impact Rubric, AY 2014-15	34
Object 19. IEEE Downloads, Papers and Presentations on CAHSI initiatives	41

Executive Summary

The executive summary is framed within the structure of the National Science Foundation RPPR document.

Section 1. Q4. Significant Results

CAHSI is increasingly serving as a unified voice for Hispanics in computing. Dissemination has shifted to focus on sharing CAHSI's perspective in new venues as CAHSI leadership promotes the initiatives and lessons learned from the CAHSI partnership. Leadership and support of CAHSI in higher education and STEM education organizations is spreading across CAHSI stakeholders. Ten faculty and staff members from 7 institutions served as CAHSI delegates to national and regional organizations interested in improving and diversifying the computing workforce, and/or in improving educational opportunities for Hispanic students. CAHSI has continuously scored 3 out of 3 on this metric, having representation changes this year with venues related to broadening participation in STEM (e.g., RESPECT 2015, SACNAS, BRAID, XCEDE), improving higher education locally or regionally (e.g., California Hispanic Serving Institution consortium, University of Puerto Rico's R2Deep school of engineering initiative), policy advocacy (e.g., Excelencia in Education), national initiatives to improve computer science education (Computer Science principles, National Endowment for the Humanities course development), and local research efforts (e.g., CREST interdisciplinary work). Faculty and staff report synergies and new ideas that stem from these collaborations, and described how serving as a delegate to support CAHSI increased awareness of CAHSI beyond the current community and influenced the work of CAHSI as well. CAHSI has been positioned as a national resource on Hispanics in computing in the recent Excelencia in Education report published in June of 2015, and from a request for information from National Public Radio to offer a position on the Capitol Forum on Hispanics in higher education. Such instances highlight how CAHSI is viewed as a national advocate for Hispanics in computing.

Section1. Q5. Key Outcomes or Other Achievements

In the 2014-15 academic year, the original seven CAHSI schools provided:1

• **15,795 hours of introductory computing content** to 351 students, nearly 2/3 were Hispanic or other underrepresented minority students.

¹Assuming a 15 week semester and a 3 hour course session per week

- 14,475 hours of undergraduate-led supplemental instruction through PLTL to 965 students, nearly 2/3 were Hispanic or other underrepresented minorities.²
- **30,825** hours of coursework using the Affinity Research Group model provided to 685 students; more than 80% were Hispanic or other underrepresented minorities.

In the past year, CAHSI has continued to produce large numbers of Hispanic baccalaureates in computing. In 2014, CAHSI increased its total number of baccalaureates by 30 students, to 288 graduates from CAHSI departments. The number of women granted BS degrees in CAHSI departments declined from 51 to 31 degree recipients. The number of CAHSI Hispanic BS graduates rose by nearly 25%, or 40 students, to 205 Hispanic degree recipients. CAHSI BS graduation rates have been on an upward trend for the past two years. Nationally, the comparison set of departments from IPEDs graduated 52% of the number of baccalaureates that they graduated in 2002, while CAHSI graduated 76% of its 2002 total. When considering only departments that have existed since 2002 (our baseline comparison year), US mainland schools graduated 643 Hispanic baccalaureates in CS/CE; 139 of those Hispanic graduates were from CAHSI mainland schools. In other words, CAHSI departments graduated 22% of all Hispanic CS/CE baccalaureates in the mainland US in 2013-14.

Section 1. Q7. How have the results been disseminated?

In 2014-15, seven accepted or presented works directly related to CAHSI initiatives were reportedly carried out by staff or faculty in CAHSI in multiple venues (Frontiers in Education, NCWIT, PLTL International Society, SACNAS). Works were found in regional, national, and international conferences. Over time, publications related to CAHSI as an organization and its related initiatives include 19 works that appear in the ACM and IEEE digital libraries with over 30 authors representing seven schools, with at least 1,954 downloads. These works represent the efforts of over 30 authors representing seven schools, with at least 1,954 downloads. This dissemination is related to CAHSI as an organization, and does not include technical research efforts that were supported through CAHSI.

Section 4. Q2. What is the impact on other disciplines?

CAHSI has successfully disseminated some of its best practices to other disciplines. For instance, Northeastern Illinois University has recently received funding to incorporate the Affinity

² Assuming a 15 week semester and a 1 hour supplemental PLTL session per week

Research Group and Peer-Led Team Learning models into basic introductory STEM courses, including Physical Geology, General Chemistry, and Physics. NEIU collected baseline course data in the academic year 2014-15 and six revised courses in the five departments will be piloted in fall, 2015. California State University- Dominguez Hills is piloting "STEM-0" courses infused with peer-led team learning with assistance from CAHSI leadership. The STEM-0 courses represent multiple STEM disciplines and have been developed with funds from a California system-wide grant. Additionally, the CREST-funded Cyber-ShARE center at the University of Texas, El Paso has adopted the ARG model in many of its research groups, spanning a range of STEM disciplines, including Computer Science, Education, Engineering, Biological Sciences, Geological Science, Information Technology, and Geophysics. The Center employed 58 student researchers in six disciplines, 14 of whom were undergraduate students.

Section 4. Q3. What is the impact on the development of human resources?

Despite the diminished CAHSI presence at the annual Society to Advance Native Americans and Chicanos in Science (SACNAS) meeting, CAHSI students involved in Affinity Research Groups (ARGs) continued to outpace their national peers in NSF research experiences for undergraduates (REUS) in rates of academic presentation and publication. Most of the ARG students (66%) reported that they attended a professional conference, while only 23% of the national sample of REU students had done so (X=86.864, p<.0001). Additionally, 66% of ARG students presented a paper or poster at a conference, while only 15% of the national sample had done so (X=49.802, p<.001).

In addition, 66% of ARG students reported that their research experience increased the likelihood that they would pursue graduate school. CAHSI students also had higher aspirations than a national sample of computing students surveyed by the Computing Research Association. For example, 15% of CAHSI students aspired to a doctoral degree, while only 13% of the national sample of students expressed that goal and 38% of CAHSI students aspired to a master's degree while only 32% of CR survey respondents did. ARG students who would be graduating within one year (14 of the 35 total respondents) reported on the steps they had taken to reach graduate school. Four out of the fourteen (29%) students reported that they had taken the GRE and all of those students reported having submitted applications for graduate school. An additional 13 students reported that they *plan* to apply to graduate school and 12 students *plan* to take the GRE in the future.

Students are gaining the skills, knowledge, and confidence from ARGs that they will need in graduate school and the computing workforce. Students' highest reported gains from participating in ARGs were in collaboration/teamwork and personal growth, such as increased confidence and interest. The collaboration scale also measures the extent to which leadership is distributed, the research group works cooperatively and other markers of a high-functioning Affinity Research Group.

CAHSI Hispanic students demonstrated a significantly greater sense of belonging and commitment to their discipline than the national sample of Hispanic CRA computing student survey respondents (t=-2.506, df=412, p=.009). Though not statistically significant, CAHSI Hispanic students perceived more support from a variety of sources, such as family, peers, and mentors, than Hispanic students at non-CAHSI institutions. CAHSI Hispanic students were statistically significantly more likely than non-CAHSI students to participate in a wide range of professional development activities, such as undergraduate research, attending conferences, belonging to computing-related professional societies, or taking a research course (p<.05).

Section 4. Q5. What is the impact on institutional resources that form infrastructure?

CAHSI is making progress in institutionalization of its initiatives; for example, CS-0 is fully institutionalized at the undergraduate level, and PLTL is increasingly funded through non-CAHSI means, often departmental or institutional funding. ARG has been sustained through the adoption of ARG strategies directly into coursework, which expands its reach. Therefore, ARG is inherently institutionalized as courses are fully funded outside of CAHSI. In considering influence on institutional resources, it is important to consider how CAHSI is viewed locally, and the extent to which colleagues value the organization and their institution's membership in CAHSI. Concrete evidence of institutional support from horizontal (peers) or vertical (administration/leadership) colleagues was attained from six institutions during the 2014-2015 school year, a substantial increase from last year's four institutions. At two of these schools, CAHSI leaders are advancing and reaching upper echelons of administration within their institutions. The increased visibility of CAHSI leaders as institutional leaders provides greater recognition of CAHSI's work. In two other instances, CAHSI initiatives have been spread to non-CAHSI departments through institutional funding. CAHSI leaders at those schools are advising and supporting and, in some cases, implementing CAHSI initiatives more widely based on these institutional directives. One school

CAHSI EVALUATION REPORT

with a recent leadership turnover has made plans to bring an administrator to the CAHSI Summit to increase knowledge of CAHSI on their local campus. Yet another institution is using CAHSI strategies as a mechanism to improve departmental climate, and faculty have explicitly written that intention into departmental accreditation planning documents. As CAHSI gains momentum outwardly, fortifying roots within the local environment is essential. Showing how CAHSI aligns with other academic and policy efforts locally can enhance support.

Recommendations

Enhancing technical trajectories for students

In an interview, a CAHSI faculty mentor described an ideal scenario for CAHSI undergraduate research students. In their first encounter with a professional conference, they could attend the CAHSI annual meeting, where they could present their technical work and receive feedback in a welcoming environment. As they continue in their research endeavors, they could apply for a technical conference in their area of expertise, in which they would present work and meet their future colleagues in their specialized publishing sphere. Past travel support provided by CAHSI for students has generally been for CAHSI or SACNAS, with limited funding for the specialized conferences needed to excel on the academic pathway. Providing limited travel opportunities for students who apply after they have been productive participants in CAHSI venues could introduce aspiring graduate students to additional academic communities they will need to be successful in graduate studies. Such travel fellowships would in turn support junior faculty who often have limited resources for conference participation. When they return from conferences, students could be expected to formally and informally share the experience with other CAHSI students across CAHSI schools, to expand the scope of knowledge across the CAHSI community.

CAHSI faculty need more networking time

As turnover and CAHSI growth brings more faculty and PIs into the fold, opportunities to spend time together as CAHSI colleagues has dwindled, in part because of the constraints of the move to SACNAS meetings rather than CAHSI meetings. Continuing to innovate in the research and education spheres necessitates time set aside for community building. The faculty interviewed in 2015 suggested more faculty collaboration time. The CAHSI Summit agenda to date notes multiple times for faculty to meet in a separate "track" from students, and this may prove a good opportunity for semi-structured networking to take place (e.g., speed dating types of activities to get to know peers), as well as more formal training of faculty. The proposed regional circuits in the CAHSI National Science Foundation proposal will also be ideal for improved local opportunities to collaborate and innovate together.

Mentoring a critical mass of students towards graduate school

CAHSI produced two computing National Science Foundation graduate fellows this year, a tremendous accomplishment. However, none of the schools met the benchmark set in the beginning of the grant cycle to support a cadre of graduating students in their efforts for graduate school (15% of upper level students). Consistently the majority of students express interest in graduate school on CAHSI student surveys, yet only a handful of students have actually applied to graduate school when probed further about their preparatory actions. Reliance on other professional conferences has assisted schools in reaching that goal. A shift towards more localized efforts in preparing students for graduate school that extends beyond research experiences may be needed if CAHSI hopes to develop a critical mass of students in this way. The Summit in September may also support greater preparation opportunities for students, as CAHSI can structure the extent to which students are guided towards successful academic pathways.

Social Networking and Communication

CAHSI has used the website and Facebook as top-down communication methods to disseminate information about CAHSI to the broader community, but these forums have limited vibrancy and engagement at present. CAHSI students in the data buddies comparison study showed less participation in social networking online than their Hispanic peers in other institutions, thus they may need support in connecting to computing colleagues in professional ways. To better engage students, particularly across CAHSI campuses, students could be supported in the design, implementation, and provision of content for an online CAHSI network of their choosing. Students reported interest in cross-campus collaborations in all qualitative studies conducted within CAHSI and its related programs (e.g., focus groups with student groups on campus, Fem Prof interviews, and the PLTLIS student participant focus group). Providing a time and place, as well as support to connect, as part of their work as CAHSI student leaders and researchers could improve student collaboration and communication, while preparing them for online networking that may be influential in their careers. At the same time, faculty expressed a need for more and varied communications about opportunities for their own professional development, as well as their students. Creating multiple communication streams and systems may enhance student and faculty participation and collaboration in the future.

Introduction

This report is divided into sections that align with the common core indicators used by the external evaluation of the NSF BPC-A program. The common core indicators measure the progress of the alliance in promoting positive individual student outcomes, building organizational capacity to advance its mission, and expanding its broader impacts by disseminating its practices and mission to a wider audience. The common core indicators measure CAHSI's development in these three critical areas: 1) *Individual Participation and Outcomes*, including student and faculty outcomes, 2) *Organizational Capacity* to maintain and sustain activities to support Hispanics in computing, and 3) *Alliance Impact* to create new partnerships and communities, and extend its reach beyond original members.

Common Core Indicator #1: Individual Participation and Outcomes

In the 2014-15 academic year, CAHSI provided intensive, deep learning experiences for students through its signature educational initiatives, including CS-0, PLTL, and ARG. The majority of students served by these initiatives were Hispanic, and, for the most part, the proportion of female participants was higher than the national representation of women in CS undergraduate programs (see NCWIT By the Numbers, 2015).

Profile of CAHSI students

In fall 2014, the Computing Research Association administered the Data Buddies survey to a national sample of computer science departments. CAHSI departments participated in this survey. All students in the department were invited to complete the survey. In all, 23 CAHSI graduate students and 151 CAHSI undergraduate students completed the survey. Collectively, these respondents provide a profile of typical students in CAHSI departments. Additionally, responses of CAHSI Hispanic students were compared to responses of Hispanic students from the larger Data Buddies sample.

The majority of CAHSI undergraduate students and a significant minority of graduate students are the first in their families to go to college. Many CAHSI students have experienced economic hardship and many of them work outside their studies, indicating the continued need to fund CAHSI students for educational activities, such as being a peer leader or student researcher. Many CAHSI undergraduate students aspire to a graduate degree and many CAHSI graduate students hope to have a career in which they can give back to their community.



OBJECT 1. CAHSI UNDERGRADUATE CRA SURVEY RESPONDENTS



OBJECT 2. CAHSI GRADUATE STUDENT CRA SURVEY RESPONDENTS

Student participation in CAHSI initiatives

CAHSI continued to provide substantial support to students throughout their degree programs. In the past academic year, more CAHSI students have been involved in ARG courses than ever before, increasing student enrollment in ARG courses by nearly 25%, although the overall enrollment in PLTL and CS-0 courses declined. In the 2014-15 academic year, the original seven CAHSI schools provided:³

- **15,795 hours of introductory computing content** to 351 students, nearly 2/3 were Hispanic or other underrepresented minority students.
- 14,475 hours of undergraduate-led supplemental instruction through PLTL to 965 students, nearly 2/3 were Hispanic or other underrepresented minorities.⁴
- **30,825** hours of coursework using the Affinity Research Group model provided to 685 students; more than 80% were Hispanic or other underrepresented minorities.

CAHSI's representation of women in the participation matrix below (Object 3) outpaces the national average of women undergraduates in computer science (14% CS BS degrees are granted to women, NCWIT By the Numbers, 2015). Nearly one quarter of the participants in CAHSI initiatives were women. Women's participation in PLTL, ARG, and CS-0 exceeded the national average.

Initiative	Total Students	Total Women	Percent Female	Total Hispanic	Percent Hispanic	Total Other Underrep. Minorities (URM)	Percent Other URM
CS-0	351	68	19%	207	59%	24	7%
PLTL	965	164	17%	509	53%	99	10%
ARG	685	120	18%	558	82%	10	1%
TOTAL	2001	352	18%	1274	64%	133	7%

OBJECT 3. COURSE ENROLLMENT, CAHSI INITIATIVES, CAHSI ORIGINAL SCHOOLS, 2014-15

12

³ Assuming a 15 week semester and a 3 hour course session per week

⁴ Assuming a 15 week semester and a 1 hour supplemental PLTL session per week

The **expanded network** of CAHSI institutions (Northeastern Illinois University) has also delivered CS education programming during the undergraduate experience. Northeastern Illinois University (NEIU) provided PLTL and ARG courses, offering:

- **5,535 hours of undergraduate-led supplemental instruction through PLTL** to 369 students, nearly 40% were Hispanic or other underrepresented minorities.
- **7,560** hours of coursework using the Affinity Research Group model provided to 168 students, nearly 30% were Hispanic or other underrepresented minorities.

OBJECT 4. COURSE ENROLLMENT, CAHSI EXPANDED SCHOOLS, AY 2014-15

Initiative	Total	Total	Proportion	Total	Proportion	Total	Total
	Students	Women	Female	Hispanic	Hispanic	Other	Other
						Underrep.	URM
						Minorities	
						(URM)	
PLTL	369	51	14%	99	27%	30	8%
ARG	168	42	25%	19	11%	2	1%
TOTAL	537	93	17%	118	22%	32	6%

CAHSI Degree Completion Rates

Bachelor's degrees

In the past year, CAHSI has continued to produce large numbers of Hispanic baccalaureates in computing. In 2014, CAHSI increased its total number of baccalaureates by 30 students, to 288 graduates from CAHSI departments. The number of women granted BS degrees in CAHSI departments declined from 51 to 31 degree recipients. **The number of CAHSI Hispanic BS** graduates rose by 25%, or 40 students, to 205 Hispanic degree recipients.



Since its inception in 2006, CAHSI's graduation rates have consistently surpassed the national decline in computing BS degree graduates. CAHSI is still outperforming the nation in BS degree production as measured against 2002 graduation rates, nearly the height of BS graduation in computing departments in the United States. Nationally, the comparison set of departments graduated 52% of the number that they graduated in 2002, while CAHSI graduated 76% of its 2002 total. Almost all CAHSI departments increased their BS graduation rates in 2013-14. In particular, University of Texas at El Paso increased their bachelor's completions by nearly 30% and California State University, Dominguez Hills has seen nearly 20% growth in Computer Technology BS degrees in recent years. When considering only departments that have existed since 2002 (our baseline comparison year), US mainland schools graduated 643 Hispanic baccalaureates in CS/CE; 139 of those Hispanic graduated 22% of all Hispanic CS/CE baccalaureates at US mainland schools in 203-14.



OBJECT 6. PERCENT OF 2002 BS GRADUATION RATES, CAHSI AND NATIONAL IPEDS DATA, 2002-2014

CAHSI graduation rates of Hispanics took a sharp fall in 2009, perhaps due to the economic recession, trended upward until 2012, and have declined in the last two years. In part, this may be due to declining Hispanic enrollment in CAHSI institutions overall (see object 8). In the most recent academic year that graduation data are available (2013-14), **61% of all BS graduates in CAHSI departments were Hispanic**. Nationally, the Hispanic graduation rate in CS/CE/CIS has remained steady at about 7%.

ded)

OBJECT 7. PERCENT OF HISPANIC COMPUTING BS GRADUATES, 2002-2014, CAHSI AND NATIONAL IPEDS DATA (UPRM EXCLUDED)



While CAHSI has consistently graduated more Hispanic baccalaureates in computing than the nation, it is possible that this could be attributed to their status as Hispanic-Serving Institutions. CAHSI has higher enrollments of Hispanics at each of its institutions than the national average, although Hispanic enrollment is declining at all institutions as they are becoming more broadly diverse. We compared CAHSI's graduation rate of Hispanics from its departments to its institutional graduation rate of Hispanics to determine whether CAHSI departments have achieved parity with institutional averages. The figure below demonstrates that before the inception of CAHSI in 2006, CAHSI departments consistently graduated fewer Hispanics than their institutions overall. However, the graduation rate of Hispanics in CAHSI departments has trended upward, and in 2012, CAHSI's Hispanic graduation rate surpassed the institutional average. This past year, **CAHSI departments continued to graduate more Hispanics than their home institutions overall.**



OBJECT 8. PERCENT OF HISPANIC BS GRADUATION, CAHSI DEPARTMENTS AND INSTITUTIONS, 2004-2014 (UPRM Excluded)

MS degrees

CAHSI has consistently graduated a high proportion of Hispanic MS degree recipients. The figure below (object 9) displays all CAHSI MS graduates. However, excluding UPRM because of its 100% Hispanic enrollment, **18% of CAHSI MS graduates in 2014 were Hispanic**. The proportion of Hispanic MS degrees granted by CAHSI schools fell from 26% last year; though the number of master's degrees awarded in CAHSI departments is smaller than the number of bachelor's degrees so small changes can make a difference in overall proportions. Likewise, **CAHSI has more than doubled its number of female Master's graduates, from 13 in 2013 to 31 in 2014**. Nationally, CAHSI mainland schools graduated 20 of the 330 Hispanic MS degree recipients in CS/CE/CIS. In other words, **CAHSI graduated 6% of all of the Hispanic MS degrees in CS/CE/CIS in the mainland US.**





PhD degrees

Hispanics remain severely underrepresented in computing doctorates. In the past, CAHSI has contributed to the number of Hispanic computing PhDs in the US. However, in 2013-14, CAHSI mainland departments did not graduate any Hispanic U.S. citizen PhDs in CS or CE. The University of Puerto Rico graduated 9 Hispanic doctorates in CE in 2013-14. The rate of Hispanic degree completion in the mainland U.S. is still stubbornly low. In 2013-14, only 11 out of 910 CS doctorates in the mainland U.S. were awarded to Hispanic students. Likewise, only 8 out of 342 CE doctorates in the mainland U.S. were awarded to Hispanic students.

CAHSI Student Outcomes Future Aspirations

This section will present findings from the annual ARG survey administered to all CAHSI student researchers and CAHSI responses from the Data Buddies survey administered by CRA.

CAHSI Hispanic students have slightly higher aspirations than the Hispanic students from the Computing Research Association's (CRA) national Data Buddies survey sample. CAHSI students have slightly stronger intentions to pursue a graduate degree, especially at the master's level. It is important to note that the totals do not equal 100% because a small proportion of students expressed interest in a professional degree (e.g., J.D., M.D., etc.) or marked that they were "uncertain" about their future plans. Though not statistically significant, **CAHSI students expressed greater interest in graduate study, especially a master's degree, than the national sample of computing students surveyed by CRA**.



OBJECT 10. HIGHEST DEGREE ASPIRATIONS OF CAHSI AND CRA NATIONAL SAMPLE, HISPANIC STUDENTS ONLY (N=414)

Professional Behaviors

Despite the diminished CAHSI presence at the annual Society to Advance Native Americans and Chicanos in Science (SACNAS) meeting, CAHSI students involved in Affinity Research Groups (ARGs) continue to outpace their national peers in NSF research experiences for undergraduates (REUS) in rates of academic presentation and publication. **Most of the ARG students (66%) reported that they attended a professional conference**—slightly less than in 2013-14—while only 23% of the national sample of REU students had done so. ARG students attended the following conferences:

- Grace Hopper (6 students)
- SACNAS (4 students)
- Tapia (2 students)
- SHPE (1 student)
- HENAC (1 student)

Additionally, ARG students published in refereed journals at rates higher than the national REU sample: 11% of ARG students and 5% of the national sample authored papers, and presented at conferences at higher rates than REU students. Using Pearson's Chi-Square Test for Goodness of Fit, differences in conference attendance and presentation are statistically significant, p=0.00001. Therefore, CAHSI students seem to have greater access to the professional practice of research than typical REU students.

OBJECT 11. FREQUENCIES OF PRESENTATION AND CONFERENCE ATTENDANCE ,	, CAHSI ARG STUDENTS AND NATIONAL REU
SAMPLE	

	Number of ARG respondents (n=35)	Percent of ARG respondents	Number of national REU sample (n=464)	Percent of national REU sample
In the past year, I	23	66%	106	23%
have <u>attended a</u>				
<u>professional</u>				
conference.**				
Effect size=.378				
(medium effect size)				
In the past year, I	4	11%	25	5%
have <u>authored or co-</u>				
<u>authored a journal</u>				
<u>paper</u> . **				
Effect size = $.242$				
(small effect size)				
In the past year, I	23	66%	70	15%
have <u>presented a</u>				
conference poster or				
paper. **				
Effect size=.316				
(medium effect size)				

**significant difference, p=0.00001

Academic Advancement

Affinity Research Groups are designed to introduce students to collaborative teamwork and other professional skills, develop their knowledge of their field and understanding of research, and to support students' preparation and pursuit of graduate school, and their advancement in the profession. ARG students who would be graduating within one year (14 of the 35 total respondents) reported on the steps they had taken to reach graduate school. Four of the fourteen (29%) ARG seniors reported that they had taken the GRE and all of those students reported having submitted applications for graduate school. An additional 13 students reported that they *plan* to apply to graduate school and 12 students *plan* to take the GRE in the future.

ARG students attribute their interest in graduate school to their experiences in their research groups. For instance, 66% of ARG students reported that they were more likely to attend graduate school because of their research experience. There were no statistically significant differences in graduate school aspirations among sub-groups in the sample, such as race, ethnicity, gender, or length of time in the research group. Thus, students seem to gain significant interest in graduate school from participating in ARGs, although some ARG students with graduate school aspirations have not yet taken action to achieve their educational goal.

Growth in Students' Knowledge and Skills

Students are gaining the skills, knowledge, and confidence from ARGs that they will need in graduate school and the computing workforce. Students reported positive outcomes on all of the modified Undergraduate Research Student Self-Assessment (URSSA) gains scales (between 3.0 and 4.0 on the 4.0 point scale, or between "good" and "great" gain).

Students' highest reported gains from ARGs were in collaboration/teamwork and personal growth, such as increased confidence and interest. The collaboration scale also measures the extent to which leadership is distributed, the research group works cooperatively and other markers of a high-functioning Affinity Research Group. Students' scores on the collaboration scale indicate that CAHSI Affinity Research Groups are operating with distributed leadership, individual accountability, positive interdependence and other hallmarks of the ARG model. Object 12 below illustrates the scale means and standard deviations for the research gains scales (4-point scale in which 1=no gain, 4=great gain).

OBJECT 12. RESEARCH GAINS, ARG STUDENTS, MODIFIED URSSA SURVEY (N=35)

Scale	Mean (4-point scale)	Standard Deviation
Collaboration:	3.45	0.645
Teamwork skills, shared leadership, mentoring		
Intellectual Gains:	3.17	1.109
Critical thinking, problem-solving, understanding of the discipline, understanding of the research process		
Personal Growth :	3.35	0.667
Self-efficacy, confidence in abilities, interest in computing, maturity, responsibility		
Skill Development:	3.24	0.667
Presentation and communication skills, technical skills		
Career Preparation:	3.22	0.674
Preparation for graduate school and career		

There were few differences among groups in students' perceptions of their gains from research, suggesting that all students benefited from their ARG experience. For the most part, women rated their gains equivalent to men, or slightly lower. Likewise, Hispanics rated their gains similarly, or slightly higher, than non-Hispanic students. However, there were so few non-Hispanic students in the sample that it is difficult to compare outcomes between groups. First-generation college students rated their gains higher than their peers with college-educated parents. For instance, first-generation college students rated their gains higher in career preparation, personal gains (confidence, interest) and collaboration/teamwork, although none of these differences were statistically significant. Thus, first-generation college students seem to benefit more from the professional skills and aptitudes that are developed through ARG experiences.



OBJECT 13. RESEARCH GAINS OF FIRST-GENERATIONS COLLEGE ARG STUDENTS

In conclusion, ARG students reported that participating in research increased their confidence as computer scientists and their interest in the subject. Student responses on the collaboration scale indicate that CAHSI ARGs are implemented in accordance with the ARG model, including distribution of expertise, positive interdependence, and individual accountability. ARG students also engage with their disciplinary research community through attending conferences at significantly higher rates than typical undergraduate research students.

Identity and Belonging

CAHSI Hispanic students demonstrated a significantly greater sense of belonging and commitment to their discipline than the national sample of Hispanic CRA computing students (t=-2.506, df=412, p=.009). CAHSI Hispanic students also reported a greater sense of self-efficacy in Computer Science (a sense of mastery and achievement in CS) than the Hispanic students in the CRA Data Buddies sample. CAHSI students also exhibited a slightly stronger sense of identity in the computer science field and were more interested in higher-level computer science careers, such as academic or industry research.



OBJECT 14. IDENTITY AND BELONGING IN CS, CAHSI AND CRA NATIONAL SAMPLE (N=414)

Climate: Support, Networking, Clubs

Since its inception, CAHSI has made an effort to foster student participation in computing clubs and professional chapters of computing groups. CAHSI has also provided mentoring experiences for students through research experiences and its annual meeting. Indeed, CAHSI students reported participating in computing-related groups at slightly higher rates than the national sample of computer science students. Though not statistically significant, CAHSI Hispanic students perceived more support from a variety of sources, such as family, peers, and mentors, than Hispanic students at non-CAHSI institutions.



OBJECT 15. SOURCES OF SUPPORT, CAHSI AND CRA NATIONAL SAMPLE, HISPANIC STUDENTS ONLY (N=414)

Professional Activities

CAHSI Hispanic students were significantly more likely than non-CAHSI students to participate in a wide range of professional development activities, such as undergraduate research, attending conferences, belonging to computing-related professional societies, or taking a research course. Therefore, CAHSI departments seem to offer Hispanic students a wider variety of professional development opportunities than other computer science departments. Most of the differences between CAHSI Hispanic students and students from other computer science departments were statistically significant.



OBJECT 16. PROFESSIONAL ACTIVITIES, CAHSI AND CRA NATIONAL SAMPLE, HISPANIC STUDENTS ONLY (N=414)

A case study of faculty development: CAHSI early-career professors

The case study for the 2014-2015 reporting year involved interviews with CAHSI faculty who received mentoring and/or professional development through CAHSI. Participants were recommended by CAHSI PIs at all institutions. Eight tenured or tenure-track faculty were interviewed, representing six CAHSI affiliated institutions. They were:

- Three female Hispanic⁵ Assistant professor
- One female associate professor
- One male Hispanic associate professor
- One male assistant professor
- One male Hispanic assistant professor
- One female assistant professor

⁵ Gender is reported for all, and Hispanic ethnicity is reported when applicable as it relates to the goals of CAHSI

Faculty pathways

The pathways described by CAHSI faculty who received mentorship and professional development were in some ways traditional and, in other ways, non-traditional. Most faculty reported both traditional and non-traditional characteristics in their pathways into academia. For instance, faculty described traditional, long-term ambitions for academia, exceling in coursework, great curiosity, and wanting to "know more about the subject," enjoying the problem solving involved in research, and learning from mentors about "academic ways of being", such as viewing research as a marathon.

At the same time, many aspects of the trajectories of tenure-track faculty were nontraditional. For example, one faculty member noted his role as a husband and father during graduate studies as setting him apart from more traditional graduate students, and this, in fact, mirrors many CAHSI graduate student realities. Multiple respondents noted that their desire to teach, rather than produce research, led to their PhD ambitions. Pathways were not always direct for CAHSI faculty they described starts and stops related to financial constraints. They described international contexts that shaped their careers—for example, Puerto Rican financial constraints have created tenure issues for assistant professors in public institutions, political unrest shifted a faculty member's initial plans to return to his home country for faculty positions, and crossing the border led to a faculty member's negotiation of differing priorities for faculty in the US (e.g., Mexican faculty have more pressure to publish, US faculty more pressure to bring in funds).

Two of the faculty interviewed were newly minted PhDs who received CAHSI mentorship to *become* faculty members. Their experiences with CAHSI were as graduate students first, now as faculty who are encouraging student participation in the CAHSI Summit this September. They valued the sense of cultural identity merged with engineering identity that has been presented at the CAHSI meetings they attended. CAHSI provided an opportunity to develop a network with students and faculty from similar backgrounds in their fields. One new faculty member recalled expanding her own perspective of what it meant to be Latina as she met Latinas in computing from South American, Caribbean, and borderlands contexts. Following their PhD experiences with CAHSI mentors, they promote scholarship, fellowship opportunities, and graduate school with the undergraduates they counsel in their roles as faculty.

Educators at Heart

Data from the faculty indicate strong intentions to educate and clear interest in supporting student development. It is probable that faculty had the predisposition to support students, and that CAHSI mentoring and professional development enhanced, recognized, and sustained that effort. They view their roles as educators seriously, and not as something they have to do as part of an academic position. Quotes from faculty highlight their intentions to develop students.

"I work with the students. I see that they grow and I play a positive role in their life. I feel like that is meaningful to me."

Good mentoring

Faculty described positive mentoring that they have given and received. They noted a need for a personal connection of some kind—whether this was related to demographic similarities or not, they found a personal, organic relationship that develops over time to be the most useful kind of mentoring relationships. The activities that strong mentors provide include:

- Close, critical review of work products
- Advocacy
- Sharing of personal experiences
- Communicating "hidden rules" of success in academia

Benefits received from CAHSI

In interviews, CAHSI faculty highlighted some of the concrete benefits they have received from CAHSI:

- Peer led team learning was described as a *faculty* benefit as well as a student benefit, as the practice provided additional mentors in the classroom and improved learning opportunities for students engaged in their courses.
- Undergraduate student research support was also listed as a benefit for faculty, as the support assists faculty in moving their research agendas forward through student efforts.
- Travel funding assists faculty in attending meetings where they network with their peers.

"(The best part of the job is) It's more like a feeling. You know when you have a feeling for this, when you have a feeling for this, when you are a part of making a change in the community, when you engage with the students and the students really grasp what computer science is. ... You make a difference in society, that is what I really like about this job." • Professional development workshops hone skills and provide opportunities to improve faculty teaching and advising.

Recommendations for enhanced faculty support

Faculty members provided ideas for improving their careers and supporting their own efforts.

- Better communication of student and faculty opportunities, through multiple channels
- More structured mentoring regarding grant writing
- More time together to develop relationships and explore ideas
- Additional support to help students develop their technical resumes (e.g. hardware, AI, etc.)

Common Core Indicator #2: CAHSI Organizational Capacity

In this section, we highlight an effort to understand collaborators' views of the CAHSI Alliance and assess how CAHSI has made progress towards creating change in computing education for Hispanics within its membership. This rubric was developed to measure organizational capacity via a healthy pipeline of interested and qualified students, resource development and training, faculty/staff engagement, and financial sustainability.

CAHSI Organizational Capacity rubric

As in each year of the current funding cycle, the evaluators measure CAHSI against the research-based rubric of organizational capacity. In the case of CAHSI, sustainability depends on departmental-level development of capacity to support CAHSI activities as well as Alliance-level abilities to continue and advance the organizations' goals. The rubric appears below with the key to interpret findings. Each row is described in detail when applicable data was collected for the year⁶.

OBJECT 17. ORGANIZATIONAL CAPACITY RUBRIC, AY 2014-15

⁶ In the 2014-15 year, the following schools participated in the evaluation of organizational capacity: NEIU, UHD, TAMUCC, UTEP, FIU, UPRM, CSUDH, & NMSU

CAHSI Organizational Capacity Rubric: Orange color	· indicates	school o	r departr	nent is ac	hieving t	he goal, <mark>yell:</mark>	<mark>ow</mark> indicates pa	artial
fulfillment; and black indicates no progress towards fulfillment; for sustainability: black indicates no additional funding, yellow								
indicates partial fulfillment via other means,	and <mark>orang</mark>	<mark>e indicat</mark>	es fully "	other" fu	nded. <mark>Pir</mark>	<mark>nk</mark> indicates t	he cell is N/A.	
Indicator v School >	S1	S2	S3	S4	S 5	S6	S7	S8
Healthy Pineline: K12 outreach using CAHSI								
initiatives (e.g. CS-0)								
initiatives (e.g., es by								
Healthy Pipeline: faculty staff or students have								
continued to innovate in course pedagogy (e.g.,								
experimenting with new initiatives, finding new								
ways to study initiatives underway)								
Healthy Pipeline: graduate school preparation (goal								
is 15% of departmental students)								
Healthy Pipeline: CAHSI graduate application (as	Available fall 2015							
defined by intent, measured across departments,								
above baseline for 2010 annual meeting rates)								
Healthy Pipeline: CAHSI graduate application (as	Availabl	e fall 201	5					
defined by application to graduate school,								
measured across departments, above baseline for								
2010 annual meeting rates)								
Resource Dev Train: host training in 1 or more								
CAHSI initiatives								
Resource Dev Train: lead training in 1 or more								
CAHSI initiatives								
Fac/staff engagement: undergraduate faculty	Funding	prohibite	ed this ev	aluation				
CAHSI awareness measured every other year								
(75%)fac survey								
Fac/staff engagement: fac CAHSI participation	Funding	prohibite	ed this ev	aluation				
(33%) fac survey								
Fac/Staff engage: undergraduate faculty								
narticinating in CAHSI during the 2014-2015 year								
(25%)								
CAHSI Alliance sustainability funda for CAUSI								
cansi Alliance sustainability: Tunus for CAHSI								
level. CS0 outreach								

CAHSI Alliance sustainability : funds for CAHSI supplemented at the department/institutional level- <u>CSO undergrad</u>				
CAHSI Alliance sustainability: funds for CAHSI supplemented at the department/institutional level- <u>PLTL</u>				
CAHSI Alliance sustainability: funds for CAHSI supplemented at the department/institutional level- <u>ARG</u>				
CAHSI Alliance sustainability: funds for CAHSI supplemented at the department/institutional level- mentorgrad/fellownet/femprof				

(31)

Healthy pipeline

Many of the schools participated in some form of outreach work that built on CAHSI initiatives, primarily CS-0 and PLTL mentoring to deliver computing content to K-12 audiences (6 of 8, 75%). These initiatives provide innovative content that would be ideal for dispersal across CAHSI (e.g., cybersecurity, unmanned aircraft, Smart grid technology, GIS programming used in industry). Three quarters of CAHSI institutions have reported education-engaged faculty who are currently exploring new ways of implementing ARG, PLTL, CS-0, and Mentorgrad strategies (6 of 8). These innovations have been co-curricular and curricular, involving contests and clubs as well as course redesign, student training and the development of supplemental materials, as well as new collaborations that bring together faculty and staff to study the effects of rich collaboration between community colleges and four-year programs. These innovations could be developed for implementation across CAHSI, once they are deemed effective in the HSI computing department settings, and the evaluators will work with interested faculty to evaluate new initiatives in the coming year. Creating a process to implement innovations more broadly within and beyond CAHSI will be important for sustained growth and innovation. Documenting what works will also support local longevity of curricular innovation and could lead to additional funding.

CAHSI success in graduate student preparation includes the preparation of two National Science Fellows in the 2015 year, from UTEP and UPRM. Even with these individual successes, ensuring that a critical mass of students have access to graduate school preparation has been declining in recent years. None of the schools have documented that they have fulfilled the 15% student preparation for graduate school goal, all have partially fulfilled this goal. Most departments prepared students through outside conference attendance, while only 3 institutions held local training within the department or institution. The increase in enrollment in CAHSI degree programs has had some influence—as the number of students grows (the denominator) it becomes harder to reach the 15% goal. Accurate graduate school interest data from students is not available until October 2015, when the CAHSI meeting survey will gauge student interest in graduate school attendance. The data buddies results gathered across all students in CAHSI departments may prove a more accurate picture of student interest in graduate school. CAHSI institutions may need to reenergize local workshops to improve student knowledge of graduate school options, and create more incentives for computer science students to attend. CAHSI's recent move towards supporting industry engagement and involvement may signal a need to expand documentation of organizational capacity in student success beyond graduate school, as the majority of computer science BS students do not pursue graduate education directly after undergraduate coursework. Expanding this measurement of student success to include entrepreneurial and/or specialized technical training from industry may better represent the realities of CAHSI student trajectories—not all are interested in post-baccalaureate education, yet CAHSI can still support student retention and advancement through successful employment outcomes.

Faculty/staff engagement and training

Half of the CAHSI institutions held a training in the past year (4 of 8) and nearly half hosted such a training (3 of 8), a slight decline from last year. Training funding (e.g., travel for training, materials, space) may need to be pursued separately, especially as CAHSI faculty experiment with new pedagogical approaches across multiple campuses and as grants that were used to fund trainings in the past have ended. The new CAHSI proposal includes plans for regional events that may provide venues for increased training opportunities and cross-institutional collaboration. Nearly all CAHSI institutions boast that at least 25% of their undergraduate faculty participate regularly in CAHSI initiatives and training, while the other 2 institutions have partially fulfilled this goal. Having a cadre of involved faculty is essential for sustainability beyond the years of the CAHSI grant. Supporting new training as turnover continues across departments is essential for strong, knowledgeable implementation of CAHSI strategies.

Funding Sustainability

Nearly all of CAHSI's outreach efforts are funded via other means such as institutional funding and grants from the National Science Foundation and other agencies, and CS-0 has again been fully institutionalized at all CAHSI schools, indicating it will live beyond the CAHSI granting cycle as long as faculty members across schools are trained in its implementation. Peer-led Team learning has been partially funded by other means at all schools involved in the initiative, with some institutionalization within departments, colleges, or schools, leading to little concern about funding in future years, except for training and course material development. ARG is funded through other, non-CAHSI means at 5 of the 6 applicable institutions. The move to ARG-inspired coursework has improved this measure as many schools now offer ARG courses to undergraduate and graduate students, reducing the need for supplemental funds. MentorGrad/FellowNet remain difficult to support through new means—only one school has managed self-sufficiency of Mentorgrad through institutionalization at the graduate school level. These may be initiatives to attempt fundi via industry, as nearly all monies go to students directly and the students could potentially complete research applicable to industry needs.

Common Core Indicator #3: Alliance Impact

In this section, the evaluators present the activities of CAHSI in 2014-2015 as they pertain to the research-based Alliance impact rubric. Results are discussed following the completed rubric.

IMPACT INDICATOR	Beginning/need s substantial improvement	Moderate/needs some improvement	Proficient
1. CAHSI Alliance impact: CAHSI	Travel scholarships for	Site collaborations lead to shared costs for	Annual meeting speakers, faculty and student travel
annual meeting resourced through	some students covered; else	annual meeting site, some travel covered by	scholarships, and site costs covered by non-profits,
other organizations/ funding sources	CAHSI funded	scholarships, funding from industry, related grants	industry support, endowments, or institutional funds
2. CAHSI Alliance	Evaluation	One to two social	Three or more social
impact: social science	focusing on	scientists well versed in higher education,	scientists well versed in higher education, Hispanics in
engagement	elements of CAHSI	and or STEM education, collaborate with CAHSI	education, and or STEIN education collaborate with CAHSI and produce 4 or more
	disseminated (baseline practice)	and produce 1-3 disseminated works	disseminated works

OBJECT 18. CAHSI ALLIANCE IMPACT RUBRIC, AY 2014-15

3. CAHSI Alliance impact: policy voice [annual activity]	1-2 national or regional venues	Less than 5 national or regional venues	Multiple CAHSI PIs served as CAHSI delegates to higher education and STEM education organizations in leadership roles in 5 or more national or regional venues across a spectrum of organization types. PIs discuss lessons learned from CAHSI rather than focusing on own institution specifically
4. CAHSI Alliance impact: faculty dissemination – education	0-4 engaged Pls/faculty publishing or presenting in 1- 2 venues	5-9 engaged PIs faculty publishing or presenting in two or fewer venues	10-15 engaged Pis/faculty publishing or presenting in more than 3 total venues
5. CAHSI Alliance impact: cyber infrastructure to support broader educational impact via web dissemination [CS0 PLTL ARG mentorgrad fellownet =5 initiatives]	0-40% of initiatives available for deployment in new settings (0- 2)	41%-99% of initiatives available for deployment in new settings (3-5)	100% of initiatives available for deployment in new settings
6. CAHSI Alliance impact: cyberinfrastructure national impact via web dissemination	0-32% of all website downloads/vie ws occur outside of original CAHSI regions	33-49% of all website downloads/views occur outside of original CAHSI regions	50% or more of all website downloads/views occur outside of original CAHSI regions (website analytic data)
7. CAHSI Alliance impact: cyberinfrastructure	Cyberinfrast collaboration, usa	ructure metric to be determ bility, and quality of commu developed	nined: focus is on research inication – survey of users to be

(35)

collaboration			
conaboration			
8. CAHSI Alliance impact: cross institutional funding- technical/scientific research	1-3 CAHSI institutions	4-6 CAHSI institutions	Each CAHSI institution is involved in a collaborative research grant/grant proposal that supports continued contact and scholarship among students and faculty
9. CAHSI Alliance impact: cross institutional funding- educational initiatives	1-3 CAHSI institutions	4-6 CAHSI institutions	Each CAHSI institution is involved in a collaborative research grant/grant proposal that supports continued contact and scholarship among students and faculty
10. CAHSI Alliance impact: leveraging CAHSI for new institutional funding	1-3 CAHSI institutions	4-6 CAHSI institutions	Each CAHSI institution is involved in a research grant/grant proposal that leverages CAHSI results, outcomes, and/or initiative strategies to develop new programs
11. CAHSI Alliance alignment of goals within institutions**: ⁷	0-40% of member institutions	41%-99% of member institutions	All CAHSI institutions have documented engagement from vertical or horizontal colleagues that indicates acknowledgement of how CAHSI aligns with institutional efforts that span departments/colleges/schools
12. CAHSI alliance impact: promoting CAHSI in policy arenas	0 meetings	1 meeting and or public activity (e.g., CAHSI collaborates with Excelencia at their conference,	CAHSI established more than 2 meetings or public activities with multiple national stakeholders and local leaders to describe and promote its

⁷ This rubric indicator has been revised to show how alignment is acted upon within institutions, rather than to show how alignment is promoted through documentation and publicity.

		publishing a white	goals and achievements; CAHSI
		paper, writing letter to	was positioned as a national
		the editor	leader in 2 or more instances
			this year
13. CAHSI Alliance	8 or fewer	9-15 departments	16 or more departments with
impact:	departments	with documented	documented implementation
collaboration	with	implementation of	of initiatives (baseline is 6 in
beyond original 7	documented	initiatives (baseline is	2010-2011)
CAHSI institutions	implementation	6 in 2010)	
	of initiatives		
	(baseline is 6 in		
	2010)		

CAHSI Annual Meeting

Just as in previous years, the CAHSI alliance scored in the "moderate/needs improvement" category (2 of possible 3) for the annual meeting shared with SACNAS. The organization is entering its fourth year of a five year agreement with SACNAS to share site space, receive administrative support in processing CAHSI student travel, and get access to content in exchange for providing computer science leadership, technical content, and faculty mentors for the SACNAS conference. To provide student travel support, CAHSI has leveraged funds from other sources, specifically the UTEP CREST grant, LS-AMP funding, institutional support, and a few SACNAS scholarships for students. However, student travel scholarships are still largely funded by CAHSI which has led to limited attendance by CAHSI students at SACNAS conference directly followed the Grace Hopper conference, which is a large draw for CAHSI women and faculty, making the CAHSI presence at SACNAS less substantial.

In the coming academic year, CAHSI leadership is bringing back the annual meeting to address shortcomings in the current arrangement with SACNAS, including a lack of computer science expertise. The SACNAS partnership has not led to increased funding opportunities for CAHSI as originally intended and the many leadership changes at SACNAS since the collaboration began have restricted communication between the organizations. In September, CAHSI will hold an annual Summit in San Juan, Puerto

Rico to revive the original annual meeting so that students can receive the community, skill development, and opportunity to meet Hispanic mentors that occurred in the past. CAHSI is working to attract industry funders to support and provide content to CAHSI students (e.g., specific industry training that occurs with limited scope in CAHSI institutions already like IBM initiatives at UTEP).

Social Science Network

A CAHSI PI who works with social scientists on a different project noted the great deal of time and effort needed to build truly collaborative, interdisciplinary work. He noted the need for time to develop "a common language" for researchers to use across disciplines. At present, the social science network has not been a high priority for CAHSI, and little time has been invested in developing relationships with social scientists (score of 2 of 3). Of the disseminated works with a social science/ educational research focus, one was developed by the evaluators and another with assistance from a social scientist outside of the current CAHSI community. A grant with a large social science research component is being pursued by the lead CAHSI institution, which could bring social science to the table in a new way for CAHSI. As was stated in previous years, it may be appropriate to focus attention on research-based educational practice and advisement from social scientists, including the evaluation team, rather than on developing new research collaborations at this stage in CAHSI's lifespan. A barrier to implementing the social science network has been a lack of funding for social scientists to explore questions of mutual interest in the CAHSI community.

CAHSI Advocacy

Leadership and support of CAHSI in higher education and STEM education organizations is spreading across CAHSI stakeholders. **Ten faculty and staff members from 7 institutions served as CAHSI delegates to national and regional organizations** interested in improving and diversifying the computing workforce, and/or in improving educational opportunities for Hispanic students. CAHSI has continuously scored 3 out of 3 on this metric, providing CAHSI representation this year in venues related to broadening participation in STEM (e.g., RESPECT 2015, SACNAS, BRAID, XCEDE), improving higher education locally or regionally (e.g., California Hispanic Serving Institution consortium, University of Puerto Rico's R2Deep school of engineering initiative), policy advocacy (e.g., Excelencia in Education), national initiatives to improve computer science education (Computer science principles, National Endowment for the Humanities course development), and local research efforts (e.g., CREST interdisciplinary work). Faculty and staff report synergies and new ideas that stem from these collaborations, and described how serving as a delegate to support CAHSI has increased awareness of CAHSI beyond the current community and influenced the work of CAHSI as well.

CAHSI dissemination

In 2015, seven accepted or presented works directly related to CAHSI initiatives (rather than technical research efforts) were reportedly disseminated by CAHSI staff or faculty in multiple venues (Frontiers in Education, NCWIT, PLTL International Society, SACNAS). Works were found in regional, national, and international conferences. CAHSI PIs are serving more often as delegates representing CAHSI as an organization, rather than disseminating specific findings in conferences. This shift is important for CAHSI's visibility as an organization that speaks with a unified voice for Hispanics in computing. In fact, students are beginning to disseminate CAHSI resources and activities in venues outside of CAHSI (e.g., **PLTLIS).** As students become increasingly involved in the curricular implementation and innovation of CAHSI (e.g., through outreach, course development, lesson creation and adaptation), providing them with the resources they need to promote CAHSI, the research background they need to study the impact of their work effectively, and the financial support to disseminate the work in appropriate venues will benefit the students and CAHSI overall. As computer science educational research becomes more prestigious and a more viable pathway for students interested in academia, CAHSI can continue to promote students' discovery of new educational best practices. The evaluation team could assist in such professional development if pursued.

Web dissemination

Creating materials on initiatives that would support the direct download and implementation of CAHSI practices has been an ongoing challenge. In part, this is due to the hands-on, collaborative nature of CAHSI's training practices within the organization-most implementation across campuses has occurred over time with faceto-face relationships built between collaborators. Another issue has been in developing a documentation format that will work across institutions so that each school could import their sample lessons and materials in a coherent way, as well as finding the time and resources to develop them for outside audiences. The local contexts of CAHSI schools have always shaped implementation of CAHSI work, particularly in curricular efforts such as CS-0 and PLTL. Because of these differences in implementation, common reporting remains difficult. With the redesigned website, fewer initiatives have downloadable materials (only 3 of 5), and staff and faculty turnover across CAHSI has led to unsupported links to some course material. CAHSI initiatives have materials available online that may support at least initial implementation of CAHSI initiatives in new locations, though the default has been to include materials primarily from the lead institution, which was the case in previous years as well. Materials include lesson plans, sample workshop resources and reference manuals; however, diversifying these materials across institutions is needed to showcase the multitude of approaches to the initiatives. CAHSI scores with 2 out of 3 on this metric. Slides developed for the newer initiatives could be shared online as in past years to improve the ways in which CAHSI disseminates to larger audiences virtually (e.g., Fellownet presentations, FemProf workshops).

Online Reach

Once a fairly robust measure of geographic dispersal of CAHSI interest, the Google analytics for the CAHSI website is showing corrupted data, and therefore the analytics analysis was not performed this year. More than 50% of page visits were recorded as "not set," providing no geographic information about the visits. In an effort to show some measure of CAHSI reach, the ACM and IEEE libraries were mined for CAHSI-related articles. The digital libraries measure "useage" as downloads of the article for ACM and for IEEE. The articles and presentations in the tables are direct from IEEE and ACM libraries, and focus on CAHSI practices rather than on research products of CAHSI students or faculty. The results indicate over thirty authors from seven institutions involved in works about CAHSI initiatives that garnered 1,954 downloads from ACM and IEEE, with the caveat that IEEE information was documented online with considerable lag time in some instances—from a few months to

eleven years post-presentation or publication. In other words, the count is most likely an underestimate of all cases for IEEE works. Information about CAHSI and its initiatives seem to have a modest following in the computing and engineering education research landscape.

Authors	Subject	Downloads	Year
Gates, Roach, Villa	ARG	19	2008*
Teller, Gates	ARG	39	2000**
Gates, Della Piana, and Bernat	ARG	32	2000***
Roach, Gates, Sullivan, Upchurch	ARG	2	2003^
Bernat, Teller, Gates, and Delgado	ARG	349	2000
Gates, Hug, Thiry, Alo, Beheshti, Fernandez, Rodriguez, Adjouadi	CAHSI	279	2011
Beheshti, Alo, Fernandez, Gates, Ranjan, Boadi, Villaverde, Hug, Thiry, Barker	CS-0 (Alice)	35	2008^^
Tedford	CS-0 (Alice)	135	2008
Tedford and King	CS-0 (Alice)	91	2008
Villaverde and Jaramillo	CS-0 (Alice)	17	2012
Freudenthal, Ogrey, Gonzalez	CS-0 (MPCT)	41	2010***
Freudenthal, Roy, Gates	CS-0 (MPCT)	31	2009**
Freudenthal, Roy, Ogrey, Terrell, Kosheleva, Gonzalez, Gates	CS-0 (MPCT)	18	2012***
Jalal-Kamali, Freudenthal	CS-0 (MPCT)	64	2012*
Freudenthal, Roy, Ogrey, Siegel	CS-0 (MPCT)	45	2010**
Freudenthal, Roy, Ogrey, Magoc, Siegel	CS-0 (MPCT)	220	2010
Gates	Hispanics in the workforce	268	2010
Sperry and Tedford	PLTL	159	2008
Hug, Thiry, Tedford	PLTL	110	2011

OBJECT 19. IEEE DOWNLOADS	PAPERS AND PRESENTATIONS	S ON CAHSI INITIATIVES
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For IEEE explore digital library, download metrics became available on the following dates: *feb 2012; **Jan 2011, ^March 2015, ***Feb 2011, ^^March 2011

Education Funds

All institutions were involved in a grant writing initiative to sustain CAHSI through National Science Foundation funds. This effort was highly collaborative, with two in-person meetings in which representatives from all CAHSI schools were involved. Beyond the CAHSI alliance funding effort, three institutions collaborated on a grant through a philanthropic organization, and 2 members of CAHSI leadership worked locally on funding for expansive efforts within their own institutions or with feeder schools. Collaborative involvement related to education includes CAHSI's continued work in the Peer Led Team Learning International Society, in which four institutions are engaged, and leadership from two CAHSI departments that serve advisory roles.

Collaboration on Technical Efforts

This year, CAHSI placed priority on seeking organizational funding, and so only two institutions were successful at collaborating on technical research grants, though multiple attempts to develop proposals were described by pairs of faculty. Interview data indicate faculty, particularly junior faculty, would like additional opportunities to pursue this type of collaboration, which is typically not part of all-hands meetings. Lack of faculty opportunity to meet, via all-hands, CAHSI, or SACNAS meeting opportunities, may be stifling these efforts. Carving out time to create research proposals that span multiple CAHSI schools may improve sustainability in ARG funding for students as well as create opportunities for faculty and student collaboration beyond the years of the CAHSI grant. Initial efforts to garner industry support, specifically for the CAHSI Summit this September shows CAHSI may be moving in this direction with industry as a supplement to federal (e.g., NSF) and philanthropic (e.g., Sloan Foundation) funding opportunities.

Leveraging CAHSI

Nearly all schools had developed a proposal that leveraged CAHSI (7 of 8 analyzed this year), developing 14 over the course of the year. As in the past, proposals extend CAHSI initiatives like PLTL to other departments within an institution, promote student researchers through ARG, or introduce proven mentoring strategies to undergraduate and graduate education environments. Many of the grants are still pending review.

CAHSI's Within-Institution Visibility

While CAHSI aspires to serve as a unified voice to serve Hispanics in computing at the national level, it is important to also consider how CAHSI is viewed locally, and the extent to which colleagues value the organization and their institution's membership in CAHSI. CAHSI seeks to improve student outcomes for Hispanics in computing, and the recognition of this goal and how it may align with larger institutional goals is valuable. As CAHSI expands and influences other educational entities, its capacity to serve as a model at home institutions for increasing equity and promoting student advancement is important to consider. This visibility may enhance the longevity and sustainability of CAHSI practices within an institution beyond the scope of the CAHSI grant. Concrete evidence of institutional support from horizontal (peers) or vertical (administration or institutional leadership) colleagues was attained from six out of eight institutions during the 2014-2015 school year, a substantial increase from last year's four institutions. At two of these schools, CAHSI leaders are advancing and reaching the upper echelons of administration within their institutions. The increased visibility of CAHSI leaders as institutional leaders provides greater recognition of CAHSI's work. In two other instances, CAHSI initiatives are spread across other departments through institutional funding. CAHSI leaders at those schools are advising, supporting, and, in some cases, implementing CAHSI initiatives more widely based on these institutional directives. One school has made plans to bring an administrator to the CAHSI Summit to increase knowledge of the alliance on the local campus. Yet another institution is using CAHSI strategies as a mechanism to improve departmental climate, and that intention was explicitly written into departmental accreditation planning documents. As CAHSI gains momentum outwardly, fortifying roots within the local environment is essential. At the same time, showing how CAHSI aligns with other academic and policy efforts locally can enhance support.

CAHSI in Policy

These public acts are valued for the ways in which they make CAHSI visible, highlight its success as an Alliance, and indicate that others view CAHSI as a united voice for Hispanics in computing. CAHSI was recently asked to provide content on a piece for National Public Radio about Hispanic Serving Institutions, specifically for the

CAHSI perspective on important outcomes for the Capitol Forum on Hispanic higher education held in Washington DC in March of 2014. This request positioned CAHSI as a national player in the work of HSIs on the national stage. Another instance of an outside organization acknowledging the importance of CAHSI's work was the publication and presentation in a webinar made by Excelencia in Education entitled "Finding Workforce: STEM" Latinos in your (http://www.edexcelencia.org/research/workforce/stem). The publication highlights CAHSI in three ways, through the promotion of some of CAHSI's key practices (peer mentoring, faculty interaction, undergraduate research), through explicit mention of CAHSI as a "What Works" award recipient and description of CAHSI's goals, and through a callout box describing the effectiveness of the computer science transfer policy between El Paso Community College and UTEP. Such instances highlight how CAHSI is viewed as a national advocate for Hispanics in computing.

CAHSI Growth in Adoption

CAHSI met this goal early in its new grant cycle. Regional events in California showed promise for developing local dissemination cohorts for CAHSI practices in similar institutions. These events have piqued interest in CAHSI and have sparked the beginning of other institutions' negotiations with CAHSI for membership. Deep collaborations at the community college level, including the development of cooperative training and a pathway for student leadership across institutions for those engaging in CAHSI's academic initiatives, are showing promise. Continuing to monitor growth and adoption will be important for making decisions about full membership in CAHSI in the future.

APPENDIX

Survey Data Collection Methods and Samples

ARG Survey

The Affinity Research Group survey was distributed in early April, 2015. CAHSI PIs provided the names of all faculty mentors advising Affinity Research Group students. The survey was sent electronically to all of these faculty mentors to distribute to their students. Three follow-up reminders were sent with updates of how many students had completed the survey from each institution.

In all, 35 CAHSI students completed the Undergraduate Research Student Self-Assessment (URSSA) survey in spring, 2015. URSSA is a statistically reliable and validated survey that was developed to measure students' cognitive, personal, and professional gains from apprentice-style research experiences.

Many students (71% or 25 students) were from University of Puerto Rico, Mayaguez. Two other schools were represented: California State University, Dominguez Hills (3 students, 9%) and University of Texas, El Paso (7 students, 20%).

The respondents were primarily juniors (40% of respondents or 14 students) and juniors (29% of respondents; 10 students), but Ph.D. students (6%), Master's students (11%), and college sophomores (14%) also completed the survey.

Women were represented in CAHSI ARG groups in higher proportions than they are nationally in undergraduate computing programs. Women represented 52% of ARG students, while women comprised only 18% of computer science bachelor's degree recipients in the nation. CAHSI faculty, therefore, seem to be recruiting higher than average rates of women into research groups.

Hispanics were also represented in ARGs at much higher rates than their national representation in computing (approximately 9%). In fact, 2/3 of ARG survey respondents were Hispanic.

A sizeable minority of ARG students were first-generation college students. Indeed, one quarter of ARG students reported that they were the first member of their family to attend college. Additionally, nearly half of students had at least one parent who had not completed a college degree.

CRA Data Buddies Survey

The Computing Research Association distributed the Data Buddies to all participating departments in fall of 2014. All BPC-Alliances were encouraged to participate in the survey. CRA shared data with CAHSI evaluators so that the findings could be used for evaluative purposes. CAHSI undergraduates and graduates participated in the survey. CRA distributes the survey through faculty liaisons in participating departments. CAHSI evaluators helped CRA to identify contact faculty members in CAHSI departments.

Overall, 2,183 students completed the Data Buddies survey; 151 of the undergraduates were CAHSI students. CRA researchers shared the data set with CAHSI evaluators. There were no other Hispanic-Serving Institutions in the Data Buddies student sample for comparison purposes, so evaluators compared CAHSI Hispanic students to non-CAHSI Hispanic students. In all, there were 306 non-CAHSI Hispanic students and 108 CAHSI Hispanic students. More detailed demographics of the entire CAHSI undergraduate and graduate student samples can be found under the heading "A Profile of CAHSI students" in the Individual Participation and Outcomes section.

