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Report on the Roundtable at the Computing Alliance for Hispanic-Serving Institutions (CAHSI) Summit, San Juan, Puerto Rico, September 12, 2015

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2015 CAHSI SUMMIT

San Juan, Puerto Rico



ROUNDTABLE REPORT

DIVERSITY & COMPUTING WORKFORCE SUCCESS: CHANGING BUSINESS AS USUAL

SEPTEMBER 12, 2015

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2015 CAHSI SUMMIT ROUNDTABLE DISCUSSION

Forward

THE URGENCY

For the United States to maintain its historic preeminence in the fields of Computing, Science, Technology, Engineering, and Mathematics (C-STEM)—it must produce, over the next decade, one million more STEM professionals (PCAST, 2012). According to the Bureau of Labor Statistics, fewer than a third of the 1.4 million computing-related job openings expected by 2022 could be filled by U.S. computing graduates (Bureau of Labor Statistics, 2013).

This shortage can be addressed by investing in the recruitment, retention, and advancement of Hispanics/Latinos¹ in C-STEM. In spite of Hispanics being the nation's largest minority group and among its fastest growing populations, Hispanic representation in higher education remains low. While the college enrollment and graduation rate for Hispanics has increased over the last ten years, the number of Hispanics in professional STEM positions is still abysmal--Hispanics comprise only 5% of the professional workforce according to the Excelencia in Education's 2015 report, *Finding Your Workforce: Latinos in STEM* (Santiago, Taylor & Galdeano, 2015). In order to thrive—and even survive—in the globalized marketplace of ideas and innovation, the U.S. must aggressively meet the challenge of increasing the number of students who complete degrees in computing areas. It is critical for our economic and social health that we maintain a globally competitive computing workforce and expand our engagement of Hispanics.

CAHSI'S CALL TO ACTION

The Computing Alliance for Hispanic-Serving Institutions (CAHSI) is a consortium of Hispanic-Serving Institutions (HSIs) committed to consolidating the strengths, resources, and efforts of organizations (public, private, federal, state, and local) that share the core value of increasing the number of Hispanics who pursue and complete baccalaureate and advanced degrees in computing areas. Currently, CAHSI draws strength from HSIs from five states (California, Florida, Illinois, New Mexico and Texas) and the Commonwealth of Puerto Rico. CAHSI's holistic approach has led to its member institutions graduating Hispanic students at 10 times the national rate of Hispanic baccalaureates in computing, thus providing a significant pipeline of new recruits into graduate studies and onto the professoriate throughout this nation. CAHSI has provided broad student support at all educational stages, and has fostered deep student engagement and development through CAHSI's proven practices.

CAHSI recognizes the importance of unifying efforts to address the complex problem of low representation of Hispanics in higher education and, in particular, the need to change business as usual. The rate of change is too slow, and the nation must accelerate the change if we are to meet the technological demands. To launch

¹ The terms "Hispanic" and "Latino" are used interchangeably in this document.

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this effort, CAHSI convened leaders in higher education, non-profit organizations, and industry to advance discussions.

UNTAPPING THE DIVERSITY SWEET SPOT

CAHSI posits that change cannot occur without the integration and coordination of deliberate efforts by industry, government, CAHSI, and other non-profits to increase Hispanics in C-STEM. In particular, it is critical that a significant effort is focused on HSIs as 59% of Hispanics in higher education attend those institutions (Santiago et al., 2015); it is doubly important that investments are made to support student success at HSIs to insure that students are prepared to enter a competitive workforce.

Fig. 1 visualizes the “sweet spot” that results from bringing together efforts across the different groups that have a vested interest in diversity and can contribute to the greater good through coordinated and integrated efforts. CAHSI contributes to the identification of evidence-based effective practices and faculty training to support the adoption and expansion of these practices. Non-profit organizations contribute longevity, infrastructure, and resources in focused areas that support Hispanic success and advancement all levels of education, including C-STEM fields. Industry is critical because of its role in motivating students regarding career paths and state-of-the-art knowledge.



Figure 1: The sweet spot that can lead to significant change through coordinated and integrated efforts.

Knowing this, what we now need is a new kind of economic development and interdisciplinary approach, as described by Bagley (2014), that melds educational institutions, human services organizations and business to provide students with internships at tech companies, to bring these companies into classrooms to share their stories with students, and to create mentoring and leadership opportunities for tech entrepreneurs.

The benefits from a student’s perspective are:

- Exposure to opportunities
- Development of skills through best practices
- Financial support to enable matriculation in a timely manner

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- Mutually beneficial workforce experiences
- Team-building experiences
- Mentoring by industry professionals, in particular by those who share similar life experiences

From a CAHSI-NPO perspective, the benefits are:

- Effective practices in student development
- Infrastructure to support collaborations
- Authentic and purposeful student engagement
- Establishment of community of scholars
- Engagement with experts
- Student support

The benefits from an industry perspective are:

- Early training that provides a return on investment
- Distributed mentorship
- Better prepared recruits
- Input into curriculum
- Articulation of workforce needs
- Diverse workforce
- Innovation and novel solutions

LOOKING AHEAD

The roundtable discussions were scheduled to encourage discussions that could result in changing the current efforts to expand participation of Hispanics in computing. We know that continuing what we now do will not make significant differences; rather, there needs to be change, and the hope is that the action items presented in the report can help define a roadmap to this change.

Executive Summary

The Computing Alliance of Hispanic Institutions (CAHSI) convened a Roundtable discussion at the 2015 CAHSI Summit in San Juan, Puerto Rico on September 12, 2015 to discuss the scope and success of current efforts targeting workforce needs and to seek novel solutions or enhancements to the challenges of underrepresentation of Hispanics in the computing workforce. It is critical for our economic and social health that the U.S. maintain a globally competitive computing workforce and expand its engagement of Hispanics, the nation's largest minority group. While the college enrollment and graduation rate for Hispanics has increased over the last ten years, Hispanic representation in higher education remains low. In order to thrive and even survive in the globalized marketplace of ideas and innovation, the U.S. must aggressively meet the challenge of increasing the number of students who complete degrees in computing areas. The Roundtable discussed new ways to challenge business as usual.

The Roundtable included deans and chairs from CAHSI institutions and institutions interested in adopting CAHSI, CAHSI faculty, CAHSI's Advisory Board, industry leaders, leaders of non-profit organizations, and CAHSI's National Science Foundation program officer. The discussion focused on the issues, strengths, and hindrances in increasing the number of prepared Hispanics, and the policies, projects, and/or structures that could be enhanced or created to increase student preparedness, hiring, and/or retention of Hispanics in the computing workforce.

The Roundtable began with a summary of the importance of CAHSI and dissemination of its practices, with particular attention to its purposeful student engagement practices that impact student success and advancement. CAHSI provides structure and accountability, and many of its practices focus on the deliberate development of students' team, professional, and technical skills. CAHSI's core purpose is to build a unified effort that consolidates the strengths, resources, and efforts of organizations that are committed to the recruitment, retention, and advancement of Hispanics in computing. CAHSI has been recognized as "What Works" by Excelencia in Education, and the White House Initiative on Educational Excellence for Hispanics announced that CAHSI is one of its "2015 Bright Spots."

Discussion ensued on the main challenges, issues, and hindrances in increasing the numbers of Hispanics in computing and from the participants' perspective center on: family obligations, lack of knowledge concerning computing professions and college success, financial needs, faculty reward systems, lack of mentors and role models, and appropriate advising. The discussion groups suggested more focus on the image of computing, involvement of faculty in first-year experiences, education on traditional and non-traditional careers in computing, advisor training (at the high school, community college, and university), development of social networks, student development and financial support through scholarships, internships, and research/project experiences, expansion of interdisciplinary courses and partnerships, and alignment of curriculum with workforce needs.

The Roundtable suggested that more publicity is needed at the national level concerning the importance of inclusion of Hispanics for the good of the nation. Addressing implicit bias in relation to the capabilities of Hispanics graduating from HSIs needs to be addressed. In addition, increased involvement of industry with

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academia through non-profit organizations, including CAHSI, can result in changing business as usual through coordinated efforts that includes accountability, metrics, and return on investment (ROI), recognizing that ROI may not be immediate.

Two “Big Hairy Audacious Goals” were proposed that could increase the number of individuals who major in computing and increase representation of Hispanics in the workforce: 1) Provide free tuition for CS majors if students have some predetermined minimum GPA or financial need; 2) Provide federal tax incentives for Fortune 100 companies who hire Hispanic students in CS internships.

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Introduction

PURPOSE OF THE ROUNDTABLE

The purpose of the Roundtable discussion was to understand the scope and success of current efforts targeting workforce needs, and to seek novel solutions or enhancements to the challenges of underrepresentation of Hispanics in the computing workforce. The Roundtable aimed to identify new ways of practices that can challenge business as usual. The desired outcome was to define a set of novel ideas and potential initiatives around student workforce preparation that can seed strategic planning with key partners.

PARTICIPANTS

The Roundtable session brought together academic deans and chairs, faculty, industry leaders, CAHSI's NSF program officer, and select nonprofit organization personnel to discuss how to make meaningful changes. The participants for the roundtable are given in Table 1.

TABLE 1: CAHSI ROUNDTABLE PARTICIPANT LIST.

Malek Adjouadi	Professor; CAHSI co-PI	Florida International University
Sandra Johnson Austin	Senior VP of Operations	National Action Council for Minorities in Engineering (NACME)
Mohsen Beheshti	Chair and Professor; CAHS co-PI	California State University Dominguez Hills
Kamau Bobb	Program Director	National Science Foundation (NSF)
Rajenda Boppana	Professor and Chair	University of Texas San Antonio
Claudia Casas	Project Manager	CAHSI
Mary Fernandez	President	MentorNet, Division of Great Minds In STEM
Bradley Jensen	Principal Partner, Business Evangelist	Microsoft
Ann Q. Gates	Chair and Professor; CAHSI PI	University of Texas at El Paso
Carlos Gonzalez	Dean	University of Puerto Rico - Rio Piedras
Sarah Hug	CAHSI Evaluator	University of Colorado, Boulder
Michele Lezama	Executive Director	GEM Consortium
Patty Lopez	Senior Platform Applications Engineer	Intel
Barbara McAllister	Deputy Director, Diversity in Technology Initiative	Intel
Ahmed Mahdy	Associate VP for Research, Commercialization and Outreach	Texas A&M University - Corpus Christi
Frank Pezold	Dean, College of Science	Texas A&M University - Corpus Christi
Enrico Pontelli	Associate Dean, College of Arts & Science; CAHSI co-PI	New Mexico State University
SK Ramesh	Dean, College of Engineering & CS	California State University, Northridge
Miguel Rios-Berrios	Manager, Data Analytics	Twitter

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Frank Rodriguez	Product Manager	Google
Hamoud Salhi	Associate Dean, College of Natural and Behavioral Sciences	California State University, Dominguez Hills
Nayda Santiago	Professor	University of Puerto Rico Mayaguez
Robert Schnabel	Dean, School of Informatics and Computer; incoming CEO of ACM	Indiana University
Richard Schoephoerster	Professor, former Dean College of Engineering	University of Texas at El Paso
Dvijesh Shastri	Assistant Professor; CAHSI co-PI	University of Houston - Downtown
Jan Swinton	Dean, Workforce Development	Glendale Community College
Marcelo Sztainberg	Interim Dean; CAHSI co-PI	Northeastern Illinois University
Heather Thiry	CAHSI Evaluator	University of Colorado, Boulder
Andrea Tirres	Interdisciplinary Research Network Manager	UTEP Office of Research and Sponsored Projects
Rullan Toro	Dean, College of Engineering	University of Puerto Rico - Mayaguez
Akif Uzman	Dean, College of Science	University of Houston - Downtown
Janice Zdankus	VP of Quality	HP Enterprise

PRE-MEETING PREPARATION

Prior to the meeting, the participants were provided with data and articles to inform the discussion. This included a flyer from the National Center for Women & Information Technology (www.ncwit.org/bythenumbers) and the Excelencia in Education's 2015 report (Santiago et al., 2015) that calls for the following actions:

- Partner with institutions to target students in K-12 and create knowledge about opportunities
- Provide internship and fellowship opportunities to Hispanic students
- Provide mentoring between employees and local Hispanic university students
- Recruit employees from institutions where Hispanics graduate

Another relevant article from *Harvard Business Review*, "Hacking Tech's Diversity Problem," attributes the lack of diversity in industry to business systems. It defines the steps to help companies identify, measure and address diversity-related bias by determining whether there is, indeed, a problem; identifying key metrics; and experimenting, measuring, and refining efforts. The *Forbes* article, "How Do We Increase Diversity in the Tech Industry?," notes the need to develop an economic base of companies that innovates continually, optimizes the use of technology, and leverages diversity of talent in order to stay globally competitive.

FORMAT OF ROUNDTABLE

The Roundtable discussions were centered on two themes: "Taking the Pulse" and "Priming the Future." Participants responded to two questions related to the first theme based on what they have read, heard, and experienced: (a) What are the most pressing issues in increasing the number of prepared Hispanics in

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entering the computing workforce? (b) What strengths and hindrances are presently evident in training and/or educating Hispanics to succeed in the computing workforce?

The single discussion question for the second theme was: What are the policies, projects, and/or structures that could be enhanced or created to increase student preparedness, hiring, and/or retention of Hispanics in the computing workforce?

The discussions for the first question were clustered by workforce affiliation groups: deans and administrators, industry leaders, non-profit organization leaders, and faculty. The discussion groups for the second question consisted of mixed workforce affiliation groups. While K-12 is critical for impacting representation of Hispanics in computing, the participants were advised to concentrate on higher education to keep the discussions more focused.

Before the discussion began, there were opening remarks from Richard Schoephoerster (former Dean of the UTEP's College of Engineering), who served as the facilitator, and a brief introduction to CAHSI by Ann Q. Gates. Next, invited speakers were asked to describe their organization's position on workforce diversity, challenges to achieving diversity, and missing links for broader and sustained outcomes to the entire group. A summary of their remarks follow.

Barbara McAlister, Deputy Director Diversity in Technology Initiative, described Intel's goal of full representation by 2020. Intel believes that the key to remaining competitive and innovative in a rapidly evolving global market is to have a workforce that is fully representative of diverse talent. McAlister noted that Intel's CEO, Brian Krzanich, is "walking the walk" and not only committed significant financial resources to address the challenge, but also has demonstrated strong leadership with clear goals, metrics and deliverables. A challenge for all stakeholders is the duplication of processes and resources, in particular, because of the difficulty in getting information about other efforts across the country. There needs to be more transparency and coordination so that we can have collective impact and move at a more accelerated pace. Aligning on vision, making sure that each partner has a clear role, and holding collaborative groups accountable through metrics are critical.

Dr. Kamau Bobb, program director at the National Science Foundation, described the importance of understanding the nature of the problem. Diversity in the technology sector will not be achieved through singular focus on elite institutions, where diversity is also a challenge. The emphasis industry places on talent identification is understandable, but may be misaligned with the problem. Is the aim to identify individuals who are already successful, or to develop individuals to become successful? Diversity can only be achieved by going after the latter. Bobb also noted that industry should utilize the alliances funded through the "Broadening Participation in Computing" program more effectively. They are national resources for effective means of student success in computing. Private-public partnerships must be focused to be effective.

Janice Zdankus, VP of Quality at HP Enterprise, described HP's partnership with the National Action Council for Minorities in Engineering (NACME) to explore what it takes to increase underrepresented minorities and women in computing. They are using a data-driven approach that is examining the life of a student from cradle to career to identify the factors that support their success in their field and the influencers. They found that

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70% of students admitted to computing programs are dropping out (a higher percentage than engineering) and that the students interested in STEM could potentially be attracted to computing fields through the use of creative strategies such as offering interdisciplinary degrees. An additional priority, although longer term in producing results, is focusing on the preparation of our youth. Math preparation and competency are the primary corollary to graduation in engineering. Zdankus also emphasized the need for a new model and the need to mobilize a city-wide partnership. Underlying the model is a commitment to metrics. HP's efforts are motivated by the fact that, despite significant dollars invested, the needle has not moved since the 1980's. Finding a way to provide longitudinal tracking across programs via technology solutions, education programs, and industry and city-wide partnerships is a requirement to demonstrate return on investment.

Saundra Johnson Austin, Senior VP of Operations at NACME, noted the 2014-2015 NACME Scholars are approximately 57% Latino, 38% African American, and 4% American Indian; males make up 67% and females 33%. Four percent (4%) of NACME Scholars are studying CS. Austin described the importance of math in engineering, and the low number of college degrees conferred to minority students. Basically, the problem is about preparation and production. Contributing to the lack of diversity in industry is the lack of diversity among high-level executives. In 2012, the NACME STEM Integration Model (NSIM) was launched in the New York and New Jersey regions and later in Texas in 2013. The organization is looking into establishing an NSIM in California. Austin noted the need to pull these ecosystems together through an MOU and emphasized the importance of accountability metrics.

Frank Rodriguez, Product Manager at Google, described CS First in which educators get students into CS as soon as possible through the inclusion of CS in the high school curriculum. In addition, he noted that a 12-week engineering practicum for freshmen and sophomores will give underclassmen the prowess that junior and senior students have. Students need to know what it means to be a computer scientist and a positive force in industry. One way to remedy workplace diversity statistics is by improving partnerships with higher education institutions. A current Google effort involves having a Googler take a hiatus and teach at an HBCU and work with the department on CS curriculum. Google is open to identifying partners.

Michele Lezama, Executive Director of GEM Consortium, noted that GEM has 107 university partners and over 30 employers that fund students to receive either a Master's or PhD degree. GEM is an effective model that encourages students to not stop at the undergraduate degree and requires students to do internships with sponsoring companies. Last year, GEM applicants were 34% Hispanic, and GEM placed 40% of the applicant pool in internship. Lezama noted that each community has very different needs. She also described a new program, Algebra by 7th Grade, which is a partnership with many other organizations.

GEM has not done well with Silicon Valley companies. GEM has data indicating students with 4.0 GPA have not secured internships because, she surmises, they are not from a top 20 institution. She asked: "How can we give students from underrepresented groups access at the internship level?" If there is a gap in students' knowledge, then the CAHSI institutions should address that. Companies need to expose what their "testing" process is so that universities can prepare students who do not perform well in particular areas; or perhaps the "testing" process (e.g., white board coding) needs to be reconsidered. If the problem is not solved, more visas will have to be sought from China and India to fill the gap. Lezama challenged CAHSI to secure

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Memoranda of Understanding (MOU) with different high tech companies that state: If a CAHSI student achieves a 3.75 cumulative GPA, an internship with the participating company is guaranteed, given pre-identified gap programming to bridge the level of rigor needed. Intel is the top funder of GEM and has been the industry leader, particular in the Silicon Valley, in supporting underrepresented computer science talent at both the internship and full-time stages.

Lezama concluded with a discussion on the internal focus of individuals, i.e., people tend to hire people who are like them. An example is hiring people who are from the same alma mater. It is important to encourage partners to think unconventionally and take “risks” in hiring. She challenged CAHSI to influence the applicant pool for the new Executive Director of GEM since she will be stepping down in August 2016.

In closing, Lezama described the need to value Master’s students as a viable pool of applicants, and a relevant pool of Master’s students who should continue on to the PhD. NPOs need to trust each other, understand what they do well, and leverage their experiences; these NPOs include MAES (Latinos in Engineering and Science), SHPE (Society of Hispanic Professional Engineers), GMiS (Great Minds in STEM), and CAHSI. We need to understand who does what best, help them do that well, and figure out what we can do as a collaboration. We need to take immediate action!

Taking the Pulse: Strengths and Challenges

This section is divided into three themes that emerged from the discussions. The first is strengths, the second is challenges, and the third centers on improvements and issues to be addressed.

STRENGTHS

Hispanics provide a large talented pool of individuals who are highly dedicated and hungry for success. Many students are eager to pursue their educational career—all the way to the doctorate level. Some motivating factors for this include a strong desire for accomplishment in the academic and professional setting and a desire or sense to contribute to their family's financial stability. However, financial challenges make it difficult for most students to pursue this goal. Fellowships, scholarships, and internships can address this lack of financial capital.

CAHSI elements that can affect sustained change with respect to diversity and workforce success are as follows:

- Authentic and purposeful student engagement through CAHSI effective practices that impact student success and advancement, e.g., Peer-Led Team Learning, MentorGrad, and workshops
- Adoption of the Affinity Research Group (ARG) model in student-industry interactions to provide structure, accountability, and deliberate development of team, professional, and technical skills
- Infrastructure to support effective practices and student development, possibly through involvement with non-profits, including student funding

CAHSI graduates bring best practices for inclusion and collaboration into the workplace to aid in retention and to mitigate unconscious bias.

CHALLENGES

Some of the challenges regarding the recruitment, retention, and advancement of Hispanics are as follows:

- Lack of training opportunities
- Math preparation and language needs (ESL, academic, and technical) of the incoming pipeline
- Inadequate integration of workforce practice with academics, including antiquated pedagogy
- Faculty lack of awareness and possible misconceptions of issues regarding low representation of Hispanics
- Recognition of the communication, technical, and management skills needed for women and underrepresented groups in the workforce
- Student pipeline
- Cultural divide between 2- and 4-year faculty advisors, including advisor bias at the high school and college level

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- Lack of student and family awareness of computer science fields especially for those who are first in family to go to college (in particular careers and academic environment)

Time management and finances are prominent and important issues in increasing Hispanic graduation rates. Related to this is a common phenomenon regarding Hispanic students' reluctance to leave home and family, which affects their access to internships and related scholarships. In addition, because many students need to work in order to finance their education, their path to a degree often takes longer than the expected four years. The literature supports the notion that financial pressures lead to low Hispanic college completion rates in spite of the high value that Hispanics place on the importance of a college education for success in life (Lopez, 2009).

IMPROVEMENTS AND ISSUES

Field-tested CAHSI practices should be institutionalized. Because one model does not fit all circumstances, it is also important to create several templates or examples of effective practices.

The types of activities that the group suggested to attract more students to computing include:

- Connect computing to real-world applications, e.g., music
- Create a sense of belonging to computing through social networks
- Involve family in first year experiences
- Educate stakeholders on academic pathways, including non-traditional pathways
- Promote champion, mentors, and role models who can provide students with support
- Work with advisors and counselors to provide awareness of the numerous possibilities in computing

The discussion concerning what needs to be done included the following points:

- Involve administrators in the discussions of the national need for computing professionals and the talent that Hispanics bring
- Provide release time to professors who are effective mentors
- Promote interdisciplinary partnerships
- Develop curriculum that aligns with workforce needs
- Promote the link between investing time and money in a CS degree and generational family security
- Involve role models, in particular those from industry who have overcome adversity, who can discuss career opportunities
- Support for finances and networking
- Establish a gap-year process so that students can compete aside from possibly being misadvised
- Change the image of computing
- Address the pedigree problem, i.e., the focus on recruitment at top universities
- Conduct exit interviews with students who leave the major to understand persistence factors and with graduating seniors to understand the success/limitation of CAHSI practices

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It was noted that the constituency missing from the discussion is HR executives. It will be important to set an agenda before them, e.g., the Society for HR Professionals, including a discussion of the metrics that define success of industry-supported initiatives. Other points related to industry include:

- Need to provide access to industry experiences for students through internships; consider internships that let students stay on campus, at least during the long semesters, and take full-time course work that will help students to stay on course and graduate faster.
- Provide access to professional role models
- Ask industry to invest early in the pipeline through small grants that could help the career development of young faculty seeking tenure
- Align student skills with industry demands

Priming the Future: Building on Successes and Accelerating Change

This session focused on policies, projects, and structures that could be enhanced or created to increase student preparedness, hiring, and/or retention of Hispanics in the computing workforce. The responses are divided into those centered on CAHSI and partnerships, academia, industry, and students.

CAHSI AND CAHSI PARTNERSHIPS

One group described the importance of challenging the current system creatively and not prescriptively. Included in this discussion was the need for CAHSI to work on a position paper on best practices and challenges. It is imperative to address CAHSI's sustainability and to continue to promote CAHSI's efforts in defining an ecosystem.

CAHSI should focus on local workforce development, which would include forging and brokering a partnership with Chambers of Commerce in local areas. It should strengthen its partnership with GEM Consortium in brokering internships. CAHSI could host a preparatory "boot camp" in the semester prior to students' participation in internships in order to better prepare them for these endeavors.

ACADEMIC STRUCTURES

As suggested in the first session, an important step in the academic environment is the need for administration to change the evaluation and promotion systems to reward efforts centered on minority student success. Release time should be granted to faculty involved in mentoring and minority programs. In addition, research-centered fellowships awarded to students under faculty guidance should be a factor in evaluating performance and granting promotion.

The alignment of student skills with industry, another suggestion, recognizes the need for technical and management skills for women and underrepresented groups in the workforce. Academia can offer certificates in areas of industry, e.g., cybersecurity, data science, and others. These could be targeted at students who seek a concentration in an area of need while another option would target professionals seeking a depth of knowledge.

Retention can be addressed through interdisciplinary approaches, such as the integration of different disciplinary topics in course projects, as well as offering courses available to students from other disciplines.

Exit interviews should be required for those leaving the field to help the institution understand why students have become dissatisfied or disaffected in that particular area. The establishment of mechanisms for students to pass on knowledge they gain from internship experiences is another priority.

The participants reiterated the need for advisor/counselor training at all levels (high school, community college, and university) so that advisors are better informed and adequately prepared to provide students

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with the appropriate direction and advice needed to succeed in computing fields. In addition, it is critical to inform and proactively engage students in co-curricular opportunities and services that can address some of the challenges described in the previous section. To do this, the group recommended advisor training.

Another suggestion, the establishment of a specific departmental roadmap for recruiting, retaining, and advancing Hispanics in computing, was also considered, especially in light of the need for an articulation agreement with the feeder community college (note—many of the CAHSI institutions have such articulation agreements/reverse-articulation agreements).

INDUSTRY

There was a suggestion for industry to invest time to work with academia on curriculum because of the importance of an agreement on the essential body of knowledge, with the possibility of providing a professional-on-loan to work with the universities. In this light, CAHSI should have MOUs with industry and non-profit organizations that focus on curriculum development, identification of gaps, and the search for volunteers to fill the gap within three years. The benefit would be to create a network and meaningful exchanges in student preparation and development.

Industry should be challenged to provide a specified number of internships with caveats that are metric based, e.g., the students pass an interview and have the appropriate GPA. This aligns with the mini-camp initiative that would prepare students for successful internships.

Industry should be encouraged to conduct their recruitment efforts broadly, rather than focusing on just the more prestigious or recognized universities, considering the wide range of CAHSI institutions developing competent and competitive graduates. If this is done, industry needs should become better aligned with curricula.

In the end, the question to ask industry is: Is your company prepared for the demographic shift and the change in diversity in the country?

POLICY

CAHSI efforts need to be connected to policy at the university and national level—this leads to systemic change. For example, university policy on tenure and promotion can explicitly acknowledge the value of mentoring students and guiding students who are awarded fellowships, which are essential for retention and advancement of Hispanic students, but require a significant time investment.

Two “Big Hairy Audacious Goals” were proposed: 1) Provide free tuition for CS majors if students have some predetermined minimum GPA or financial need; 2) Provide federal tax incentives for Fortune 100 companies who hire Hispanic students in CS internships.

Summary of Actions

The primary action is to work with a top executive from a major corporation to write a position paper that brings attention to the importance of Hispanics in meeting our nation's workforce needs in computing. The article should be submitted to a high-profile outlet, such as the *New York Times*, and argue for the need for investment and involvement from multiple sectors. The challenge is to move away from the status quo, that is, practicing "business as usual," the type of business that has not changed the numbers, and incorporating more innovative approaches to increase Hispanic representation in the workforce. One issue that has been identified is the "pedigree problem," i.e., a focus on recruitment at top universities. We know that talent has no boundaries, and top students can be found at any institution. A lesson was learned years ago when the U.S. Olympic Committee moved away from primarily funding athletes at the top Olympic training camps to recruiting talented athletes from all walks of life, supporting their training and preparing them for the Olympics. In the same light, what if industry recruitment did not solely focus on the so-called "best institutions," but adopted blind, objective policies that rewarded competence and knowledge, rather than status or heritage? Addressing such implicit bias is paramount.

Another argument calls for providing free tuition to CS majors if these students maintain a predetermined minimum GPA or demonstrate financial need. According to the Bureau of Labor Statistics, fewer than one third of the 1.4 million computing-related job openings expected by 2022 could be filled by U.S. computing graduates (Bureau of Labor Statistics, 2013). An investment must be made in building a technically savvy workforce of U.S. citizens if the country is to maintain its prominence in the field. Involvement of CAHSI, non-profit organizations, and industry partnerships can result in funding opportunities, as well as curricular and co-curricular activities, such as research and internship experiences, that prepare Hispanics who are competitive in the workforce. Providing federal tax incentives to motivate Fortune 100 companies to hire Hispanic students in CS internships can change the diversity profile of high-tech businesses and result in role models who are essential for attracting students from underrepresented groups to computing.

Student interactions with professionals, in particular those who share similar life experiences, are critical from the perspective of motivating students' persistence in the major, supporting student development, and preparing the future workforce. Industry's investments in internships are critical. More meaningful collaborations with industry are needed. Coordination of tech talks, curriculum review, engaging workshops at CAHSI events and departments, and university-industry projects are interactions that can result in change. The importance of coordinated industry, non-profit organizations, government, and CAHSI partnerships cannot be emphasized enough with accountability and return on investment considered. One group cannot achieve change by working alone. Creating a community of Hispanic scholars and partnerships committed to Hispanic parity in the computing workforce is essential to sustain efforts needed for change.

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