NSF BPC-AE
COMPUTING ALLIANCE OF
HISPANIC-SERVING
INSTITUTIONS

NSF 2009 ANNUAL REPORT
AWARD # 0837556
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Project Participants

Senior Personnel

Name: Gates, Ann
Worked for more than 160 Hours: Yes
Contribution to Project:
Ann Gates (UTEP) coordinates the collective activities and initiatives of CA-HSI, manages the general budget of the Alliance, and coordinates MentorGrad and undergraduate research intervention at UTEP. She receives support from BPC funds.

Name: Rodriguez, Nestor
Worked for more than 160 Hours: Yes
Contribution to Project:
Nestor J. Rodriguez (UPRM) oversees UPRM interventions (MentorGrad, development workshops and undergraduate research). He also coordinates the Annual Meeting Research Poster Session. He receives support from BPC funds.

Name: Beheshti, Mohsen
Worked for more than 160 Hours: Yes
Contribution to Project:
Mohsen Beheshti (CSUDH) is overseeing the student intervention activities at CSUDH pertaining to the project. These include MentorGrad, CS0, PLTL, and undergraduate research. He receives support from BPC funds.

Name: Villaverde, Karen
Worked for more than 160 Hours: Yes
Contribution to Project:
Karen Villaverde (New Mexico State University) leads the CA-HSI efforts at NMSU, including Affinity Research Groups and MentorGrad. She is supported from BPC funds.

Name: Fernandez, John
Worked for more than 160 Hours: Yes
Contribution to Project:
John Fernandez (Texas A&M Corpus Christi) serves on the CA-HSI Executive Committee. He leads the PaperNet initiative. He is participating in the following interventions: undergraduate research, CS0, and PLTL. He receives support from BPC funds.

Name: Ranjan, Desh
Worked for more than 160 Hours: No
Contribution to Project:
Desh Ranjan (NMSU) supports the student intervention activities at NMSU pertaining to the project. These include MentorGrad, CS0 and undergraduate research. He receives support from BPC funds.
Name: Rodriguez, Domingo  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Domingo Rodriguez (University Puerto Rico Mayaguez) co-leads the Development Workshops effort. He receives support from BPC funds.

Name: Gad, Sangeeta  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Sangeeta Gad assists Richard Aló at UHD with activities pertaining to the project. These include student and faculty development, ARG implementation and undergraduate research. She receives no support from BPC funds.

Name: Aló, Richard  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Richard Aló supports, supervises and oversees the development of the student and faculty intervention activities at UHD pertaining to the project. These include MentorGrad, CS0, PLTL, ARG and undergraduate research. He also is disseminating CAHSI activities at other HSI and MSI and national/international venues He receives support from BPC funds.

Name: Adjouadi, Malek  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Malek Adjouadi (FIU) oversees the CAHSI Fellow-Net initiative. FIU is participating in Mentor-Grad, CS0 and PLTL initiatives. He receives support from BPC.

Name: Santiago, Nayda  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Nayda Santiago (UPRM) co-leads the undergraduate research effort. She is also a leader on the Mentor-Grad initiative. She receives support from BPC.

**Other Participants**

Name: Sirisaengtaksin, Ongard  
**Worked for more than 160 Hours:** No  
**Contribution to Project:**  
Ongard Sirisaengtaksin is in charge of developing CS0 and PLTL materials for CS at UHD. He has received support from BPC funds.

Name: Mitsue, Nakamura  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**
Mitsue Nakamura trains and supervises PLTL peer tutors at UHD under the supervision of Richard Aló. He has received support from other CCSDS sources and some travel funds from BPC.

**Name:** Hodgess, Erin  
**Worked for more than 160 Hours:** No  
**Contribution to Project:**  
Erin at UHD is CAHSI faculty advocate, CAHSI Student Advocate Coordinator and assists with ARG development. She receives support from BPC funds.

**Name:** Han, Jianchao  
**Worked for more than 160 Hours:** No  
**Contribution to Project:**  
Han Jianchao is the PLTL and research faculty advisor at CSUDH. He receives support from BPC funds.

**Name:** Boadi, Antonia  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Antonia Boadi is the CS0 faculty facilitator at CSUDH. She receives support from BPC funds.

**Name:** Tedford, Phyllis  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Phyllis Tedford teaches CS-0 at TAMUCC. She receives support from BPC funds.

**Name:** Freudenthal, Eric  
**Worked for more than 160 Hours:** No  
**Contribution to Project:**  
Eric Freudenthal oversees the CS-0 effort at UTEP. He does not receive support from BPC funds.

**Name:** Wizner, Liza  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Liza Wisner is oversees grant activities at Texas A&M Corpus Christi. She receives support from BPC funds.

**Name:** Thiry, Heather  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Heather Thiry is one of two CA-HSI evaluators for the grant. She receives support from BPC funds.

**Name:** Hug, Sarah  
**Worked for more than 160 Hours:** Yes
**Contribution to Project:**
Sarah Hug is one of two CA-HSI evaluators for the grant. She receives support from BPC funds.

**Name:** Alonso, Miguel  
**Worked for more than 160 Hours:** No  
**Contribution to Project:**  
Miguel Alonso is leading the CA-HSI student advocates. He receives support from BPC funds.

**Name:** Roach, Steve  
**Worked for more than 160 Hours:** No  
**Contribution to Project:**  
Steve Roach is the CA-HSI faculty advocate, and PLTL faculty leader at UTEP. He does not receive support from BPC funds.

**Name:** Guillen, Rocio  
**Worked for more than 160 Hours:** No  
**Contribution to Project:**  
Rocio Guillen is leading the adopting of CA-HSI practices at California State San Marcos. She receives travel support from BPC funds.

**Name:** Edmunds, Bruce  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Bruce Edmunds is the CA-HSI Project Manager. He is supported by BPC funds.

**Name:** Herrera, Arnold  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Arnold Herrera is the CA-HSI Web Developer. He is supported by BPC funds.

**Name:** Figueroa, Andres  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Andres Figueroa (UT Pan American) represents one of the adopting CAHISI institutions. He is supported by BPC funds.

**Name:** Perera, Graciela  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Graciela Perera (Youngstown) represents a CAHISI adopting institution. Her travel has been funded by BPC funds.
Organizational Partners

The IBM Academic Initiative (AI) program
The IBM Academic Initiative (AI) program provides CAHSE institutions with access to software, hardware, workshops, training, tools, books, and discounts with the goal of improving student preparation for information technology and jobs in computing.

Hispanic Scholarship Fund Institute
Hispanic Scholarship Fund (HSF) HSF is the nation’s leading Hispanic scholarship organization, providing the Hispanic and other underserved communities more college scholarships and educational outreach support than any other organization in the country. HSF will serve as a liaison between potential industry partners and CA-HSI. HSF and CA-HSI will jointly collaborate to develop programs that explore joint solicitation of sponsorships and set up meetings with computing industry contacts to develop new scholarship programs.

Society for Professional Hispanic Engineers
Society for Professional Hispanic Engineers (SHPE) and CA-HSI are entering into an MOU to partner in student development workshops.

Team for Research in Ubiquitous Secure
Kristen Gates, Executive Director of Education (TRUST) at the University of California, Berkeley has been working with CAHSE in recruiting students to attend development workshops and participate in research experiences in the TRUST program. CAHSE is promoted on the TRUST TAO website (tao.truststc.org/members/whrobinson/CAHSE).

The GEM Consortium
GEM Consortium and CA-HSI have partnered in GEM workshops, in particular preparing a Statement of Purpose. CA-HSI is using this material for its MentorGrad effort. CAHSE member(s) serve on scholarship review panels.

EL ALLIANCE
The EL Alliance has provided scholarships to CA-HSI female students to attend the 2009 Grace Hopper conference.

Latinas in Computing (LiC)
Latinas in Computing (LiC) LiC is comprised of Latinas from the industry, government labs and the Academia. Their goal is to define key strategies to promote leadership and professional development among current and next generation of Latinas. Latinas in Computing worked with CAHSE in preparing developmental workshops and panels.

SACNAS
Society for Advancing Hispanics, Chicanos, and Native Americans in Science (SACNAS): This society is dedicated to fostering the success of Hispanic/Chicano and Native American scientists, from college students to professionals in attaining advanced degrees, careers, and positions of leadership. With a focus of expanding to include computing and
engineering, a partnership with SACNAS is critical because of its focus on preparing and advancing students in research careers. SACNAS provided CAHSI with meeting space at their 2009 conference to hold a All-Hands meeting and an ARG workshop. John Fernandez serves on the SACNAS Program Committee

**Anita Borg Institute for Women and Technology**
Anita Borg Institute (Grace Hopper Conference): Through an invitation from the Anita Borg Institute, Ann Gates participated in the How to Become a Person of Influence workshop The FemProf BPC demonstration program, under the direction of Nayda Santiago and Nestor Rodriguez, presented an overview of their program during the FemProf: Advancing Undergraduate Female Students to a Professoriate Career: A Case Study session at GHC. Nayda Santiago serves on the Grace Hopper Academic Advisory Committee. CAHSI students received financial support to attend 2009 GHC.

**CRA Coalition to Diversify Computing-CDC**
Through the EL Alliance in cooperation with CDC, CAHSI arranged to hold its All Hands meeting at the 2009 Tapia Celebration of Diversity in Computing Conference. Meeting space was provided to CAHSI.

**A4RC**
A4RC is collaborating with CAHSI to disseminate the Affinity Research Group model. A4RC promotes CAHSI (ARG) on their website (http://www.a4rc.org/). Dr. Ann Gates serves on A4RC’s Advisory Board.

**VACCINE**
VACCINE is a new Homeland Security Center of Excellence in Visual Analytics for Command, Control and Interoperability Environments. The center promotes CAHSI initiatives amongst its MSI outreach. Richard Alo is Associate Director for MSI outreach.

**NCWIT**
NCWIT: National Center for Women in Information Technology NCWIT published three Promising Practices handouts that include CAHSI initiatives. CAHSI is adopting practices to increase the number of Hispanic women in computing.

**ATLAS Assessment & Research Center**
Heather Thiry and Sara Hug from the ATLAS Assessment & Research Center, located at the University of Colorado-Boulder, work on the evaluation of the project.

**Google**
Google hosted the 3rd CAHSI Annual Meeting in January 2009. Anna Davda, University Program Specialist, is working with CAHSI to identify students and faculty to apply for Google scholarships, RISE, and BOLD. Opportunities are reserved for CAHSI students.
Other Collaborators or Contacts

Miami Children’s Hospital - Through the Brain Institute and the Joint Neuro-Engineering and Computing Program with FIU, MCH has contributed a joint faculty line in the area of optical imaging, on-site research space for neuroscience studies, and has hired one of our doctoral students, Dr. Mercedes Cabrerizo, who is now the Ware Foundation Research Fellow at the Brain Institute.

The following individuals have collaborations with CAHSI:

- Manuel Perez, Associate Professor Virginia Tech; working with CA-HSI to host the Hispanic Ph.D. mailing list; adopting the Affinity Research Group model for student development
- Jorge Diaz-Herrera, Dean of Thomas Golisano College of Computing and Information Sciences at RIT: recruitment of Hispanic faculty
- Jagdish Chandra (retired ARO/ARL Director), The George Washington University working on a proposal with CAHSI members for a DHS research initiative
- Bart Sheinberg, West Houston Science and Engineering of the Houston Community College on several proposals including a NSF funded BPC SGER, Alliance for Enhanced Computing Education Bridges with follow up proposal to NSF BPC for AECEB
- Diane Baxter, San Diego Supercomputer Center, same as above

Activities and Findings

Research and Education Activities

This section is divided as follows:

A. CAHSI Extension Efforts
B. Mentoring Initiatives
C. Resource Development and Dissemination
D. CAHSI Interventions
E. Collaboration and Dissemination Efforts
F. Annual Meeting
G. CAHSI Lecture Series

A. CAHSI Extension Efforts

Institutions that have become members of CAHSI include:

- Dade College: Contact: Miguel Alonso
- California State University-San Marcos: Contact: Rocio Guillen
- University of Texas Pan American: Contact: Miguel Figueroa
- Youngstown University: Contact: Graciela Perez
These institutions are attending workshops and adopting CAHSI initiatives, e.g., CS0, PLTL, Affinity Research Groups, and mentoring. Other institutions that are interested in becoming part of CAHSI will be supported with limited funding through the original BPC funds. This includes Northeastern Illinois University (contact: Marcelo Sztainberg).

**B. Mentoring Initiatives**

The 'Mentor-Prof' initiative began in Spring 2009. Each of the institutions has identified 4-5 students who have been recruited to be part of Mentor-Prof. The initiative aims to provide the intellectual nurturing of Hispanics majoring in the computing sciences and pursuing careers as professors and researchers.

Total students participating in MentorGrad (55), CSU-DH (6), FIU (9), NMSU (7), TAMU-CC (9), UTEP (7), UH-D (6), UPR-M (11). The results are presented in Appendix A, Table 1.

**Student and Faculty Advocates**

This year, each CAHSI institution named a student advocate to improve student awareness about the mission of CAHSI and to increase student participation in Internships, workshops, seminars, research experiences (internal and external), scholarship or fellowship competitions, and Fellow-Net. The student advocate disseminated relevant information, motivated students to submit applications to appropriate opportunities, and facilitated the application process by arranging assistance. In July of 2009, all advocates participated in an initial conference call/webinar where Miguel Alonso, the CAHSI student advocate lead disseminated all the information and required documentation regarding the initiative to the advocates. Since then, the student advocate from each institution have documented their work, and we are in the process of collecting data regarding the number of students they have helped and who have applied for fellowship and scholarship opportunities; they will continue to monitor applications and provide CAHSI with the results of the student’s applications. In addition, the student advocate for UTEP helped organize two separate student focus groups pertaining to computer science retention issues, fears related to fellowship and scholarship applications, issues related to getting involved in research, and also provided valuable feedback on the recently launched CAHSI student portal. The role of the faculty advocate is to nominate qualified faculty for awards; actively recruit and encourage the nomination or recommendation of Hispanic faculty and young professionals for positions in key committees, panels, or other key positions that build leadership; and assist student advocates to ensure they achieve their goals. Working with faculty, they involve students in activities that assist them in preparing competitive applications to local and external programs and scholarships. The results are presented in Appendix A, Table 3.

**C. On-Line Resource Development**

CAHSI has established on-line resources through its website (www.cahsi.org). The changes that were made include the following:
- A new 'Opportunities' module has been added on the homepage to give increased visibility to upcoming scholarships, fellowships, and events.
- A 'Promo' tile/module has also been added to the homepage to help promote upcoming conferences/workshops for students and faculty. This tile will also be used to highlight CAHSI-related events, such as annual meetings and ARG workshops.
- CAHSI is hosting profiles and brief bios for members of the 'Hispanic PhD Mailing List’. Members of the mailing list have already begun to utilize the website.
- The Resources page now includes reports on national statistics and literature on Hispanics.
- In September 2009, Google Analytics tracking code was incorporated on the website to gather data related to CAHSI's website traffic. This will provide CAHSI with the ability to gather the metrics and use it to conduct an on-going analysis of the website.
- Direct links have been provided to BPC Portal, and the CAHSI collaborators.
- Creation of a CAHSI Student Portal that will allow students to see content specific to their interests such as student opportunities(scholarships, fellowships), student testimonials, recent highlights/accomplishments, events, and resources (resume tips, scholarship application advise, etc)

**D. CAHSI Interventions**

CAHSI is implementing a variety of interventions that support students at critical stages in the academic pipeline: the transition from high school to college, from college to graduate school, and from graduate school to the professoriate. These interventions have been chosen to address key causes of under-representation of Hispanics in computing. The interventions are: CS0, Peer-Led Team Learning (PLTL), Undergraduate Research, Mentoring, and Workshops. The CS0 effort focuses on adoption of pre-CS, a three-unit course that uses graphics and animation to engage and prepare students who have no prior experience in computing. Students are provided with an opportunity to learn the basics of programming concepts and to develop problem solving and systemic reasoning skills, while becoming familiar with a programming environment. PLTL is a proven strategy for retention, providing an active learning experience for students and creating leadership roles for undergraduates. The PLTL effort supports academic performance and retention in the gatekeeper courses.

**CS0**

Under the leadership of Mohsen Beheshti and Richard Alo, CS0 and PLTL was disseminated at FIU in spring 2009. In summer 2009, FIU’s Computer Science Summer Academy (CSSA) began implementation of CS0. Twenty two high school students from Miami-Dade County Public Schools and private schools attended class at Florida International University. The summer program provided students with accelerated classroom instruction in computer science. With classes being held at the University Park Campuses, students had the opportunity to experience college life during their summer academy. The student's course was given in a computer lab at the university and the students had lunch in the cafeteria as if they were part of the university community.
TAMU-CC offered an Alice workshop for educators during June 2009 in conjunction with Carnegie Mellon University and funded by an NSF CCLI grant. The workshop targeted community college and high school teachers. The goal was to train one or two more faculty members at TAMUCC at this workshop to expand the available pool of people trained in the CMU approach to using the Alice programming environment.

At NMSU, Dr. Karen Villaverde taught a version of the 'Computer Animation' 5-week course to a group of 15 high school women for the 'Young Women in Computing' program that is supported at NMSU through a BPC demonstration project grant. At the end of the course, the students completed a project where they created a game using Alice.

After a CAHSI workshop on CS0 given by Mohsen Beheshti (CSU-DH) and Eric Freudenthal (UTEP), FIU Computer Science faculty members adapted the model to teach a Computer Science Summer Academy (CSSA) students in June 2009. The primary goal of our teachers and staff is to provide a top quality education with an emphasis on Computer Science preparation as well as development of more traditional academic skills. Additionally, the staff included of university support staff and students. The CSSA program will allow the student’s to receive college course credits for Computer Science and the course was taught with the ALICE software.

UTEP has developed a new family of courses titled A Computational Introduction to Programming, Mathematical Modeling, and Dynamic Phenomena, also known as Media Propelled Computational Thinking (MPCT) and Computational CS-Zero (CCS0). CCS0 introduces students with weak mathematical maturity to the basics of programming through multimedia, and then uses these programming techniques to examine basic functions that generate graphics through the creation of algorithms that draw lines and curves. At the end of the course students use these same techniques to explore the principles underlying familiar dynamic processes such as ballistics and resonance.

Through the initial investigation and implementation of disarming simple graphics algorithms that students do not initially recognize as math, CCS0 uses easily taught and adaptable programming concepts as a framework for modeling the behavior of physical objects. The course reinforces the concepts and intuitions of pre-calculus and mathematical modeling by engaging students in hands-on simulations of physical systems. An Introduction to Computational Systems teaches the foundations of programming while promoting mathematical competence necessary for academic success.

Total enrollment for all CAHSI institutions in CS-0 (233) for Fall 08 (88) and Spring 2009 (125) Summer 2009 (20). Total percent women (38%) Total percent Hispanic (43%). The results are presented in Appendix A, Table 4.

PLTL

Total enrollment for all CAHSI institutions in PLTL (711) for Fall 08 (299) and Spring 2009 (412). Total percent women (22%) Total percent Hispanic (54%).
Note: Evaluators do not keep track of UHD PLTL because it occurs outside of computing, and FIU has not adopted PLTL at their institution. Table 5 in Appendix A shows PLTL undergraduate student enrollment. The results are presented in Appendix A, Table 5.

UPRM professor Dr. Pedro Rivera is integrating PLTL in a programming languages course next semester. He is in the process of training three PLTL leaders for this course. Additional funding will be provided to UPR-M to participate in this intervention. UPRM generated at least 10 different activities for the CS1 course at UPR-Mayaguez during the fall semester of 2008. Also, during that semester, five undergraduate students were selected to serve as PLTL leaders on the activities that were coordinated for the spring semester of 2009. The activities were conducted on a weekly basis (two hours period per week) during 12 weeks.

Undergraduate Research - Affinity Research Groups
The Affinity Research Group (ARG) model and an undergraduate research course are two efforts that emphasize the development of student research and professional skills. The ARG model provides both undergraduate and graduate students with opportunities to learn, use, and integrate the knowledge and skills that are required for research with those required for cooperative work. The research course incorporates ARG components and focuses on three fundamental aspects that have been identified to contribute to success of undergraduate research: research methods, experimentation and validation, and technical writing and presentations. The undergraduate research intervention targets the retention and advancement of students into graduate school. All the CAHSI members have adopted the Affinity Research Group model.

E. Collaboration and Dissemination Efforts
CAHSI is developing relationships (many via Memoranda of Understanding) throughout the Hispanic STEM community; the academic Hispanic community, and within BPC. At this writing, CAHSI has been developing informal and formal relationships with ten organizations, sharing the initiatives widely through these multiple networks. Memberships to CAHSI have been tightly controlled as membership often relates to funding for initiative implementation and travel. However, CAHSI and their collaborators are creating tangible benefits for all parties, e.g., GEM is allocating a set of scholarships for CAHSI participants. This practice ensures a wider recruitment base for GEM and additional, outside funded academic opportunities for CAHSI students. These substantive collaborations are a promising first step towards sustaining CAHSI financially.

Collaborative Proposals

The following collaborative proposals were submitted by members of CAHSI in 2009:

Title: NSF-BPC Demo project-Scaling and Adapting CASHI Initiatives (SACI)
Investigators: Miguel Alonso Jr., Andres Figueroa, Danmary Albertini, Rocio Guillen Castrillo
Relationship to CAHSI: Miami Dade College, California State University - San Marcos, and University of Texas-Pan American are joining CAHSI to implement CAHSI best practices and
join in the vision of recruiting, retaining, and advancing Hispanics in computing. In particular, the goals are to increase the number of Hispanic, female, and other underrepresented students who enter and complete degrees in computing areas and to develop and sustain competitive academic and research programs at the partnering institutions. The program will achieve these goals is through implementing CAHSI best practices across the partnering institutions on this project.

Status: Recommended

**Title:** BPC Demo project- Young Women in Computing  
**Investigators:** Enrico Pontelli (NMSU), Inna Pivkina (NMSU), Karen Villaverde (NMSU),  
**Description:** The objective of the project is to research, test and deploy intervention strategies aimed at enhancing the educational pipeline towards for a 4-year degree in Computer Science for female students.  
Status: Funded

**Title:** Lumina Foundation  
**Investigators:** Ann Gates (PI), Roy Mathew, Donna Ekal  
**Description:** The goal of the project is to develop an in-depth understanding of the factors that contribute to the success of students at UTEP and across the state of Texas. The project is collaborating with the El Paso Community College, Texas A&M International, and Prairie View A&M University to identify institutional structures that foster student success.  
Status: Funded

**Title:** NSF-REESE-Contextual Research-Empirical: Coordination of Peer Leading in Introductory Computer Science between Community College and University: A Model for Facilitating Community College Transfers  
**Investigators:** Steve Roach (UTEP), John Fernandez (TAMU-CC), and representatives from El Paso Community College and Del Mar Community College:  
**Description:** This project will identify specific factors related to PLTL that impact student success in computer science at two critical transitions: when they first enter the CS program, and when they move from the introductory courses into the upper division. The project will also identify specific factors that lead to the success of students transferring from introductory courses at a community college into the upper division at a 4-year institution. Understanding these factors will facilitate program modifications that improve retention and progress of students in CS.  
Status: Pending

**Title:** NSF-CPATH- Revitalizing Engagement through Access to Computational Thinking (REACT)  
**Investigators:** Mohsen Beheshti (CSU-DH), Richard Alo (UH-D), Eric Freudenthal (UTEP)  
**Description:** This project was designed to enhance and revitalize undergraduate curricula through computational thinking (CT) modules of tools and techniques integrated into existing gatekeeper core courses to attract and retain greater undergraduate numbers in computer science (CS) and related fields- especially a more diverse student population.  
Status: Not funded
Title: BPC-A - Alliance for Enhanced Computing Education Bridges (AECEB)

Investigators: Richard Alo (UH-D), Ali Berrached (UH-D), Ping Chen (UH-D), Ongard Sirisaengtaksin(UH-D)

Description: This project focuses on creating a vertically integrated computing-focused educational infrastructure (transitioning bridges), starting in middle/secondary school and continuing through community college, four year institutions and graduate school. It provides Minority Serving Institutions’ students with a highly structured transitional process to their academic experiences at the community college, undergraduate degree and into graduate school utilizing joint mentoring, GRE preparation and other confidence building, supportive activities.

Status: Not funded

Other Dissemination Efforts

Materials concerning CAHSI have been disseminated through the following venues:

- SACNAS 2009
- Grace Hopper 2009 (through Latinas in Computing session)
- NCWIT Promising Practices Workshop
- A4RC website
- Center for Career and Technology Education group visit to Utep September 14-17, 2009 - 240 students for Computer Science (Steve Roach)

TAMUCC personnel made a presentation to counselors in the region detailing the needs in computer science for more students, especially underrepresented students.

Dr. Eric Freudenthal, an Assistant Professor of Computer Science at The UTEP, was invited to participate in the National Academy of Engineering’s (NAE) first Frontiers of Engineering Education (FOEE) symposium held November 15-18 2009 in Herndon, Virginia. The symposium examined innovative approaches to teaching engineering fundamentals. Dr. Freudenthal's invitation was based on the innovative teaching methodologies he developed for a course for entering college students interested in studying STEM (science, technology, engineering, and math) disciplines entitled Computational Computer-Science Zero (CCS0), which stems from the CS0 effort. Like language immersion techniques, students in CCS0 begin to converse with the programming language to achieve engaging results from the first day of class.

F. CAHSI Annual Meeting

The Alliance hosts an annual meeting with the goal of engaging the broader community in Alliance efforts. The theme of the CAHSI 2009 Annual Meeting held on January 15-18, 2009 at the Google Headquarters in Mountain View, California was “Developing the Next Generation of Leaders through Mentoring”. CAHSI views mentoring as a crucial component in fulfilling our mission to recruit, retain, and advance Hispanics in computing. The three
day event catered to over 148 attendees, 84 of them students who were also presenting posters or student panels. A summary of the meeting follows:

- Poster Student presentation with a welcome address by Alan Eustace, Google Senior Vice President, Engineering and Research.
- Keynote speaker: Daniel Atkins, past director of the NSF Office of Cyberinfrastructure and Professor in the School of Information and in the Department of Electrical and Computer Engineering at the University of Michigan
- Keynote speaker: Dr. Juan Vargas, University Relations Manager at Google; Professor, Computer Science and Engineering, University of South Carolina.
- Panel on 'Mentoring Lessons shared' featured the following speakers: Katy Dickinson, Director and CTO, Sun Microsystems; Dilma da Silva, Researcher, IBM; T.J. Watson Research Center Gaby Aguilera, Software Engineer, Google; Amie Aldana, Director of Programs and Partnerships, MentorNet.
- Student panel on 'The Challenges that Female Students Face in the Computing Undergraduate Studies'. Here the panelists presented solutions and ways to cope with these challenges based on our own experiences as students.
- Student panel on 'Reshaping the Image of Computing'. The New Image of Computing project is an NSF-funded project that is focused on innovating the image of computing to attract middle to high school Hispanic girls to computing. CAHSI commented and critiqued the preliminary documentation that has been created for the Image of Computing project.
- Cecilia Aragon, Lawrence Berkeley Nat’l Lab, Dilma da Silva, IBM, T.J. Watson Research Gilda Garreton, Sun Microsystems, Nayda Santiago, UPR Mayaguez (CAHSI). Presented a panel on 'Selling Yourself and Your Ideas', where a panel of researchers and program managers from academia, government, and industry discussed what works and what does not work in obtaining funding for research.

The students who attended the annual meeting are listed in Table 6 of Appendix A. Total attendance for the 3rd Annual Meeting (n=149): Students (85) Faculty (26) Others (38).

The following two subsections describe the poster sessions and student panel session. The proceedings as well as the posters are available at: http://cahsi.cs.utep.edu/Portals/0/Proceedings3rdAnnualv5sm.pdf. Appendix B provides a listing of the extended abstracts submitted by CAHSI students.

**Poster Sessions**

The poster session for the Third CAHSI Annual Meeting highlighted the quality of research being conducted at HSIs. Graduate and undergraduate students from the seven CAHSI institutions and three non CAHSI institutions submitted poster proposals. The selection of the winning proposals took place at the end of November 2008, and all winners were invited to present their research at the Third CAHSI Annual Meeting Poster Session. Proceedings with short papers of the posters were produced as a means of dissemination of ongoing research conducted by CAHSI students. These appear in the proceedings referenced above.
**Student Panel Sessions**

Student panel sessions were organized during the Third CAHSI Annual Meeting. The objective of these sessions was to foster dialogue among students that could help the advancement of their careers in computing. A call for proposals was disseminated. Panel sessions consisted of 3-4 students, not necessarily from the same institution, sharing valuable experiences on a particular topic followed by a dialogue with the audience.

**G. CAHSI Lecture Series**

The goal of the lecture series is to disseminate new developments and research in computing among CAHSI institutions and the computing research community at large. The lectures are broadcasted through video streaming, recorded and made available to the scientific community through the CAHSI website.

The lectures in 2009 are:

**Title:** Service-Oriented Wireless Network  
**Lecturer:** Kejie Lu, University of Puerto Rico at Mayaguez  
**Description:** Over the past decade, wireless networks have significantly changed the life of everybody. In this presentation, we will first briefly review existing wireless networking technologies, such as different generations of cellular networks, wireless local area networks (WLANs), and wireless sensor network (WSN). We will then focus on the design of future wireless network, in particular the design based on the service-oriented principle. A general framework for the service-oriented design will be presented. Within this framework, a number of research topics will also be discussed.

**Title:** A Direct Constrained Optimization Method for Solving the KOHN-SHAM Equations  
**Lecturer:** Dr. Juan Meza, Lawrence Berkeley National Laboratory  
**Description:** Research of nanostructures requires Ab Initio materials simulations to compute ground state energy and single-particle many-electron atomistic system wave functions. Simulation cores, which are typically based on Self-Consistent Field iteration may fail if a particular surrogate minimize increases total energy. We propose an optimization that minimizes the Kohn-Sham total energy directly. A trust region technique is introduced to restrict wave function updates within a small neighborhood of an approximate solution.

**Findings**

**BPC Goal 1: Increasing/contributing to the increase of post-secondary degrees**

In recent years, computer science and engineering baccalaureate degrees have declined nationally. Evaluators compared CAHSI rates of undergraduate degree attainment with national and regional rates of computer science baccalaureate degree attainment.

The 2001-2002 academic year marked the peak of Bachelor degree production in North America. Between academic years 2001-2002 and 2006-2007, the number of degrees
earned annually dropped from 16,907 to 10,284. During those years, CAHSI schools saw an increase in the number of bachelor's degrees earned in computer science, from a total of 258 to 322. Therefore, while the US and Canada are producing fewer and fewer computer science graduates at the Bachelor's degree level each year, CAHSI schools are experiencing steady growth. CAHSI's success is not attributable to regional anomalies either, as regional schools show an even steeper decline than the national trend.

CAHSI institutions have also increased the number of Hispanic students receiving post secondary degrees in computing fields. We compared CAHSI to regional schools for baccalaureate graduation rates in CS departments during the target years, 2002-2007. CAHSI graduated are over one third Hispanic (ranging between 31% and 41%), while regional rates were only 9-15% Hispanic. As computer science degree attainment among Hispanics is declining regionally, CAHSI schools are in fact showing growth in the total number of Hispanic students receiving computer science degrees.

Evaluators also compared CAHSI graduation rates of master's degrees in computing fields to regional and national trends. Masters' degree production has been more variable in CAHSI schools than in CAHSI comparison schools, where data show a slightly declining trend in recent years. However, CAHSI's current master's degree production is still over one and one half times higher (150%) than in 2002?a rate higher than other institutions in the region. The proportion of Master's degree recipients identifying as Hispanic at the CAHSI schools also far exceeds the national and state level averages.

**BPC Goal 2: Create sustainable changes in culture or practices at the institutional, departmental, or organizational levels that contribute to broadening participation in computing.**

Researchers have studied higher education 'best practices' for decades with particular focus on elements that promote rich learning environments for retaining and engaging students. Four of these elements that have been argued to promote student learning, and foster departmental and institutional change, are relevant to CAHSI interventions:

- Promoting academic dispositions that enhance classroom learning
- Explicit development of learning communities
- Seeding or facilitating faculty-student interaction and
- Mainstreaming mentoring

The opportunity to engage in meaningful, 'hands-on' work fosters the skills, knowledge, and temperament that contribute to students’ classroom learning. CAHSI promotes academic dispositions that enhance classroom learning through initiatives such as ARGs and PLTL. Affinity Research Groups differ from the traditional undergraduate research model because of the deliberate development of leadership, teamwork, and communication skills through structured mentoring and group interactions. Likewise, peer-led team learning emphasizes cooperative learning, and deepened conceptual understanding of course material. Student survey responses demonstrate that participation in ARGs and
PLTL helped students to develop the intellectual and technical skills that will contribute to their success and advancement in their coursework.

Departments and institutions that explicitly develop structured learning communities find students are more engaged in their learning, experience greater academic and social support, and increased retention. CAHSI has explicitly developed learning communities through PLTL and ARGs. PLTL communities are inclusive by design, and support peer mentoring opportunities. ARGs leverage the different levels of experience inherent in a research group to foster positive interdependence within the group. Principal Investigators and faculty from CAHSI institutions also describe resurgence in departmental-wide activities, such as the creation of a local computer science club and a new gaming club.

When faculty and students interact regularly, students gain more knowledge and skills than when interaction is limited to classroom participation (Astin, 1993; Endo & Harpel, 1982; Kuh & Hu, 2001). CAHSI initiatives have fostered student and faculty interaction?PLTL leaders meet regularly with course instructors to go over activity planning, ARG students meet with graduate students and faculty to discuss research issues, findings, and next steps, and students who engage in CAHSI scholars, FellowNet and PaperNet have substantive interaction around academic content and goals. Preliminary interview data indicate that CAHSI initiatives have increased faculty-student interaction.

Higher education research has continuously affirmed the notion that mentoring supports students' psychological and professional needs. CAHSI initiatives develop webs of support for students in computing departments, encouraging not only faculty mentoring but peer mentoring as well. Affinity Research Groups provide structured mentoring opportunities for students and 88% of PLTL students reported that they have access to a mentor in their department. CAHSI annual meetings provide opportunities for mentoring and networking. Following the annual meeting, most students (76%) indicated they had informal mentoring support from faculty.

**BPC Goal 3: Increase the duration and scope of the alliance award**

At the time of this writing, a BPC demonstration project proposal was under negotiation with the National Science Foundation to add three schools to the CAHSI family: Miami Dade College; University of Texas, Pan American; and California State University, San Marcos. Pending funding, they will participate as full members of the CAHSI alliance, adopting key initiatives, and contributing to leadership and planning. This addition will broaden CAHSI’s reach combined, these three schools graduated 60 Associate degrees, 47 Bachelor degrees, and 25 Master’s degrees in computing fields in 2007-2008. CAHSI is developing relationships (e.g. Memoranda of Understanding) throughout the broader STEM community; the Hispanic computing community, and within BPC. At this writing, CAHSI has been developing informal and formal relationships with ten organizations, sharing their initiatives and gaining resources through these networks.
BPC Goal 4: Serving as a Visible Model/Repository for Effective Practice to Broaden Participation

To increase awareness of CAHSI and its objectives at the departmental and institutional levels, a new initiative was developed in the latest round of funding. Each campus has at least one student and one faculty advocate for CAHSI. Under the leadership of Miguel Alonso, a new SACI PI, advocates will document their recruitment efforts. Recruitment is aimed at increasing student knowledge of academic opportunities that CAHSI offers and increasing awareness of the broader alliance and its goals. Custom posters were developed for CAHSI institutions to promote this effort.

Dissemination

CAHSI faculty members have spread (or have plans to spread) their initiatives over 11 states via in-person training or presentations. CAHSI faculty and evaluators have shared their knowledge of effective practices in at least 8 professional venues, including HACU publications, the American Educational Research Association, the Understanding Interventions Conference supported by AAAS, and multiple Frontiers in Education conferences. However, CAHSI lacks a systematic method to disseminate broadly, and as CAHSI continues to grow, a more strategic dissemination plan may be in order.

Distribution of materials, resources

CAHSI has also distributed resources and materials electronically and through partnerships with other organizations. The CAHSI website has downloadable web resources available for CS-0, PLTL, and ARG. NCWIT, a prominent BPC alliance, has published two promising practices resources that feature CAHSI initiatives, and the Anita Borg Institute highlighted CAHSI’s mentoring efforts.

GOALS OF THE ALLIANCE INTERVENTIONS

CS0- Increasing Regard for Computing Careers for Entry Computing Students

CS0 is a course designed to introduce computing concepts to introductory students. CS-0 students took a survey developed by Lent, Brown and Hackett (2004) and based on the constructs of Social Cognitive Career Theory (SCCT): self-efficacy (sense of mastery in computing), interest in computing, outcome expectations (beliefs about the benefits of a computing major or career), and educational goals.

CS0 influenced students’ perceptions about computing careers and their interest in computing. Students reported increases in interest in computing activities (such as solving problems with computers), and enhanced outcome expectations of a computing major. Computer majors perceived supportive academic communities within their departments. When compared to findings from a peer-reviewed study of information technology students using a survey with similar constructs, CS0 students consistently reported higher
gains, including enhanced expectations for positive outcomes from a career in computing, and increased interest in computing.

**PLTL: Retaining Students in Computing**

Students enrolled in PLTL courses (courses receiving one hour per week of undergraduate student-led activities/instruction) took the same survey as CS0 students, based on SCCT constructs. Nearly ninety percent of students surveyed showed gains/positive values across all of the Social Cognitive Career Theory constructs, including self-efficacy, coping with a difficult major, access to social support, and increase in interest in computing.

When compared to findings from national samples of students from refereed articles using the SCCT survey, CAHSI students had similar outcome expectations ratings, similar perceived barriers and supports, and similar or better ratings of academic self efficacy as more traditional populations of engineering students from two sample studies. Students from PLTL had higher interest in computing and most important for retention, higher educational goal ratings than more traditional populations of engineering students. Students had mixed results when comparing coping self-efficacy across populations.

**PLTL: Becoming Leaders, Becoming Mentors**

Peer-Led Team Learning cultivates pedagogical leaders, students who serve as role models for undergraduates and represent the 'next steps' along the academic computing path. Peer leaders were confident they held the knowledge they needed to lead PLTL sessions effectively (100%), and most noted that leading sessions increased their computing knowledge (86%). Peer leaders also gained skills that may benefit them in future careers, such as interpersonal skills (91%), leadership skills (95%), oral communication skills (100%), and teaching skills (95%).

Creating a cadre of mentors on campus who resemble the underrepresented students CAHSI schools serve appears to benefit not only the undergraduates receiving mentoring but the mentors themselves.

**Affinity Research Groups: Advancing Undergraduates**

Affinity Research Groups (ARG) are designed to socialize students into professional computer science research communities of practice. ARG students completed a survey adapted from the Undergraduate Research Student Self-Assessment (Laursen, Weston, Hunter, & Thiry, 2009).

ARG students reported roughly equivalent gains (means of 3.2 to 3.4 out of 4.0) on all of the URSSA scales: collaboration/teamwork, career preparation, personal growth, and skills. T-tests revealed that Hispanics made higher gains in career preparation and understanding the research process than non-Hispanic students. These gains are particularly important for Hispanic students as they may enter the research experience with less confidence and background knowledge than their majority peers.
Participation in ARGs also had a strong influence on students’ aspirations to pursue graduate degrees. Students cited the research experience and their research faculty mentor as the primary influences on their decisions to attend graduate school. ARG students learned about graduate school from working with and observing graduate students. Greater knowledge about graduate school increased students’ confidence that they could successfully complete the degree.

ARG students were also able to participate in the broader computer science research community. Over three-quarters of ARG students attended a professional computing conference, and almost half of ARG students presented a poster at a conference. In addition, 13% of students authored or co-authored a journal manuscript, and 15% presented a conference paper.

When compared to a national sample of undergraduate researchers who took the URSSA survey, tests of statistical significance show that ARG students are significantly more likely to report communication skill development, and significantly more likely to attend professional conferences, author or co-author a journal article, and present a poster or academic paper. These activities are vital to students’ academic achievement and support students’ advancement in their academic fields.

Development Workshops: Advancing Academic Careers

From their participation in CAHSI annual meetings, Hispanics are advancing their careers across the academic computing pipeline. Following the annual meeting, students near the beginning of the career path applied for scholarships (26%, 13 students), inquired about graduate school opportunities (46%, 23 students), and submitted applications for graduate school (12%, 6 students). Attendance at the annual meeting also promoted networking among CAHSI students, faculty, and industry professionals. The majority of students contacted peers following the annual meeting, while close to a quarter contacted faculty or industry professionals.

Beyond the PhD-Promoting Hispanic Junior Faculty and Industry Professionals

CAHSI initiatives also target professionals in the computing field. CAHSI evaluators interviewed a sample of five Hispanic industry and faculty professionals engaged in the alliance. CAHSI professionals noted many ways that CAHSI had contributed to their professional development and career success. CAHSI provided funding, resources, information, and materials to support their academic scholarship and the advancement of their students. CAHSI professionals expanded their networks at CAHSI meetings and events. CAHSI professionals also felt a sense of support, mentoring, and community that many of them do not have in their home departments or organizations. One woman mentioned that participating in CAHSI was like an inoculation against the discomfort and isolation she sometimes felt in her job.

For the full report and references, please refer to Appendix C.
Training and Development

The developmental workshops that were presented in 2009 are below:

**Title:** APPLYING TO GRADUATE SCHOOL AND SCHOLARSHIPS  
**Venue:** CAHSI 2009 Annual Meeting  
**Speakers:** Michele Lezama and Jacqueline Thomas, National GEM Consortium; Paco Flores, Hispanic Scholarship Fund  
**Description:** The National GEM Consortium and the Hispanic Scholarship Fund sponsored a workshop designed to excite and encourage promising undergraduate engineering and science students to consider master and PhD technical research programs. The workshop encouraged students' consideration of graduate engineering school by delivering vital information on the importance of research and innovation, the process of choosing a graduate program and preparing an application. The workshop ended with a discussion of applying for scholarships through the GEM Consortium and the Hispanic Scholarship Fund.

**Title:** ALGORITHM PARTITIONING FOR DISTRIBUTED HARDWARE ARCHITECTURES  
**Venue:** CAHSI 2009 Annual Meeting  
**Speaker:** Dr. Rafael Arce-Nazario, University of Puerto Rico at R?o Piedras  
**Description:** Tools and methodologies that assist in mapping to distributed architectures are of paramount importance in helping programmers and scientists take full advantage of the available hardware technology. This workshop presented methods and tools for mapping algorithms to distributed hardware architectures such as the evolving multicore systems. The workshop addressed issues such as the development of objective functions for partitioning optimization and performance estimation and the design of heuristics for algebraic-level exploration.

**Title:** BECOMING A CAHSI ADVOCATE  
**Venue:** CAHSI 2009 Annual Meeting  
**Speakers:** Dr. Ann Gates, University of Texas at El Paso; Dr. Luis Martinez, Scripps Research Institute, Florida  
**Description:** Students were invited to make an impact by becoming a CCAHSI advocate! This interactive workshop focused on preparing students and faculty in becoming a CAHSI advocate. Student advocates work with students at their home institutions by encouraging and facilitating student participation in REU opportunities, seminars, workshops, and internships. Working with faculty, they involve students in activities that assist them in preparing competitive applications to local and external programs and scholarships. The role of faculty advocates is to promote Hispanic faculty and young professionals into leadership roles. This includes award nominations and making recommendations for key committee positions, panels, and other positions that build leadership.

**Title:** SELLING YOURSELF AND YOUR IDEAS  
**Venue:** CAHSI 2009 Annual Meeting  
**Speakers:** Dr. Cecilia Arag?n, Lawrence Berkeley National Laboratory; Dr. Dilma da Silva, IBM T.J. Watson Research Center; Dr. Gilda Garreton, Sun Microsystems; Dr. Nayda Santiago, University of Puerto Rico at Mayaguez
Description: A panel of researchers and program managers from academia, government, and industry discussed what works and what does not work in obtaining funding for research. Panelists represented the three perspectives on funding: (1) Industry: patents, white papers, internal funding; the 'patent vs. publish vs. trade secret' decision, (2) Government: proposals, living on soft money, publications, (3) Academic: proposals (research, education, equipment)

Title: INDUSTRY AND ACADEMIC RESEARCH: ARE THEY DIFFERENT BEASTS?
Venue: CAHSI 2009 Annual Meeting
Speaker: Dr. Sandra Ramos Thuel, Alcatel-Lucent
Description: This workshop dealt with the nature of the research challenges that a particular doctoral student will face in industry and the type of skills that might be useful to address these challenges. The speaker discussed her broad experience in the communications industry to elucidate how necessary it is to have a flexible, but well-defined research vision, with associated mission and objectives, as well as the importance of utilizing effective means to market this vision to industry, academia, or government. Contrasting perspectives on career success in industry versus academic research were presented, shedding light on key issues impacting both research career paths.

Title: DATA MANAGEMENT TECHNIQUES IN CYBERSPACE
Venue: CAHSI 2009 Annual Meeting
Speaker: Dr. Manuel Rodriguez, University of Puerto Rico at Mayaguez
Description: The Internet has become a valuable tool for scientists and engineers to publish data collections produced as part of their research projects. Data collections, e.g., terabytes of data from Biological experiments, geospatial instruments, and atmospheric observations, are often replicated to increase their availability and reliability. This workshop introduces participants to data management techniques and the types of challenges that are often encountered in cyberspace.

Title: PREPARING FOR GRADUATE STUDIES WORKSHOP
Venue: University of Texas at El Paso (June 2009)
Speaker: Jacqueline Thomas, National GEM Consortium; Ann Gates, CAHSI PI; Yvonne Lopez, Asst. Dean Graduate School, UTEP
Description: Workshop that focused on the steps for preparing and applying to graduate school.

Title: PROMOTION AND PROPOSAL WRITING WORKSHOP
Venue: Richard Tapia Celebration of Diversity in Computing Conference
Speakers: Bryant York (Portland State); Juan Gilbert (Auburn University); Ann Gates (UTEP); and others
Description: Workshop that focused on the steps for proper preparation and writing of a proposal

Title: THE ROLE OF DEPARTMENT CHAIRS IN BROADENING HISPANIC PARTICIPATION IN COMPUTING
Venue: Richard Tapia Celebration of Diversity in Computing Tapia Conference
Speakers: John Fernandez, TAMU-CC; Ann Gates, UTEP; Desh Ranjan, NMSU
Description: The objectives of the panel were to: discuss the causes for underrepresentation of Hispanics in STEM fields; describe strategies and practices for addressing underrepresentation at critical stages in the academic pipeline; and emphasize the role of the chair in creating a community that addresses the recruitment, retention, and advancement of Hispanic students

Title: HOW TO BECOME A PERSON OF INFLUENCE WORKSHOP
Venue: 2009 Grace Hopper Conference
Speakers: Jo Miller; Nina Bhatti, Principal Scientist, HP Labs; Debra Danielson, Sr. Vice President, CA; Ann Gates, Associate Vice President of Research, University of Texas at El Paso; Wei Lin, Sr. Director of Engineering, Symantec; and Rebecca Norlander, Partner Engineering Manager, Microsoft
Description: Women who break through into positions of leadership in technology get there with a reputation for delivering results. They are comfortable gaining and using power. They come across as credible, and strategic. When they speak, others listen. They have a 'seat at the table', and use it, to make a difference. This workshop provided insight on influencing styles and skills or techniques used; Why it is important that technical women learn how to influence; and advice on how to become a strong influencer.

Title: WOMEN OF COLOR: IDENTIFYING AND DISCUSSING THE UNIQUE ISSUES
Venue: 2009 Grace Hopper Conference
Speakers: Valerie Taylor, TAMU; Jamika B Urge, Penn State; Ann Gates, UTEP; Monica Martinez-Canales, Intel; Tiki Suarez-Brown, FAMU
Description: This panel was organized to provide an open discussion about effective environments and career paths that lead to success for women of color.

Title: GRADUATE SCHOOL: A GUIDE TO THE APPLICATION PROCESS
Venue: UPR-M
Speaker(s): Nestor J. Rodriguez
Description: Provided information about the graduate school application process such as: school selection, required exams, required documents, financing the studies and application deadlines. The students learned when to start the application process, where to find information about graduate programs, when and how to submit applications, identify the required documents and exams, and identify potential funding sources.

Title: FACING THE GRE
Venue: UPR-M
Speaker(s): Gladys Omayra Ducoudary
Description: Familiarized students with the GRE exam, format, and grading system. The student was taught to understand the format of the GRE, the time limitation, and the preparation needed.

Title: CRACKING THE GRE
Venue: UPR-M
Speaker(s): Gladys Omayra Ducoudary
**Description:** The students were able to understand clues on the verbal part and avoid trick questions on the quantitative part of the GRE. The students were able to have better time management. Students were able to take mock exams of the GRE and improve their original mock exam score.

**Title:** CREATIVE PROBLEM SOLVING  
**Venue:** UPR-M  
**Speaker(s):** Fernando Vega  
**Description:** Exposed students to a new way of thinking, promote the creation of unordinary ideas, and promote innovation instead of conformity. The audience was exposed to a new way in which they can come up with new ideas, analyze them and develop them further. They learned methods on how to determine which ideas they should follow on through and how to follow them.

**Title:** PREPARING A STATEMENT OF PURPOSE  
**Venue:** UPR-M  
**Speaker(s):** Nayda Santiago  
**Description:** Prepared students to be able to compose a coherent statement of purpose. Students were expected to correct and improve their original statement of purpose.

**Title:** INDEPENDENT WORK  
**Venue:** UPR-M  
**Speaker(s):** Nayda Santiago, Nestor J. Rodriguez  
**Description:** Increased the student awareness and changed their perspective on independent work to increase their success rate both in undergraduate and graduate school. Students changed their problem solving strategies and acquired self confidence on their skills.

**Title:** LITERATURE SEARCH  
**Venue:** UPR-M  
**Speaker(s):** Nayda Santiago  
**Description:** Familiarized students with the literature search process. Students critically evaluated papers and conducted a thorough literature search related to their respective projects.

**Title:** WRITING A PAPER  
**Venue:** UPR-M  
**Speaker(s):** Manuel Jimenez  
**Description:** Developed writing skills for publication. Students started documenting their research with a technical publication mindset. Students became active published researchers.

**Title:** REUs  
**Venue:** UPR-M  
**Speaker(s):** Nestor J. Rodriguez
Description: Provided information about summer undergraduate research experiences and encouraged the students to apply to them. Students learned about the benefits of having a REU experience, how they work, and how to apply to them. Students were expected to actively search and apply to different REU opportunities for next summer.

Title: GENDER ISSUES I
Venue: UPR-M
Speaker(s): Luisa Seijo-Maldonado
Description: Created awareness about the gender issues that have an effect on their studies, their career development and life in general. Students were expected to have a better understanding of gender issues that affect their lives, in particular their studies and career development, and how to deal with them effectively.

Title: GENDER ISSUES II
Venue: UPR-M
Speaker(s): Luisa Seijo-Maldonado
Description: Created awareness about the gender issues that have an effect on their studies, their career development and life in general. Students were expected to have a better understanding of gender issues that affect their lives, in particular their studies and career development, and how to deal with them effectively.

Title: COMMUNICATION AND CONFLICT MANAGEMENT
Venue: UPR-M
Speaker(s): Vilma Lopez
Description: Addressed the issues of effective communication in conflict management. Students got a better understanding of the importance of effective communication when dealing with conflict management, and learned strategies to deal with conflict management.

Title: GENERATION Y: CHALLENGE OPPORTUNITY
Venue: UPR-M
Speaker(s): Vilma Lopez
Description: Provided an overview of the Y generation, (the students’ generation) and compared it with the professors’ generations. Students learned the main characteristics of their own generation and the generations of their professors. They used this knowledge to get a better understanding of the compatibility or incompatibility of their academic expectations with those of their professors’.

Title: SCIENTIFIC METHODS
Venue: UPR-M
Speaker(s): Nayda Santiago
Description: Provided a formal definition of the scientific method and its components and correlated this information with the steps students should follow in their undergraduate research project. Students learned the fundamental components of the scientific method, including operationalization and validation. Different types of research methods, such as
case study, correlational studies, and experimentation were presented. Students were able to identify the types of research that they are undertaking and understand the roadmap to complete it.

**Title:** RESEARCH ISSUES, CREATION OF IDEAS VS. DEVELOPMENT  
**Venue:** UPR-M  
**Speaker(s):** Domingo Rodriguez  
**Description:** Emphasized the importance of creation of ideas in the development of innovative research. The students learned how to stimulate themselves into creating and applying ideas in the research development process.

**Title:** HEALTHY RELATIONSHIPS  
**Venue:** UPR-M  
**Speaker(s):** Luisa Seijo-Maldonado  
**Description:** Addressed the issues that should be considered in the developing of healthy relationships. The students will identify the key characteristics of what constitutes a good or a bad relationship. The students were expected to use the information learned to improve present or future relationships with significant others.

**Title:** SELF ESTEEM  
**Venue:** UPR-M  
**Speaker(s):** Luisa Seijo-Maldonado  
**Description:** Addressed the manifestation, causes and effects of low self esteem and learned how to improve it. The students learned strategies to improve their self esteem and overcome barriers that it may pose in the development of their professional careers.

**Title:** PLANNING ARG ACTIVITIES FOR THE YEAR  
**Venue:** 2009 SACNAS conference  
**Presenters:** Ann Gates, Steve Roach, Elsa Villa, Kerrie Kephart  
**Number of Participants:** 22 participants from CA-HSI and non-CAHSI institutions

**Title:** AFFINITY RESEARCH GROUPS? CONSTRUCTIVE CRITIQUE OF RESEARCH POSTERS  
**Venue:** 2009 SACNAS conference  
**Presenters:** Ann Gates, Steve Roach  
**Number of Participants:** 30 undergraduate students and mentors

**Title:** AFFINITY RESEARCH GROUPS  
**Venue:** NSF CISE REU Sites PI meeting: (May 2009)  
**Presenters:** Ann Gates, Steve Roach  
**Number of Participants:** 55 faculty + NSF program officers

**Title:** AFFINITY RESEARCH GROUPS  
**Venue:** University of North Carolina Charlotte REU Program (June 2009)  
**Topics:** Day 1: Orientation to ARG; Day 2: Setting research goals, objectives and timelines  
**Presenters:** Ann Gates, Steve Roach  
**Number of Participants:** 20 Undergraduates, graduates, and faculty
Title: AFFINITY RESEARCH GROUP ORIENTATION  
**Venue:** Iowa State University: SPIRE-EIT (Emerging Interface Technologies) Summer REU program (May 2009)  
**Presenters:** Ann Gates, Steve Roach  
**Number of Participants:** 30 from NSF REU Site: Undergraduate and graduate students, faculty

Title: AFFINITY RESEARCH GROUP ORIENTATION  
**Venue:** University of Buffalo/Buffalo State University REU program in math and physics (January 2009)  
**Presenters:** Ann Gates, Steve Roach  
**Number of Participants:** 18 undergraduates and faculty

Title: AFFINITY RESEARCH GROUP ORIENTATION  
**Venue:** University Puerto Rico-Mayaguez and other Puerto Rico Universities; multiple disciplines (January 2009)  
**Presenters:** Ann Gates  
**Number of Participants:** 25 students and faculty

Title: PLTL Orientation  
**Venue:** Northeastern Illinois University to multiple disciplines (August 2009) during NEIU Rising Freshman Summer Research Program  
**Presenters:** Richard Alo and Craig Cassidy  
**Number of Participants:** 53 including faculty, rising freshman (25) participants in NEIU summer research experience and undergrad /grad students

Title: CS0 Orientation  
**Venue:** Northeastern Illinois University to Science College (September, 2009)  
**Presenters:** Richard Alo and Craig Cassidy  
**Number of Participants:** 22 faculty

Title: CS0 and PLTL Orientation  
**Venue:** University of Houston Computer Science Department Retreat (February, 2009)  
**Presenter:** Richard Alo  
**Number of Participants:** 32 faculty

Title: CS0 and PLTL Orientation  
**Venue:** California State University Long Beach (September 2009)  
**Presenter:** Richard Alo  
**Number of Participants:** 10 (faculty, administrators, grad students)

Panel: Working with Diverse Communities  
**Venue:** NCWIT K-12 Outreach Practices Workshop (June 10-12, 2009) Crystal City, Virginia  
**Presenters:** Richard Alo; Stephanie Ludi; Paula Shelton, Stephanie Cippoletti; Kathie Benedettii; Daniela Marghitu  
**Number of Patiticpants:** 45 faculty
Panel: Climate on Campus for STEM Women Faculty and Students and for Faculty and Students with Disabilities
Venue: Quality Education for Minorities Outreach Forum: Building STEM Research and Education Capacity at HSIs. (September 25-26 2009, Albuquerque)
Presenters: Richard Alo’; Peter Malo; Sarah Cotton; Michelle Steiger
Number of Participants: 68 HSI faculty, administrators and 7 NSF directors

Title: Workshop Follow Up (Building STEM Research and Education Capacity at HSIs Role of CAHSI in Faculty Development, Retention and Motivation
Venue: Quality Education for Minorities, (December, 2009), Las Vegas
Presenter: Richard Alo
Number of Participants: 68 HSI faculty and NSF administrators

Title: Workshop for K-12 Computing Teachers:
Venue: NSF-funded workshop given by the Anita Borg Institute for Women and Technology, in collaboration with the Computer Science Teachers Association and the University of Arizona
Presenter: Ann Gates
Description: This panel explored teaching practices and tools for underrepresented students.
Number of Participants: 100 high school teachers

Outreach Activities

In September 2009, Eric Feudenthal held a Computational CS0 (Python) workshop for St. Joseph’s Parochial school computer science faculty. They have implemented CS0 in computing programs that begin before- and after- school, impacting a total of 30 high school students, 22 of which are female. The results of these courses will be presented to the Superintendent of the Catholic Diocese of El Paso and if the results are favorable, the diocese will begin implementation of CS0 courses as part of the core curriculum across all Catholic schools in the El Paso area.

In September 2009, Dr. Steve Roach (UTEP) provided direct support for an effort with The Center for Career and Technology Education in El Paso Texas. The project was coordinated by Julie Hartness of the New Student Orientation program at UTEP, which brought in a number of high school students interested in technology. Dr. Roach gave a career talk about computer science and other technology majors. There were 8 total sessions with 10 to 20 students per presentation.

Computer Science at CSUDH completed an articulation agreement on a 2+2 program with three Community Colleges to pipe line students to Computer Technology Program. The three Colleges included Mt. SAC College, Long Beach City College, and Rio Hondo College.
FIU held a Summer Enrichment Program for high school students. The purpose of the workshop was to teach high school students CS0 as a 3-credit course that can be applied to the student's transcripts once they join FIU.

A strong ongoing joint Neuro-Engineering Program between FIU and Miami Children’s hospital (MCH) has been established and FIU's new recruits are getting clinical experience as means to validate their engineering and computing research findings.

The Computing Sciences Department at TAMU-CC held a workshop in fall 2009 aimed at training secondary and post-secondary educators in effectively using the Alice programming environment at the secondary and post-secondary education levels. Dissemination of the workshop materials, as well as information regarding future workshops can be found at http://cs.tamucc.edu/aliceworkshop.

In March 2009 TAMU-CC hosted Science Rules!, an exposition for over 100 fifth graders from West Oso School, Corpus Christi, Texas. This event is greatly appreciated by the faculty and staff at West Oso, as well as rewarding to the participants planned and delivered the demonstrations. Science Rules was an interactive event, designed to engage the children in science. It was also an opportunity to reinforce the fifth grade learning outcomes related to STEM (Science, Technology, Engineering, and Mathematics). The CAHSI research fellows participate in Science Rules by organizing showcase booths for the expo. There were 12 booths in 2009.

TAMU-CC hosted Island Day, a series of open houses designed to give high school students a first-hand look at what the university has to offer. Prospective students and guests were encouraged to take this opportunity to visit with staff and current students and get a sneak peek at what campus life is all about. By attending Island Day, students were invited to get a head start on the application process, living arrangements, and financial assistance. Representatives from various departments were on-site to answer questions and assist people in obtaining the tools needed to achieve at TAMU-CC. At Island Day, the students had the opportunity to assist the participants to explore academic interests, learn about the various services provided on campus, discover the many ways to get involved at the University, and speak with admissions counselors, financial assistance representatives, and on-campus housing associates.

In the 2009 Animators competition held at TAMU-CC, over 100 students from all over Corpus Christi registered to participate in the Animator 2009 competition and spent over two months creating their own animations, games, stories, art and music for submission to the competition. Out of all the submissions, twelve finalists from various high schools were selected to compete and create the best animated game or movie in one hour, using the computer program called 'Scratch.' Scratch is freely-available interactive multimedia educational software from the Massachusetts Institute of Technology. It is intended to teach basic computer programming concepts using simple manipulations of graphics, images and shapes.
Other TAMU-CC (with CAHSI faculty/student involvement) outreach include the following:

1. Direct educational initiatives: TAMU-CC has been working with K-12 instructors to provide training opportunities in the area of computing (e.g., workshops, presentations). They have also directly involved students at the middle and high-school levels in educational activities, including seminars, presentations and summer camps.

2. Outreach initiatives aimed at promoting the image and interest of female students towards the field of computing. These initiatives include the establishment of student clubs and other student cohorts and the execution of road shows.

3. Development of educational programs within the department to address the needs of high-school girls. In particular, the summer experience included a reduced version of the CS0 course (taught by one of the students that is also part of the CAHSI team - Daniel Jaramillo). The course was attended by 15 (female) students for 5 weeks during the Summer II session in 2009.

TAMU-CC is trying to expand the role of the project to include more collaborators from the Department of Education; Susan Brown (Dept. of Curriculum and Instruction) is an official partner of the program. TAMU-CC has conducted one workshop dedicated to exposing high school and middle school instructors to the use of computational methods in teaching biology. (23 participants)

TAMU-CC has supported the visits of several speakers, representing excellent role models for women in computer science. All the speakers made presentations about their careers in science. Some of the speakers included:

- Judy Pino (Santa Fe Community College)
- Harriet Fell (Northeastern University)
- Michele Nishiguchi (New Mexico State University)
- Patty Lopez (Intel Corporation)

**Journal Publications**


**Books or Other One-time Publications**


Bibliography: TeraGrid 09 meeting, Arlington, VA


Bibliography: 31st Annual International Conference of the IEEE EMBS, Minneapolis, Minnesota, USA, September 2-6, 2009, pp.5397-5400


Y. Chen, M. Adjouadi, C. Han, and A. Barreto, "A New Unconstrained Iris Image Analysis and Segmentation Method in Biometrics", (2009). Conference proceedings, Published

Bibliography: IEEE- AINA International Conference, pp. 966-971

J. Han, J. Rodriguez, M. Beheshti, T.-h. Kim, and et al., "Discovering Decision Tree Based Diabetes Prediction model", (2009). Conference proceedings, Published
Bibliography: Lecture Notes in Computer Science, pp. 99-109, Springer-Verlag Berlin Heidelberg


Bibliography: International Technology, Education and Development Conference, INTED09, Valencia, Spain


E. Pontelli, I. Pivkina, J. Haebe, and R. Jensen, "Young Women in Computing: Lessons Learned from an Educational and Outreach Program", (2009). Conference proceedings, Published

Bibliography: ACM Symposium on Computer Science Education (SIGCSE), ACM Press, pp. 509-513


C. Han, M. Adjouadi, A. Barreto, N. Rishe, and J. Andrian, "Improved Pyramidal Neural Network for Segmented Handwritten Characters Recognition", (2009). Conference proceedings, Published


Bibliography: Proceedings of the 3rd Annual Conference on Understanding Interventions that Broaden Participation in Research Careers

Bibliography: Proceedings of the 3rd Annual Conference on Understanding Interventions that Broaden Participation in Research Careers


Bibliography: Proceedings Frontiers in Education


Bibliography: Proceedings of Frontiers in Education


Bibliography: Proceedings ASEE (American Society for Engineering Education) Annual Conference and Exposition

Web/Internet Site

URL(s):

http://cahsi.org

Description:

The website documents the CAHSI efforts and initiatives. It provides a student portal, as well as one for Ph.D. students. In addition, the website serves as a resource for social science information, it highlights accomplishments of Hispanic students, faculty, and professions, and it announces upcoming events and opportunities.

Other Specific Products

Product Type: Software

Product Description:

The PaperNet tool was conceived to provide CA-HSI students with simulated peer review to assist them hone their technical writing skills. The tool is meant to help faculty advisers who are constrained by time, increase the number of students who are able to receive assistance, and to increase the number of faculty who can provide the equivalent of a blind review, in a timely manner. Built on a mostly-self-service, internet/web-based infrastructure PaperNet supports the ability of students, faculty advisers, and reviewers, both faculty and industry professionals to collaborate asynchronously on reviews of technical reports.
The effort is currently in the testing phase with students, professors, and industry professionals. The next steps are to revise based on feedback, add additional resources, and deploy.

**Sharing Information:**
The tool will be used by CAHSI institutions in 2010. After rigorous testing, it will be made available to the general public through the CAHSI website.

**Product Type:** Teaching aids

**Product Description:**
CAHSI has documented PLTL lessons, CS0 lessons, and ARG materials.

**Sharing Information:**
All materials are available through the CAHSI website.

**Contributions**

**Contributions within Discipline:**

CAHSI is promoting best practices for recruiting, retaining, and advancing Hispanics in computing. Resources associated with the practices are disseminated through the CAHSI website, A4RC website, Trust Science and Technology Center website, HACU, and others. Approximately twenty institutions have adopted one or more CAHSI initiatives.

**Contributions to Other Disciplines:**

A number of talks and articles were presented on CAHSI efforts that reached an audience outside of computing disciplines.

A summary list is presented below.


• Dr. Ann Gates, Dr. Michael Hubbard, and Mimi McClure presented on Funding Opportunities for Computing and Cyberinfrastructure during the 2009 Minority Serving Institutions Technical Assistance and Capacity Building Conference in September of 2009. The presentation focused on broadening awareness about programs to may help expand and support computer science programs and how to utilize partnerships to expand institutions’ computing capability. Discussion included impact of award on the institution and future research programs.

• Dr. Mohsen Beheshti presented at the National Science Foundation Listening Session, Section 7033 of the America Competes Act: Hispanic Serving Institutions and Science, Technology, Engineering and Mathematics (STEM) Conference held March 1, 2009. The presentation mentioned the success of CAHSI interventions in dealing with preparation of students to enter STEM fields and to conduct research.

• NMSU has initiated the development of new computational methods to enhance education in the early grades, especially targeting students with learning disabilities within the local school systems (Las Cruces Public Schools and Gadsden Independent).

• CAHSI evaluators, Sarah Hug and Heather Thiry, University of Colorado - Boulder along with session moderator Rachel Ivie presented at the AAAS Interventions Conference: Identity & Belonging, Session Title: The role of identity and belonging in career decision making held in May 2009. Their presentation titled, Developing the Identity of a Scientist: Situative Learning Theory as a Framework for Apprenticing Hispanics into Scientific Research focused on highlighting the adherence of the Affinity Research Group model to situative learning theory. Situative learning theory was presented as a conceptual framework to examine the role of Affinity Research Groups (ARGs) in promoting the student retention and advancement goals of the Computing Alliance for Hispanic Institutions (CAHSI).


ARG workshops were given at various venues (see descriptions in the Training and Development section) that included faculty from mathematics, physics, chemistry, biology, English, psychology, environmental science, geological sciences, and engineering.
Contributions to Human Resource Development:

CAHSI initiatives focus on the development of professional, team, and research skills of students. The Activities and Training and Development sections describes the various efforts.

In addition, CAHSI supports early and mid-career Hispanic professionals with networking opportunities, funding, mentoring, technical and career related information, as well as training opportunities. In order to understand the role of CAHSI in promoting Hispanic computing professionals, CAHSI evaluators interviewed a sample of five Hispanic industry and faculty professionals engaged in the alliance.

An assistant professor from a commuter school in an economically depressed community learned about the CAHSI annual meeting and requested funding to attend with her two students. At the meeting, Graciela presented her technical work along with her students at the poster session. She met multiple mentors, most of them Hispanics in the field, who continue to provide support and advice. She learned about a workshop for faculty and students held at Berkeley labs, and decided to attend the event with her students.

Based on information gained at CAHSI, one student applied for and received scholarships to attend college, and is no longer balancing full time employment with a heavy evening course load. The three students are now considering graduate school, something they never thought about before their time at the CAHSI annual meeting at Google. Through their participation at Berkeley, they met and worked with other faculty members from around the country who are experts in their field.

On campus, the faculty member found funding for her students to help her in her research, which lessened her work load and provided students with on-campus work opportunities. She has been featured in the campus publication for her work with students, and was a keynote speaker at the Women in Science event at her school. She brought her students along for her presentation, because, she says 'we are a team, and I want the focus to be on what students do, not just on what faculty do.' She also received course materials from a CAHSI faculty member, and plans to start a new research course for undergraduates on her campus. The faculty member views CAHSI as instrumental to her professional development, and to her students' success.

Benefits of Participation: Expanding Academic and Industry Networks:

'For me CAHSI was a life changing experience because of the networking connections made and the information that was gathered. Meeting Ann Gates was incredible, Steve (Roach), and Miguel (Alonso)- we collaborate a lot, I kept in touch with a faculty member who gave a presentation and she’s been helping me with the personal side of things, the life balance, because no one tells you how to do those things.'

All of the interviewees mentioned that their involvement with CAHSI led to their expanded networks of computing professionals. The alliance’s tangential communities, like Latinas in Computing, related Broadening Participation in Computing (BPC) alliances such as the
Empowering Leadership Alliance, as well as CAHSI leadership’s personal acquaintances and colleagues across the country expand the pool of mentors for early career professionals. One woman mentioned she felt her role in CAHSI was as the link between multiple communities, she would connect professionals and students to one another. Professionals were particularly impressed with the collective experience and prestige of CAHSI leaders, whom they considered mentors as well as leaders in the technical field. Another female professional in industry stated that expanding her network at the Google annual meeting allowed her to meet her peers.

Benefits of Participation- Feeling comfortable and having a sense of belonging: Professionals mentioned the comfort they felt in the company of CAHSI leadership and the extended CAHSI community. This notion of comfort and feeling like he or she belongs is noted in the research as a necessary component for the retention of underrepresented computing professionals. One woman mentioned that communicating with CAHSI and Latinas in Computing was like an inoculation against the discomfort and isolation she sometimes felt in her job. With the understanding gained at CAHSI meetings of the societal, educational, and systematic barriers Hispanics face in computing, one professional gained a broadened perspective of the problems faced at work and a new view of how to interact with co-workers who were expressing naive ideas about Hispanic computing professionals as well as women in the field.

Contributions to Resources for Research and Education:

The investigators have created an updated student bookmark that disseminates information about the Alliance, including the newly adopted interventions. It educates students on the statistics related to Hispanics in Computing and what they can do to make a difference, including how their involvement in CA-HSI can change the numbers nationally.

The website contains resources for faculty and the general public.
- Statistics on Hispanics
- Reports on Hispanics
- News releases about Hispanics

In addition, the website includes resources that target students and faculty specifically. CAHSI faculty and evaluators have shared their knowledge of effective practices in at least 8 professional venues, including HACU publications, American Educational Research Association, the Understanding Interventions Conference supported by AAAS, and multiple Frontiers in Education conferences. Up to this point, faculty members from other institutions have learned of CAHSI via professional networks and interaction at conferences.

Contributions Beyond Science and Engineering:

CAHSI members have presented at the HACU Capitol Forum in Washington, DC, March 1-3 that included a meeting to get input on a new NSF program directed toward HSIs and STEM. In addition, CAHSI presented a position paper to Fae Korsmo, Senior Advisor, Office
of the Director NSF, that described CAHSI and made recommendations regarding NSF programs directed at HSIs and STEM.
Table 1: MentorGrad Student Participants

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<tr>
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<td>Yashira Colón</td>
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### Table 3: CAHSI Student Advocates

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<td>Damian A. Torres</td>
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### Table 4: CS-0 Undergraduate Student Enrollment

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Table 6: Students who attended CAHSI Annual meeting Continued

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Appendix B

Listing of Extended Abstracts (Short Papers) by CAHSI Students

CAHSI Annual Meeting 2009
The extended abstracts (Short Papers) by student authors listed below are published in the *Proceedings of the CA-HSI Third Annual Meeting*, Mountain View, CA, January 2009. The proceedings and posters can be viewed on the CA-HSI website:


1. Johnly Tomelden, "*Method of Incorporating Data Mining with Snort and Iptables*".

2. Gabriel Lizarraga, et al. "*Integration of Dipole Model and Current Density Reconstruction towards 3-D Source Localization using EEG and MRI*".

3. Magno R. Guillen, et al., "*Classification of Typical and Atypical Language Network Activations Using Nonlinear Decision Functions*".

4. Maria Tito, et al., "*Detecting Seizures Using Gamma-Range Power Measurements and Nonlinear Decision Functions*".

5. Melvin Ayala, et al., "*Detecting Electrodes Leading to Seizure from Subdural EEG using Spectral Phase Analysis towards Seizure Prediction*".

6. Mercedes Cabrerizo, et al., "*Coherence Analysis of Subdural EEG towards the Delineation of Electrodes that Initiates Epileptic Seizures*".

7. Mouncef Lahlou, et al., "*Illumination Invariant Face Detection with Time-Dependent Intrinsic Images under Near-IR lighting*".

8. Ana M. Guzman, et al., "*Thermal Infrared Imaging for the Detection of Temperature Increase on the Head Surface Due to Motor Activity*".

9. Joel Ortiz, "*Resolving Malicious Patterns in Network Traffic using Data Mining Techniques*".

10. Eric Flior, "*CSRL See5 Transformation: Using PHP for Data Transformation Between SNORT->IDS Databases and See5 Flat Files*".

11. Daniel Jaramillo, "*Using Alice to Quickly Prototype Video Game Mechanics and Ideas*".


13. Sridurga Shilpa Ganapathineedi, "*Gaming Mechanics in Alice*".

14. Joseph Santini, "*Characterization of local protein structure geometry from the Protein Data Bank - A senior project in bioinformatics*".

15. Bo Dong, "*A Survey of Underwater Wireless Sensor Networks*".

16. Diego Rojas Bandini & Dugan Um, "*Underwater Robotics*".

17. Liem Luong, "*Improving Web Search Results with a Natural Language Filter*".

18. Reuben Rodriguez, "*Creating a Windows or Xbox 360 Video Game Using C# and Microsoft XNA Game Studio*".
19. Melinda Chin, et al., "Obtaining the Most Reliable Path in a Complex Network of Nodes".
20. Arturo Geigel, "Combining Phones, Syllable and Phonological Features in Speech Recognition Using Neural Networks".
21. Adam Magana, et al., "Tipping Point Evaluation of a Network Intrusion Detection System (NIDS) for Peer-to-Peer Networks".
23. Amritam Sarcar, "Runtime Assertion Checking Support for JML on Eclipse Platform".
24. Essau Ramirez, "Gait Analysis Using Optimization and Constraint Programming".
26. Eliana Valenzuela-Andrade, "Autonomic Ranking of Data Sources and Query Processing Sites using Ant Colony Theory".
28. Geovany A. Ramirez, "Detecting Objects in Images Using Asymmetric Haar Features".
30. Fernando J. Maymi, "Utility Functions for Efficient Geocast Information Sharing".
31. Sarah Spofford, "Modeling Teeth for Facial Animation".
32. Omar Ochoa, "Towards a Fast, Practical Alternative to Joint Inversion of Multiple Datasets: Model Fusion".
33. Irbis Gallegos, "Formally Specifying and Validating Data Assurance Properties for Real Time Data Processing Applications".
35. Arnaldo Cruz, "Communicating High-level Programs with FPGA-based Acceleration Hardware".
37. Leonardo Salayandia, & Aida Gandara, "Enhancing Workflow-Driven Ontologies: A Meta Model to Create Conceptual Workflows at Multiple Abstraction Levels".
39. Hugo D. Porras & Nicholas Del Rio, "Probe-It! Visualization Improvements".
41. Marie Lluberes, "Automata Signal Analysis and Convolution Image Algebra for an Entropy-based Change Detection Modeling Framework"

42. Abigail Fuentes, "Sensor Array Beamforming Algorithms for Bioacoustics Signal Analysis"

43. John Sanabria, "Gridjobs - A Personal High Throughput Computing Platform"

44. Hector Santiago, "Instrumentation Support Testbed for Bioacoustics Signal Processing"

45. Inerys Otero, "System Level Design Approach to Signal Processing Algorithms"

46. Jonathan Keele, "Electronic Learning Agent System".

47. Lola Bautista, “Analysis of Environmental Data in Data Centers”

48. Luis de la Torre, “Scheduling Master-worker Divisible Tasks”

Appendix C
Recruiting, Retaining, and Advancing Hispanics in Computing:
CAHSI Progress Report
November 2009
Sarah Hug
Heather Thiry
Tim Weston
Thomas Reynolds
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Executive Summary

The Computing Alliance of Hispanic-Serving Institutions (CAHSI) is a partnership of seven higher education institutions with the mission of increasing the number of Hispanics pursuing bachelors and advanced degrees in computing. To achieve these goals, the alliance has implemented multiple interventions across three critical educational transitions: high school to college; undergraduate to graduate study; and graduate study to the professoriate.

The executive summary, and the evaluation report itself, is structured to address several of the Broadening Participation in Computing (BPC) Goals. We analyze data across interventions to provide a holistic assessment of CAHSI’s progress towards achieving its objectives to recruit, retain, and advance Hispanics in computing. We now address each of the BPC goals in turn.

BPC Goal 1: Increasing/contributing to the increase of post-secondary degrees

In recent years, computer science and engineering baccalaureate degrees have declined nationally. Evaluators compared CAHSI rates of undergraduate degree attainment with national and regional rates of computer science baccalaureate degree attainment.

The 2001-2002 academic year marked the peak of Bachelor degree production in North America. Between academic years 2001-2002 and 2006-2007, the number of degrees earned annually dropped from 16,907 to 10,284. During those years, CAHSI schools saw an increase in the number of bachelor’s degrees earned in computer science, from a total of 258 to 322. Therefore, while the US and Canada are producing fewer and fewer computer science graduates at the Bachelor’s degree level each year, CAHSI schools are experiencing steady growth. CAHSI’s success is not attributable to regional anomalies either, as regional schools show an even steeper decline than the national trend.

CAHSI institutions have also increased the number of Hispanic students receiving post-secondary degrees in computing fields. We compared CAHSI to regional schools for baccalaureate graduation rates in CS departments during the target years, 2002-2007. CAHSI graduated are over one third Hispanic (ranging between 31% and 41%), while regional rates were only 9-15% Hispanic. As computer science degree attainment among Hispanics is declining regionally, CAHSI schools are in fact showing growth in the total number of Hispanic students receiving computer science degrees.

Evaluators also compared CAHSI graduation rates of master’s degrees in computing fields to regional and national trends. Masters’ degree production has been more variable in CAHSI schools than in CAHSI comparison schools, where data show a slightly declining trend in recent years. However, CAHSI’s current master’s degree production is still over one and one half times higher (150%) than in
2002—a rate higher than other institutions in the region. The proportion of Master’s degree recipients identifying as Hispanic at the CAHSI schools also far exceeds the national and state level averages.

We now address CAHSI interventions designed to support students and faculty at each of the critical transition points in computing career pathways: high school to college, undergraduate to graduate study, and graduate study to the professoriate.

**Computer Science Zero- Increasing Regard for Computing Careers for Entry Computing Students**

Computer Science Zero is a course designed to introduce computing concepts to introductory students. CS-0 students took a survey developed by Lent, Brown and Hackett (2004) and based on the constructs of Social Cognitive Career Theory (SCCT): self-efficacy (sense of mastery in computing), interest in computing, outcome expectations (beliefs about the benefits of a computing major or career), and educational goals.

*CS-0 influenced students’ perceptions about computing careers and their interest in computing.* Students reported increases in interest in computing activities (such as solving problems with computers), and enhanced outcome expectations of a computing major. Computer majors perceived supportive academic communities within their departments. When compared to findings from a peer-reviewed study of information technology students using a survey with similar constructs, CS-0 students consistently reported higher gains, including enhanced expectations for positive outcomes from a career in computing, and increased interest in computing.

**PLTL: Retaining Students in Computing**

Students enrolled in PLTL courses (courses receiving one hour per week of undergraduate student-led activities/instruction) took the same survey as CS-0 students, based on SCCT constructs. *Nearly ninety percent of students surveyed showed gains/positive values across all of the Social Cognitive Career Theory constructs, including self-efficacy, coping with a difficult major, access to social support, and increase in interest in computing.*

When compared to findings from national samples of students from refereed articles using the SCCT survey, CAHSI students had *similar outcome expectations ratings, similar perceived barriers and supports, and similar or better ratings of academic self efficacy* as more traditional populations of engineering students from two sample studies. Students from PLTL had *higher interest in computing* and most important for retention, *higher educational goal ratings* than more traditional populations of engineering students. Students had mixed results when comparing coping self-efficacy across populations.

**PLTL: Becoming Leaders, Becoming Mentors**
Peer-Led Team Learning cultivates pedagogical leaders, students who serve as role models for undergraduates and represent the "next steps" along the academic computing path. Peer leaders were confident they held the knowledge they needed to lead PLTL sessions effectively (100%), and most noted that leading sessions increased their computing knowledge (86%). Peer leaders also gained skills that may benefit them in future careers, such as interpersonal skills (91%), leadership skills (95%), oral communication skills (100%), and teaching skills (95%). Creating a cadre of mentors on campus who resemble the underrepresented students CAHSI schools serve appears to benefit not only the undergraduates receiving mentoring but the mentors themselves.

**Affinity Research Groups: Advancing Undergraduates**

Affinity Research Groups (ARG) are designed to socialize students into professional computer science research communities of practice. ARG students completed a survey adapted from the Undergraduate Research Student Self-Assessment (Laursen, Weston, Hunter, & Thiry, 2009).

ARG students reported roughly equivalent gains (means of 3.2 to 3.4 out of 4.0) on all of the URSSA scales: collaboration/teamwork, career preparation, personal growth, and skills. T-tests revealed that Hispanics made higher gains in career preparation and understanding the research process than non-Hispanic students. These gains are particularly important for Hispanic students as they may enter the research experience with less confidence and background knowledge than their majority peers.

Participation in ARGs also had a strong influence on students’ aspirations to pursue graduate degrees. Students cited the research experience and their research faculty mentor as the primary influences on their decisions to attend graduate school. ARG students learned about graduate school from working with and observing graduate students. Greater knowledge about graduate school increased students’ confidence that they could successfully complete the degree.

ARG students were also able to participate in the broader computer science research community. Over three-quarters of ARG students attended a professional computing conference, and almost half of ARG students presented a poster at a conference. In addition, 13% of students authored or co-authored a journal manuscript, and 15% presented a conference paper.

When compared to a national sample of undergraduate researchers who took the URSSA survey, tests of statistical significance show that ARG students are significantly more likely to report communication skill development, and significantly more likely to attend professional conferences, author or co-author a journal article, and present a poster or academic paper. These activities are vital to students’ academic achievement and support students’ advancement in their academic fields.

**Development Workshops: Advancing Academic Careers**
From their participation in CAHSI annual meetings, Hispanics are advancing their careers across the academic computing pipeline. Following the annual meeting, students near the beginning of the career path applied for scholarships (26%, 13 students), inquired about graduate school opportunities (46%, 23 students), and submitted applications for graduate school (12%, 6 students). Attendance at the annual meeting also promoted networking among CAHSI students, faculty, and industry professionals. The majority of students contacted peers following the annual meeting, while close to a quarter contacted faculty or industry professionals.

Beyond the PhD—Promoting Hispanic Junior Faculty and Industry Professionals

CAHSI initiatives also target professionals in the computing field. CAHSI evaluators interviewed a sample of five Hispanic industry and faculty professionals engaged in the alliance. CAHSI professionals noted many ways that CAHSI had contributed to their professional development and career success. CAHSI provided funding, resources, information, and materials to support their academic scholarship and the advancement of their students. CAHSI professionals expanded their networks at CAHSI meetings and events. CAHSI professionals also felt a sense of support, mentoring, and community that many of them do not have in their home departments or organizations. One woman mentioned that participating in CAHSI was like an inoculation against the discomfort and isolation she sometimes felt in her job.

BPC Goal 2: Create sustainable changes in culture or practices at the institutional, departmental, or organizational levels that contribute to broadening participation in computing.

Researchers have studied higher education “best practices” for decades (Astin, 1975; Kuh 2008), with particular focus on elements that promote rich learning environments for retaining and engaging students. Four of these elements that have been argued to promote student learning, and foster departmental and institutional change, are relevant to CAHSI interventions:

- Promoting academic dispositions that enhance classroom learning
- Explicit development of learning communities
- Seeding or facilitating faculty-student interaction and
- Mainstreaming mentoring

The opportunity to engage in meaningful, “hands-on” work fosters the skills, knowledge, and temperament that contribute to students’ classroom learning. **CAHSI promotes academic dispositions that enhance classroom learning through initiatives such as ARGs and PLTL.** Affinity Research Groups differ from the traditional undergraduate research model because of the deliberate development
of leadership, teamwork, and communication skills through structured mentoring and group interactions (Kephart et al., 2008). Likewise, peer-led team learning emphasizes cooperative learning, and deepened conceptual understanding of course material (Eberlein, 2008; Gosser et al., 2001). Student survey responses demonstrate that participation in ARGs and PLTL helped students to develop the intellectual and technical skills that will contribute to their success and advancement in their coursework.

Departments and institutions that explicitly develop structured learning communities find students are more engaged in their learning, experience greater academic and social support, and increased retention (Astin, 1975; Kuh, Kinzie, Schuh, & Whit 2005; Tinto, 1997). **CAHSI has explicitly developed learning communities through PLTL and ARGs.** PLTL communities are inclusive by design, and support peer mentoring opportunities. ARGs leverage the different levels of experience inherent in a research group to foster positive interdependence within the group. Principal Investigators and faculty from CAHSI institutions also describe resurgence in departmental-wide activities, such as the creation of a local computer science club and a new gaming club.

When faculty and students interact regularly, students gain more knowledge and skills than when interaction is limited to classroom participation (Astin, 1993; Endo & Harpel, 1982; Kuh & Hu, 2001). **CAHSI initiatives have fostered student and faculty interaction**—PLTL leaders meet regularly with course instructors to go over activity planning, ARG students meet with graduate students and faculty to discuss research issues, findings, and next steps, and students who engage in CAHSI scholars, fellownet and papernet have substantive interaction around academic content and goals. Preliminary interview data indicate that CAHSI initiatives have increased faculty-student interaction.

Higher education research has continuously affirmed the notion that mentoring supports students’ psychological and professional needs (Hall & Sandler, 1983; National Academies Press, 2009; Tillman, 1995; Zachary, 2005). **CAHSI initiatives develop webs of support for students in computing departments, encouraging not only faculty mentoring but peer mentoring as well.** Affinity Research Groups provide structured mentoring opportunities for students and 88% of PLTL students reported that they have access to a mentor in their department. CAHSI annual meetings provide opportunities for mentoring and networking. Following the annual meeting, most students (76%) indicated they had informal mentoring support from faculty.

**BPC Goal 3: Increase the duration and scope of the alliance award**

At the time of this writing, a BPC demonstration project proposal was under negotiation with the National Science Foundation to add three schools to the CAHSI family: Miami Dade College; University of Texas, Pan American; and California State University, San Marcos. Pending funding, they will participate as full members of the CAHSI alliance, adopting key initiatives, and contributing to leadership and planning. This addition will broaden CAHSI’s reach—combined, these three schools graduated 60 Associate degrees, 47 Bachelor degrees, and 25 Master’s degrees in computing fields in 2007-2008.
CAHSI is developing relationships (e.g. Memoranda of Understanding) throughout the broader STEM community; the Hispanic computing community, and within BPC. At this writing, CAHSI has been developing informal and formal relationships with ten organizations, sharing their initiatives and gaining resources through these networks.

**BPC Goal 4: Serving as a Visible Model/Repository for Effective Practice to Broaden Participation**

To increase awareness of CAHSI and its objectives at the departmental and institutional levels, a new initiative was developed in the latest round of funding. Each campus has at least one student and one faculty advocate for CAHSI. Under the leadership of Miguel Alonso, a new SACI PI, advocates will document their recruitment efforts. Recruitment is aimed at increasing student knowledge of academic opportunities that CAHSI offers and increasing awareness of the broader alliance and its goals. Custom posters were developed for CAHSI institutions to promote this effort.

**Dissemination**

CAHSI faculty members have spread (or have plans to spread) their initiatives over 11 states via in-person training or presentations. CAHSI faculty and evaluators have shared their knowledge of effective practices in at least 8 professional venues, including HACU publications, the American Educational Research Association, the Understanding Interventions Conference supported by AAAS, and multiple Frontiers in Education conferences. However, CAHSI lacks a systematic method to disseminate broadly, and as CAHSI continues to grow, a more strategic dissemination plan may be in order.

**Distribution of materials, resources**

CAHSI has also distributed resources and materials electronically and through partnerships with other organizations. The CAHSI website has downloadable web resources available for CS-0, PLTL, and ARG. NCWIT, a prominent BPC alliance, has published two promising practices resources that feature CAHSI initiatives, and the Anita Borg Institute highlighted CAHSI’s mentoring efforts.
Introduction

The Computing Alliance of Hispanic-Serving Institutions (CAHSI) is a partnership of seven higher education institutions and the Hispanic Association of Colleges and Universities, with the mission of increasing the number of Hispanics pursuing bachelors and advanced degrees in computing. The methods of goal attainment include the implementation of several interventions that address the key causes for under-representation of Hispanics in computing. These interventions support the recruitment, retention, and advancement of Hispanic undergraduate and graduate students and faculty in the computing, information sciences, and engineering (CISE) areas, and are integrated across three critical educational transitions: high school to college; undergraduate to graduate study; and graduate study to the professoriate.

Organization of the report

This year, the progress report is structured to address many of the six Broadening Participation in Computing (BPC) Goals. We analyze data across interventions to provide a holistic assessment of CAHSI’s progress towards increasing the number of students, especially Hispanic students, who earn post-baccalaureate degrees in computing disciplines. The indicators used to measure success can be found in Appendix A. When related or similar data is available publicly, we compare CAHSI student responses to other students’ responses on similar or in some cases the same survey constructs, and compare other publicly available graduation data to CAHSI school data. Through these comparisons we hypothesize that CAHSI students, who tend to be underrepresented in computing and may lack preparation, confidence, and role models in the field, will compare favorably or equally with majority students on indicators such as computing confidence, aspirations to succeed in their field, and ability to cope with pressures in the STEM majors. We also look at “vita enhancing” academic and professional behaviors in which CAHSI students engaged, and compare them to nationally available data to see if CAHSI students are becoming better prepared for continued study in computing.

BPC Goal 1: Increasing/contributing to the increase of post-secondary degrees

Graduating computing professionals: CAHSI institutions in context

CAHSI is underway during a time of great decline nationally in computer science bachelor degree attainment. To understand how CAHSI is impacting the number of students, especially underrepresented students, receiving degrees in computing, it is important to describe the larger academic computing

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1 Note that at the time of this progress report, not all data were available to fulfill assessment at each of the indicators presented in Appendix A.
context. The Computer Research Association’s Taulbee Survey provides data regarding computer science and computer engineering degree attainment in the US and Canada. The graph below shows the total number of reported B.S. degrees in computer science from 2002-2007, though this list is incomplete and can show only trends. Between academic years 2001-2002 and 2006-2007, the number of degrees earned annually dropped from 16,907 to 10,284.

![Total # degrees in CS from US and Canada from participating Taulbee schools](image)

**Object 1: Total Number of Computer Science Degrees from the US and Canada Reported in the Taulbee Survey, Years 2002-2007.**

While the US and Canada undoubtedly experienced an overall decline in computing degree production, it was conceivable that regional differences could be masked by larger studies of computer science degree attainment. In order to detect possible regional differences in degree attainment CAHSI evaluators chose to collect data from comparison institutions most like the CAHSI schools—public and private not for profit universities and colleges in CAHSI serving states (California, Florida, New Mexico, and Texas).

The evaluators queried the Integrated Postsecondary Education Data System (IPEDS) for data on comparison schools, and were able to obtain data from all schools that fit the given parameters\(^2\). As data from IPEDS was available from 2001-2002 though 2006-2007 only, we limited our study to these academic years. Note that CAHSI began during this time period, with initiative adoption at some institutions starting in 2003-2004, and alliance funding beginning in 2005-2006. Degrees in the following IPEDS categories were included in the query of computer science bachelor degree attainment: Computer and information sciences general; Computer science; Computer/Information Technology Administration and Management; and Computer and information sciences, other.

\(^2\) Note that CAHSI schools are a subset of regional schools.
The trend depicted in the Taulbee Survey data can be seen in the graph of all public and private not for profit colleges and universities operating in CAHSI serving states. From 2002 until 2007, the number of undergraduate computer science degrees earned decreased from 5,693 to 2,775 annually. See figure below.

Next, we compare national and regional trends to CAHSI computer science bachelor degree attainment. To maintain consistency, we report IPEDS-generated data on the CAHSI schools, rather than the data we obtain directly from institutional research offices. During the 2002-2007 timeframe, CAHSI institutions did not experience a decline in undergraduate computer science attainment. In fact, when summed across CAHSI schools, we see an increase in the number of bachelor’s degrees earned in computer science at the seven CAHSI institutions, from a total of 258 in 2002 to a total of 322 in 2007. See figure below.
Object 3: Total Number of Computer Science Degrees, CAHSI Institutions, Years 2002-2007

To compare the decline experienced across the US and Canada with regional and CAHSI-specific trends in bachelor degree attainment, we converted all values to a proportion of 2002 computer science degree attainment in each category. In this way we can look at relative decline and relative stability, given the large difference in actual values. The original 2002 figure for each comparison group is reported in brackets within the “year 2002” row. See table and figure below.

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent of 2002 Bachelor Degree Attainment</th>
<th>Percent of 2002 Bachelor Degree Attainment</th>
<th>Percent of 2002 Bachelor Degree Attainment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Taulbee results US/Canada)</td>
<td>(Regional Schools)</td>
<td>(CAHSI)</td>
</tr>
<tr>
<td>year 2002</td>
<td>100 [16,907]</td>
<td>100 [5,693]</td>
<td>100 [258]</td>
</tr>
<tr>
<td>year 2003</td>
<td>98</td>
<td>75</td>
<td>116</td>
</tr>
<tr>
<td>year 2004</td>
<td>106</td>
<td>73</td>
<td>126</td>
</tr>
<tr>
<td>year 2005</td>
<td>90</td>
<td>68</td>
<td>123</td>
</tr>
<tr>
<td>year 2006</td>
<td>76</td>
<td>55</td>
<td>131</td>
</tr>
<tr>
<td>year 2007</td>
<td>61</td>
<td>49</td>
<td>125</td>
</tr>
</tbody>
</table>

Object 4: Percent of 2002 Bachelor Degree Attainment Over Time for Taulbee Schools, Regional Comparison Schools, and CAHSI schools
Object 5: Percent of 2002 Bachelor Degree Attainment Over Time for Taulbee Schools, Regional Comparison Schools, and CAHSI schools

The 2001-2002 school year marked the peak of Bachelor degree production in the US and Canada according to Taulbee data. The table above shows that while the US and Canada are producing fewer and fewer computer science graduates at the Bachelor’s degree level each year, CAHSI schools are experiencing steady growth. CAHSI’s success is not attributable to regional anomalies, as comparison schools in CAHSI-serving states show decline similar to, and in fact steeper than, Taulbee data in computer science degree production at the undergraduate level.

In order to represent the differences in trends in terms of real numbers of students, we continue in this line of comparison. In the figures below we calculate the difference in number of degrees experienced at CAHSI schools by calculating an expected value of degree earners for each year and comparing this to the actual value of bachelor’s degrees attained at CAHSI schools. In other words, we calculate the number of degrees that would be expected if CAHSI schools followed national trends of decline, as well as the number of degrees that would be expected if CAHSI schools followed regional trends of decline. We compare these values in the following table and figures.
### Comparison of CAHSI actual CS degree production with expected degree production, given US and Canada trends reported in Taulbee data, trends in CAHSI comparison school data

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual # degrees in CS from CAHSI schools</th>
<th>Expected # degrees in CS, given Taulbee trends</th>
<th>Calculated difference between actual values and expected regional values (positive values indicate actual numbers are larger than expected values)</th>
<th>Expected # degrees in CS, given CA, FL, NM, and TX combined trends</th>
<th>Calculated difference between actual values and expected regional values (positive values indicate actual numbers are larger than expected values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>258</td>
<td>258</td>
<td>0</td>
<td>258</td>
<td>0</td>
</tr>
<tr>
<td>2003</td>
<td>298</td>
<td>253</td>
<td>+45</td>
<td>194</td>
<td>+104</td>
</tr>
<tr>
<td>2004</td>
<td>326</td>
<td>273</td>
<td>+53</td>
<td>188</td>
<td>+138</td>
</tr>
<tr>
<td>2005</td>
<td>317</td>
<td>232</td>
<td>+85</td>
<td>175</td>
<td>+142</td>
</tr>
<tr>
<td>2006</td>
<td>338</td>
<td>196</td>
<td>+142</td>
<td>142</td>
<td>+196</td>
</tr>
<tr>
<td>2007</td>
<td>322</td>
<td>157</td>
<td>+165</td>
<td>126</td>
<td>+196</td>
</tr>
</tbody>
</table>

**Object 6: Comparison of CAHSI actual CS degree production with expected degree production, given US and Canada trends reported in Taulbee data, trends in CAHSI comparison school data**

### Comparison of Actual CAHSI CS degree production with expected values, given national trends

- **year 2007**
- **year 2006**
- **year 2005**
- **year 2004**
- **year 2003**
- **year 2002**

- **expected # degrees in CS, given Taulbee trends**
- **actual # degrees in CS from CAHSI schools**

**Object 7: Comparison of Actual CAHSI BS degrees earned annually with expected degree production, given Taulbee data trends**

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Object 8: Comparison of Actual CAHSI CS BS degrees earned annually with expected degree production, given CA FL NM and TX data trends

Given the data above, it seems clear that CAHSI schools are producing far more than the expected or average number of bachelor's degrees in computer science. In 2007 CAHSI graduated more than double the expected number of bachelor's degrees in computer science, when compared to neighboring schools and when compared to Taulbee rates of degree production.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of CE BS degrees: FIU and UPRM</th>
<th>Number of CE BS degrees: CAHSI regional schools</th>
<th>Number of CE BS degrees: Taulbee schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>116</td>
<td>1583</td>
<td>3770</td>
</tr>
<tr>
<td>2003</td>
<td>138</td>
<td>1812</td>
<td>3357</td>
</tr>
<tr>
<td>2004</td>
<td>105</td>
<td>1774</td>
<td>3095</td>
</tr>
<tr>
<td>2005</td>
<td>100</td>
<td>1939</td>
<td>3095</td>
</tr>
</tbody>
</table>
Object 9: Number of CE BS degrees: FIU and UPRM; CAHSI regional schools; and CE BS degrees in Taulbee study

Proportion of Hispanic students receiving BS degrees in computer science

The objective of the CAHSI alliance is to increase the number of students, especially Hispanic students, who receive post-secondary degrees in computing fields. We calculated the proportion of computer science Bachelor’s degree earners at CAHSI schools for comparison over the target years. We also compare the proportions of Hispanic students earning BS degrees in computer science with all degree earners from private or public not-for-profit institutions in CAHSI serving states. Note that CAHSI serving states, California, Florida, New Mexico, and Texas, are among those with the highest populations of Hispanic, college age individuals in the United States. We did not make direct comparisons with Taulbee data in this category, as Taulbee surveys do not have complete information regarding student race/ethnicity. For instance, in 2008, race/ethnicity was known for fewer than three fourths of degree earners. When available, we comment regarding percent Hispanic students reported in Taulbee data throughout the text of this report section. See figure below.

<table>
<thead>
<tr>
<th>Year</th>
<th>Hispanic BS Earners</th>
<th>Total BS Earners</th>
<th>Total Hispanic BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>94</td>
<td>1596</td>
<td>2494</td>
</tr>
<tr>
<td>2007</td>
<td>107</td>
<td>1349</td>
<td>2214</td>
</tr>
</tbody>
</table>

Object 10: Proportion of Hispanic Students Earning BS degrees in Computer Science in CAHSI Schools and in Comparison Regional Schools

While CAHSI computer science BS graduates are over one third Hispanic (ranging between 31% and 41%), comparison schools in the same CAHSI –serving states graduate only 9-15% Hispanic students in their undergraduate computer science programs. As computer science degree attainment is declining in the states reported here, this increase in proportion represents a decrease in total number of Hispanic
student graduates. At the same time, CAHSI schools are in fact showing growth in the total number of Hispanic students receiving computer science degrees. See table below.

<table>
<thead>
<tr>
<th>Year</th>
<th>All regional (Hispanic)</th>
<th>CAHSI (Hispanic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>486</td>
<td>90</td>
</tr>
<tr>
<td>2003</td>
<td>396</td>
<td>91</td>
</tr>
<tr>
<td>2004</td>
<td>471</td>
<td>127</td>
</tr>
<tr>
<td>2005</td>
<td>505</td>
<td>126</td>
</tr>
<tr>
<td>2006</td>
<td>448</td>
<td>141</td>
</tr>
<tr>
<td>2007</td>
<td>428</td>
<td>125</td>
</tr>
</tbody>
</table>

Object 11: Total number of Hispanic Computer Science BS graduates summed across regional comparison schools and across CAHSI schools

Graduate degree trends in CAHSI schools-Master’s degrees

Evaluators also examined CAHSI graduation rates in comparison with Taulbee report data and IPEDS state level data. See table below for total number of MS degrees in computer science.

<table>
<thead>
<tr>
<th>Year</th>
<th>Taulbee MS CS totals</th>
<th>Regional MS CS totals</th>
<th>CAHSI MS CS totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>7,031</td>
<td>2613</td>
<td>56</td>
</tr>
<tr>
<td>2003</td>
<td>8148</td>
<td>3027</td>
<td>69</td>
</tr>
<tr>
<td>2004</td>
<td>8735</td>
<td>3310</td>
<td>101</td>
</tr>
<tr>
<td>2005</td>
<td>8466</td>
<td>3336</td>
<td>172</td>
</tr>
<tr>
<td>2006</td>
<td>7117</td>
<td>2970</td>
<td>95</td>
</tr>
<tr>
<td>2007</td>
<td>7561</td>
<td>2505</td>
<td>90</td>
</tr>
</tbody>
</table>

Object 12: Number of Computer Science Master’s degrees earned, 2002-2007, from Taulbee study (national estimate) IPEDS data set (CAHSI states) and CAHSI schools
In an effort to put these values in context, we again compare the trends in graduation by representing the totals as percents of 2002 graduation. See figure below.

**Object 13: Computer Science MS Graduates as a proportion of 2002 values**

Masters’ degree production has been more variable in CAHSI schools than in CAHSI comparison schools, where trends show a relatively stable, though slightly declining trend in recent years. After a dramatic peak in 2005, a year they nearly doubled production of Master’s degrees in computer science over 2004, CAHSI schools showed a dip in graduate production. This decline, however, left CAHSI degree production at over one and one half times (150%) that of 2002 degree production.

This huge rise and decline is difficult to interpret, though one factor might be UTEP’s early adoption of Affinity Research Groups in 1999, an initiative aimed to increase graduate enrollment. Another factor might be CAHSI students’ increasing enrollment in PhD programs in CAHSI schools and beyond.
Hispanic Computer Science Masters’ Degree Recipients

Object 14: Percent of Computer Science MS Degree Recipients who are Hispanic

Not surprisingly, the proportion of Master’s degree recipients identifying as Hispanic at the CAHSI schools far exceeds the national and state level averages. These values do not include the many non-resident students who attend CAHSI institutions from communities on the Mexican side of border towns in Texas and New Mexico. The upward trend in student proportion of Hispanic graduates indicates CAHSI.

CAHSI has achieved moderate success in increasing Master’s degree attainment in computer science, yet not to the extent of the increase in undergraduate degrees. This trend is difficult to interpret, particularly because of the variability from year to year in graduation rates of Master’s degrees at CAHSI schools. Several factors may influence this trend. A primary goal of CAHSI is to increase the number of students receiving doctoral degrees in computing fields, and not all CAHSI institutions offer doctoral programs. Therefore, some students may be continuing their studies at other institutions with Ph.D. options. Another factor may be that CAHSI has focused less effort on graduate recruitment, and greater effort on undergraduate retention. Therefore, CAHSI’s achievements in undergraduate degree attainment are greater than their Master’s degree attainment rates.

Recruiting/Retaining Undergraduates in Computing

PLTL—retaining students in computing

Students enrolled in PLTL courses (courses receiving one hour per week of undergraduate student-led activities/instruction) were asked to take a survey during the final days of the semester. This interim
report focuses on 160 student responses obtained in April and May of 2009 following the spring 2009 semester. The majority of students were Hispanic (70%), most were computer science or engineering majors (76%) and the vast majority of PLTL students were male (71%), though this proportion of males is less than expected given current female graduation rates in computing disciplines. Most students attended 90% of PLTL sessions, and two thirds of students had experienced 3 or more mathematics courses by the time they enrolled in their current PLTL course. Nearly half (44%) had taken two or more additional computing courses when they enrolled in the current PLTL course.

Surveys were adapted from Lent's 2008 Social Cognitive Career Theory instrument, which measures student self efficacy, student coping efficacy, student interest in the field, student educational goals, student outcome expectations of the major, and student perception of social supports and barriers. The instrument was obtained from Dr. Robert Lent of the University of Maryland, and was modified to indicate change based on PLTL course experience. Overall student averages for each of the sub scales are reported in the table below. All items were adjusted to indicate positive values, where 10 = strongly agree/very likely/greatly increased intention. Note that a neutral response would occur at 5.5, and all mean values are between 7.24 and 8.38, indicating the PLTL course positively impacted students.

Nearly ninety percent of students surveyed showed gains/positive values across all of the Social Cognitive Career Theory constructs, including self efficacy, coping with a difficult major, strongly held educational goals and educational outcome expectations for themselves, access to social support, and increase in interest in computing. No significant differences were detected in subscale mean scores when comparing men and women, Hispanic students with non-Hispanic students, students with more mathematics or computer science course taking experience with less course taking experience. Only one subscale showed significant difference by school (interest in computing). Both schools showed positive values in this regard.

**Object 15: PLTL student Social Cognitive Career Theory Average scores**

The goals of PLTL align with increasing educational goals, self efficacy (academic outcomes), coping efficacy, student interest in computing, and in increasing social supports/decrease social barriers.
to student success in computing. As status quo is for students from underrepresented groups to compare negatively with fully represented groups (in other words, Hispanics and females of all groups tend to report lower values for these constructs), **as PLTL aims to close gaps between underrepresented groups and the majority of computer science students, a successful PLTL intervention would show CAHSI students responding similarly to majority populations.**
In order to test the hypotheses that CAHSI PLTL students (majority of whom are Hispanic) have similar social-cognitive outcomes as majority students, evaluators vetted published articles citing SCCT (Lent, Brown, and Hackett) for comparison subscale mean data. Articles including sufficient population and sampling information, as well as scale mean scores with standard deviation values for groups of engineering/computing/information technology undergraduate students were selected for comparison. The table below describes each publication’s sample, sampling procedures, and details mean values for each of the Social Cognitive Career Theory subscales, when available. All values were adjusted to fit CAHSI’s and Lent’s 10 point scale.3

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study participants</strong></td>
<td>160 computer science students enrolled in CAHSI PLTL courses, taken during class. Majority (70%) Hispanic, three-fourths male; 20% freshmen, 35% sophomores, 31% juniors, 10% seniors, 4% graduate students. Represent four CAHSI HSIs.</td>
<td>197 engineering students from west coast university, mostly Caucasian (63%), with purposeful oversampling of Hispanic (23%), Asian (11%), African American (5%) and female (24%) students.</td>
<td>153 engineering students enrolled in an east coast introductory design course; mostly male (75%) Caucasian (68%) first year students (74%) from one eastern research university</td>
<td>1208 IT/computing students (CS, MIS, CE, etc.) at HBCU or PWI schools; 42% African American/black; 39% Caucasian, 6% Asian; 5% Hispanic, 8% multiple race/ethnicity; 70% male; 51% computer science majors.</td>
</tr>
<tr>
<td><strong>Intervention (if applicable)</strong></td>
<td>PLTL</td>
<td>None</td>
<td>Design pedagogy rather than traditional lecture</td>
<td>None</td>
</tr>
<tr>
<td><strong>Sampling Procedures</strong></td>
<td>All students in target courses asked to take the survey and given time to complete the survey in class. Spring semester 2009</td>
<td>Sampled from engineering classes, underrepresented students were additionally contacted via mail survey</td>
<td>All students in target course asked to take the survey and given time to complete the survey in class.</td>
<td>Students were recruited by faculty to participate via flyers, presentations, personal contact in fall 2004.</td>
</tr>
</tbody>
</table>

3 For example, scales reported on a 5 point scale were multiplied by 2 to create a comparable value, and scales that were reported with a 0-9 scale were shifted 1 point higher for better comparison. Note these comparisons are approximate, and not based on the same instrument but on the same construct (e.g. self-efficacy).
### Self Efficacy

<table>
<thead>
<tr>
<th></th>
<th>CAHSI</th>
<th>Engineering Group 1</th>
<th>Engineering Group 2</th>
<th>Computing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self Efficacy</td>
<td>7.65 (SD 2.04)</td>
<td>7.15</td>
<td>7.43</td>
<td>8.36 **</td>
</tr>
</tbody>
</table>

### Coping Efficacy

<table>
<thead>
<tr>
<th></th>
<th>CAHSI</th>
<th>Engineering Group 1</th>
<th>Engineering Group 2</th>
<th>Computing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coping Efficacy</td>
<td>7.32 (SD 1.89)</td>
<td>6.7</td>
<td>7.72 *</td>
<td>7.84</td>
</tr>
</tbody>
</table>

### Outcome Expectations

<table>
<thead>
<tr>
<th></th>
<th>CAHSI</th>
<th>Engineering Group 1</th>
<th>Engineering Group 2</th>
<th>Computing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>8.35 (SD 1.69)</td>
<td>7.8</td>
<td>8.29</td>
<td>8.18</td>
</tr>
</tbody>
</table>

### Interests

<table>
<thead>
<tr>
<th></th>
<th>CAHSI</th>
<th>Engineering Group 1</th>
<th>Computing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interests</td>
<td>7.74 (SD 2.09)</td>
<td>6.1 **</td>
<td>Not available</td>
</tr>
</tbody>
</table>

### Social Supports & Barriers

<table>
<thead>
<tr>
<th></th>
<th>CAHSI</th>
<th>Engineering Group 1</th>
<th>Computing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>7.24 (SD 1.35)</td>
<td>7.1</td>
<td>Not available</td>
</tr>
</tbody>
</table>

### Educational Goals

<table>
<thead>
<tr>
<th></th>
<th>CAHSI</th>
<th>Engineering Group 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational</td>
<td>8.38 *</td>
<td>7.54 *</td>
</tr>
</tbody>
</table>

---

**Object 16: PLTL Data comparisons between CAHSI and similar published studies in STEM education**

#### Self Efficacy

Self Efficacy - A student’s judgment of his or her capability to perform effectively in a computing/engineering major

“Excel in my discipline over the next two semesters”

T-tests were performed for all comparison groups to determine whether CAHSI PLTL students differed in their degree of engineering/computing self-efficacy from more typical populations of engineering students. The evaluators view the engineering groups of students in columns 2 and 3 as the most appropriate comparison groups to the CAHSI PLTL sample, because they are comprised of students enrolled in engineering courses, have more similar sampling procedures to CAHSI (beginning sampling procedures within target courses), and resemble the typical US proportions of race and ethnicity populations within engineering disciplines. We include the computing sample in column 4, though we caution that sampling procedures favoring participant self-selection, variety in computing majors (from engineering departments, business schools, and other interdisciplinary programs), and combination of HBCU and PWI institutions all complicate interpretation of measures.

|---------------------|---------------------------|-------------------------------------|----------------------------------------|---------------------------|

---

PLTL aims to close the gap between Hispanic students and majority students. We find that following PLTL course experience, CAHSI students report similar levels of self efficacy to engineering students in an east coast engineering design course composed of majority students (column 3), and report greater self efficacy than the group of west coast engineering students (column 2) (t=3.03 two tailed, =0.003). PLTL students did not report self efficacy at the level of computing (e.g., computer science, business, IT) students from HBCUs and PWIs.

In open-ended comments, students described the influence of PLTL on their sense of self-efficacy in their major: 55% of students described increases in self-efficacy in computing. Students with decreased self-efficacy noted that they had difficulty understanding the course material, or had earned poor grades. A few students also mentioned that they did not get along with or did not like their peer leader or course professor. Although these students experienced a dip in confidence, most of them were still committed to their major and hoped that they would have greater understanding of material or better grades in future computing courses.

“This was a pretty difficult course and I did not understand everything at its fullest. I hope it doesn't contribute negatively in the rest of the CS courses.”

Conversely, students with increased self-efficacy often cited success in the course or good grades as factors in their rise in self-efficacy in computing. Some students also mentioned that they had learned and retained the material well, or enjoyed the subject. Finally, students reported that high-quality teaching increased their confidence in the subject.

“I have had very good teachers and TA’s and I feel I’ve learned programming as well as confidence from them.”

“Me and mathematics do not get along in any way, shape, or form. (no matter how hard I try), yet I have had many successes this semester, and I plan on continuing this growth.”

Coping Self Efficacy- A student’s judgment of his or her capability to cope with a variety of barriers inherent to a computing/engineering major

“Find ways to overcome communication problems with professors or teaching assistants in your discipline”
PLTL student coping efficacy compares negatively with the groups in columns 3 and 4, though PLTL students had higher reported coping efficacy than the group of west coast engineering students. All mean values across populations are positive, mid-range responses. Coping efficacy items focused on students’ abilities to communicate well with professors and TAs, while the PLTL model introduces a new set of mentors, undergraduate students. It is conceivable that while PLTL did not directly influence students’ abilities to talk with professors, the initiative added a new human resource for students, which we discuss in the “social barriers and supports” section of this report. Additionally, we note that our survey asked students to describe a change in coping self-efficacy based on the PLTL intervention, and so student responses may be sufficiently different from a more general notion of an individuals’ ability to cope with departmental issues and culture without an intervention.

In an open-ended question, PLTL students described the influence of the course on their sense of coping self-efficacy. One-third of students noted decreased coping self-efficacy due to the difficulty of the course, or a heavy work load or time commitments for the major. These students were still committed to their major, yet had begun to realize that it may be more difficult than anticipated.

“Because there are many responsibilities other than going to school and studying, and taking this course makes me realize that this is a demanding major.”

On the other hand, two-thirds of PLTL students reported that supportive faculty or peer leaders, and academic success in the course had positively influenced their confidence to overcome obstacles to degree completion. This increase in coping self-efficacy was particularly important for non-traditional students returning to college later in life.

“Support from faculty has been one of the main reasons I haven’t lost confidence and been able to acclimate to the classroom environment after returning to school.”

“I was completely new to computer programming but excelled in my class. This gave me more confidence for my future classes.”

Outcome Expectations
**Outcome Expectations** - A student's judgment regarding the likelihood that valued rewards will occur as a result of pursuing a computing major.

“(To what extent do you feel you are) going into a field with high employment demand?”

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Outcome Expectations</td>
<td>8.35 (SD 1.69)</td>
<td>7.8 (SD 1.0-1.4)</td>
<td>8.29 (SD 1.03)</td>
<td>8.18 (SD 1.40)</td>
</tr>
</tbody>
</table>

PLTL students have similar or higher outcome expectations for their computing discipline than the comparison groups. CAHSI students had higher outcome expectations than the west coast university students with a more typical population of students (in terms of representation). Data show that students' experiences in PLTL show them the benefits of studying in the field.

**Computing Interests**

*Computing Interest* - An emotion that arouses attention to, curiosity about, and concern with a computing major.

“(How much interest do you have in) solving computer software problems?”

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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Interests</td>
<td>7.74 (SD 2.09)**</td>
<td>6.1**</td>
<td></td>
<td>7.76 (SD 1.34)</td>
</tr>
</tbody>
</table>

CAHSI students exhibit similar interest levels as the computing students from PWIs and HBCUs enrolled in computing-related disciplines, and greater interest (to a statistically significant degree) in their career field than west coast university engineering students surveyed. East coast introductory design students were not asked to describe interest levels.
Social Supports/Lack of Social Barriers

Social Supports/Lack of Social Barriers - Conditions of department, school, and social network of a student that promote successful completion of the computing major.

“(To what extent do you) feel that there are people “like you” in the discipline?”

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<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Supports &amp; Barriers</td>
<td>7.24 (SD 1.35)**</td>
<td>7.1</td>
<td>6.97 **</td>
<td></td>
</tr>
</tbody>
</table>

CAHSI students responded similarly to the east coast introductory design students regarding the support and barriers they experience in engineering majors. CAHSI students in PLTL felt significantly more supported in their endeavors than the computing students from PWIs and HBCUs. West coast student data did not include this measure.

Educational Goals

Educational Goals - Student intentions to persist in their computing discipline

“(To what extent do you) feel you will excel in your discipline over the next semester?”

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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Goals</td>
<td>8.38 (SD 1.89)*</td>
<td>7.54 (SD 1.44)*</td>
<td>9.18 (SD 1.22)</td>
<td></td>
</tr>
</tbody>
</table>
PLTL students compared favorably with east coast introductory design students regarding their intentions to persist in the computing major—the differences between the two populations were statistically significant. PLTL students did score significantly lower than the IT students from HBCUs and PWIs. All mean scores for all groups were above 7.5 on a 10 point scale.

In an open-ended question, PLTL students addressed the influence of the course on their intentions to persist in the major and pursue a computing career. Some students (48%) began to have second thoughts about a computing career due to the difficulty of the coursework and the amount of time required for a computing major.

“This major requires a lot of effort and time to obtain, probably a lot more than I had anticipated.”

On the other hand, one-third of students reported that their interest in a computing career had increased as a result of their PLTL course. Several students commented that the coursework was interesting and they would like to learn more about computing.

“Interesting work, I would like to go deeper into it.”

Some students also mentioned that peer leaders, faculty mentors, or a positive departmental climate had encouraged them to persist in computing. It was important for CAHSI students to have a sense of support from peers and faculty in order to want to continue in the major and pursue a computing career.

“The good feeling that there are people in the CS department that really want you to succeed.”

“The peer leading made me see how this career could be fun.”

Impact of PLTL: Creating supportive environments, Encouraging strong educational goals

The HBCU and PWI population of IT students tended to score higher than the PLTL students on most measures, except supports and barriers. The sampling procedures and the variety of students surveyed suggests this population is significantly different from the PLTL students, as they are studying in a variety of departments, and were recruited for the study in multiple ways by faculty in their schools rather than the course specific distribution of surveys like in PLTL and the other two samples. Given the differences in samples, we focus on comparisons of engineering student samples with PLTL students from CAHSI.

Following PLTL experiences, students at HSIs have similar outcome expectations ratings, similar perceived barriers and supports, and similar or better ratings of academic self efficacy as
more traditional populations of engineering students from two sample studies. Students from PLTL had higher interests in computing and most important for retention, **higher educational goal ratings** than more traditional populations of engineering students. Students had mixed results when comparing coping self-efficacy across populations.

**PLTL: Becoming Leaders, Becoming Mentors**

Peer-Led Team Learning cultivates pedagogical leaders, students who serve as role models for undergraduates and represent the “next steps” along the academic computing path. While leaders serve to promote undergraduate student development, the practice also solidifies their own computing knowledge, develops communication skills, decision-making skills, and other vital attributes of a competent 21st century computer science worker. Evaluators sought to discover whether the PLTL leadership experience led to the increase (or contributed to the increase) of undergraduate students, particularly underrepresented students, earning bachelor’s degrees in a computing field. We view students’ development of professional skills, interest in the computing field, and computing knowledge as retention factors of interest for PLTL leaders.

---

**PLTL Leaders’ Computing Knowledge**

Please answer to the best of your ability with regard to your PLTL leader experience.

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am typically able to answer students’ computing questions.</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Leading PLTL has increased my computing knowledge.</td>
<td>0</td>
<td>3</td>
<td>10</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>I understand computing concepts well enough to be an effective peer leader.</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>15</td>
<td>0</td>
</tr>
</tbody>
</table>

---

**Object 17: PLTL leaders’ self-report of computing knowledge**

Leaders were confident they held the knowledge they needed to lead PLTL sessions effectively (100%), and to answer student posed questions (95%) and most note that leading sessions increased their computing knowledge (86%) as well.

---

**PLTL Leader’s Professional Skill Development**

Please answer to the best of your ability with regard to your PLTL leader experience.

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>I don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leading PLTL has improved my interpersonal skills (in other words, my ability to cooperate with others).</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Leading PLTL has improved my leadership skills.</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>
Leaders gained interpersonal skills (91%), leadership skills (95%), oral communication skills (100%), teaching skills (95%), and to some extent, decision-making skills (64%) as they guided their peers.

<table>
<thead>
<tr>
<th>Leading PLTL has improved my decision-making skills.</th>
<th>0</th>
<th>3</th>
<th>10</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leading PLTL has improved my oral communication skills.</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Leading PLTL has improved my teaching skills.</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>15</td>
<td>1</td>
</tr>
</tbody>
</table>

**Object 18: PLTL Leaders’ Professional Skill Development**

Guiding students through lessons on computing concepts influenced peer leaders’ impressions of becoming professors (53%). For most, the experience was positive and led to increased interest or confidence—a feeling that the student could in fact become a professor.

“I always wanted to teach when I retired from my career and this has shown me that I have the skills to do so.”

“It has seriously enhanced my love of teaching.”

“PLTL experience has left an impression about being a computer science professor. Seeing what these students need to succeed and seeing the scenarios I faced when I was in their position has some influence that being a CSC professor is possible.”

For a few students, the experience helped them realize they would not want to become professors because of the stress and the time involved in planning and preparing for classes.

“As much as I love being a Peer Leader, I have no intentions to become a teacher.”

“I now realize how tough it can be to teach students and all the work involved in preparing lessons for them. I realize that teaching as a professor is not for me.”
Nearly all students found that leading PLTL sessions increased their interest in a computing career (91%). This may be the case because when they taught the concepts to others and related them to everyday ideas, they learned more about their own field.

**PLTL Leaders “look like me”**

Because leaders are chosen from the undergraduate pool of students who were recently successful in the target course, leaders are often known to the students they guide, are from similar communities, and share similar experiences. This resemblance to a mentor is shown to be particularly salient for underrepresented students, who rarely find like role models in the field of computing. Leaders in the spring of 2009 had the following characteristics.

**Objects20-23: PLTL Leader Demographics**

The majority of student leaders were seniors, though nearly a quarter were juniors. Leaders were divided rather evenly by experience, with nearly one quarter of students participating for the first, third and fourth semesters as leaders, while a lightly larger number were leading for the second time in the spring of 2009. Most of the leaders were men, and half of the leaders were Hispanic. Given that women are also significantly underrepresented in computing fields, CAHSI may be well served by attempting to recruit more female peer leaders to serve as role models for female computing majors.
PLTL seemed to increase student knowledge, interest in computing, and students’ professional skills, according to PLTL leaders. PLTL student responses confirm that leaders were knowledgeable, helpful mentors through the target courses. Creating a cadre of mentors on campus who resemble the underrepresented students CAHSI schools serve appears to benefit not only the undergraduates receiving mentoring but the mentors themselves as well. It appears that PLTL is a useful practice for increasing the number of students, particularly underrepresented students, who earn baccalaureate degrees in computing.

**Computer Science Zero- Increasing Regard for Computing Careers**

**Computer Science Zero Survey Responses, spring and summer 2009**

Computer Science Zero is a course designed to introduce computing concepts to students who are A) majors ill-prepared for computer science 1 courses or B) non-majors engaged in an elective or summer bridge course. CS-0 students took the same SCCT survey regarding computing careers that the PLTL students (nearly all computing majors) took at the end of their semester of CS-0.

Students represented five schools in the spring of 2009 data set, and 15 different majors. Nearly two thirds of those responding to the survey indicated they are Hispanic, and two thirds indicated a GPA of 3.0 and above. About a quarter of students’ mothers attended some graduate school or received a post baccalaureate degree, about a third attended some college and/or received a 2 or 4-year degree, while the remaining students’ mothers attended some high school or finished high school with a diploma or GED. Students fathers’ were more likely to attend some college though less likely to attend graduate school.

As CS-0 students are not all majors, we would expect that they would gain interest in computing fields, but may not exhibit the same levels of self-efficacy in academics. Because CS-0 courses often introduce computing career information we might expect that the CS-0 students report positive outcome expectations for computing careers. The collaborative, collegial nature of computer science zero courses may similarly enhance majors’ attitudes regarding social support in the computing field.

<table>
<thead>
<tr>
<th>SCCT constructs (Scale of 1-10)</th>
<th>Number of all students (number of computing students)</th>
<th>Percent all students reporting increase/positive ratings (5.50 or better average)</th>
<th>Overall Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome Expectations (11 items)</td>
<td>41(7 majors)</td>
<td>88%</td>
<td>7.76</td>
<td>1.999</td>
</tr>
<tr>
<td>Social</td>
<td>NA (7 majors)</td>
<td>100%</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

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Supports/Barriers (majors only) (8 items)

| Computing Interest (5 items) | 38 (7 majors) | 74% | 6.46 | 2.592 |

Object 24: CS-0 Student Average Scores on Social Cognitive Career Theory Constructs (Lent, Et. al. 2008)

From the data presented above, we find that students’ average ratings over multiple survey items for the three key elements in computing career choice are consistently positive. For each category, between 74% and 100% of respondents averaged over 5.5 on a 10 point scale, indicating most individuals reacted positively to computing following the CS-0 course across categories, with computer science majors indicating higher scores in all categories.

Following our hypotheses, overall averages show CS-0 students stated their interest increased in computing activities (such as solving problems with computers) and expressed positive educational outcomes (such as improving lives and receiving high salaries in computing careers) for computing degrees. Computer majors perceived supportive academic communities within computer science departments.

It is important to note the relatively low scoring construct (6.46 out of 10), interest regarding computing activities. The items in the survey asked students to rate their interest relative to their interest before entering the course. Evaluators found through pre-post measures of CS-0 in past semesters that students enter the course with high (perhaps inflated) perceived interest in computing, that remained relatively flat or unchanged during the course. We submit that youth have a great deal of peripheral, positive experience with using the computer as a tool. This experience may shape entering interests in computing activities which then is put into perspective in the CS-0 course, as they begin to understand the complexities of computer use and computer programming.

We found that 26% of students did not experience an increase in computing interest, though many of these same students did experience positive perceptions or changes in all other categories (8 of 10 who did not experience increase in interest), while one student had negative scores across all 6 categories and another responded negatively in one additional category. In open-ended comments, CS-0 students discussed the influence of the course on their career intentions and their sense of self-efficacy in computing. Some students noted that “good teaching” and enjoyable curriculum had influenced their thoughts on computing careers.

“I liked this course in computer programming so I think I would like to continue on this path in computers.”
Some students also mentioned that the knowledge they gained from the course, along with the success they experienced, contributed to an increased interest in computing careers.

“My first attempt to learn programming through a class in high school overwhelmed me and put me off to majoring in computer science. After this class, and seeing a slow pace that is easy to learn with, my interest in the subject has increased.”

Some students also noted an increased sense of self-efficacy in computing. For these students, experiencing success in CS-0 helped to increase their sense of mastery of computing and interest in the subject.

“Learning basic concepts of programming in the class helped me feel that programming a computer may be something I could actually do.”

**CS-0 in Context—Comparing CS-0 results with publicly available data from similar students**

As we searched for results for comparison to PLTL students, we found a recent study of majors’ and non-majors’ interest in information technology careers that provided adequate mean, standard deviation, and sample description for inclusion in this report. Survey constructs resembled but did not correspond exactly to social cognitive career theory constructs as described, as can be seen in the table below.

<table>
<thead>
<tr>
<th>Publication/ Authors</th>
<th>Hug Thiry Weston Reynolds (CAHSI)</th>
<th>Johnson, Stone, &amp; Phillips (2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study participants</td>
<td>Forty seven students enrolled in CS-0 courses in the spring of 2009. Represent four CAHSI HSIs.</td>
<td>Two hundred fifty seven students from two southeastern colleges/universities, ~60% African American and 40% Caucasian; from all majors</td>
</tr>
<tr>
<td>Intervention (if applicable)</td>
<td>CS-0</td>
<td>None</td>
</tr>
<tr>
<td>Sampling Procedures</td>
<td>All students in target courses (for dual HS/college credit and for college credit) were asked to take the survey and were given time to complete the survey in class. Spring semester 2009 and summer 2009.</td>
<td>All students recruited from various introductory undergraduate courses with various majors</td>
</tr>
<tr>
<td>Student sample</td>
<td>All students</td>
<td>All respondents (majors)</td>
</tr>
</tbody>
</table>
Comparison with published data regarding career interest in information technology shows that CS-0 students have more positive attitudes regarding CS/IT jobs, and perceive fewer social barriers/more social supports regarding entering the CS/IT field.

**Advancing Undergraduate Students**

Affinity Research Groups (ARG) are designed to socialize students into professional computer science research communities of practice. ARG students were invited to complete a survey in the spring and summer of 2009. The survey was adapted from the Undergraduate Research Student Self-Assessment (Laursen, Weston, & Hunter, 2009), an instrument designed and rigorously tested to assess students’ intellectual, personal, and professional gains from participation in research. Fifty-three students completed the survey during spring and summer 2009.

ARG students were primarily undergraduates, with a few graduate student participants. Undergraduate students tended to be upperclassmen. Many ARG students were relatively inexperienced researchers. The majority of students (55%) had only completed 1-2 semesters or summers of research. ARG students were predominantly Hispanic (69% of students), and male (81% of students). The gender representation of ARG students is consistent with the national average: in 2005, 22% of bachelor’s degrees in computer science were awarded to women (NSF, 2006).

**ARG students understood their research tasks and goals**
Affinity Research Groups teach students valuable research skills, dispositions, and understandings through structured mentoring within the research group, and deliberate emphasis on skill building, project management, and goal setting. ARG students answered a series of questions about the clarity of their project goals, its fit with the work of the research group, and their sense of ownership of their research tasks. The overall mean for these items was quite high (3.49 out of 4.0),\(^5\) indicating that most students had a solid understanding of the tasks at hand and how they related to the work of the larger group. A sense of ownership over the project and clarity about the project’s goals are essential for achieving the greatest gains from an apprenticeship experience in research (Thiry, Hunter & Laursen, 2010).

**Students’ top gains were technical knowledge and research skills**

Students were asked to pick their top three gains from their research experience. The most frequently selected gain was technical knowledge. Students also cited research skills, personal growth, and communication skills as prominent areas of learning. Students’ selections of their top three gains areas are outlined in the figure below.

### Research gain scales

Students evaluated their growth and development in several areas:

- **Career clarification:** Clarification and/or confirmation of students’ career and educational goals.

---

\(^5\) All gains items were rated on a 4.0 point scale with 1=strongly disagree, 2=disagree, 3=agree, and 4= strongly agree.
- **Personal growth**: Growth in confidence, interest in computer science, independence and responsibility.
- **Collaboration/teamwork**: Increases in teamwork skills, and the extent to which students worked collaboratively with their research groups and contributed to the work of the larger group.
- **Skills**: Increases in communication skills, and intellectual and problem-solving skills.
- **Understanding the computer science research process**: Increases in students’ understanding of the research process in computer science, and greater appreciation for the relevance of computer science coursework to research.

Students made roughly equal gains in all of the above categories (means of 3.2 to 3.4 out of 4.0). Tests of statistical significance revealed no statistically significant differences for gender, institution, or amount of research experience. However, there were statistically significant differences in outcomes between Hispanics and non-Hispanics.

**Hispanics make stronger gains than non-Hispanics**

While participation in Affinity Research Groups clearly benefited all students, Hispanics consistently reported higher gains than their peers. The figure below illustrates the means for Hispanics and non-Hispanics on all of the research gains scales. Hispanics reported higher gains on all scales, with statistically significant differences in career preparation and understanding the research process. These gains are particularly important for Hispanic students as they may enter the research experience with less confidence and background knowledge than their majority peers. See figure below.

**Means for research gains**

*Comparison of Hispanics and non-Hispanics, (n=53)*

<table>
<thead>
<tr>
<th></th>
<th>Hispanic</th>
<th>Non-Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding the research process*</td>
<td>2.92</td>
<td>3.32</td>
</tr>
<tr>
<td>Confidence/interest</td>
<td>3.19</td>
<td>3.33</td>
</tr>
<tr>
<td>Collaboration/teamwork</td>
<td>3.16</td>
<td>3.34</td>
</tr>
<tr>
<td>Career preparation*</td>
<td>3.09</td>
<td>3.42</td>
</tr>
<tr>
<td>Skills</td>
<td>3.15</td>
<td>3.52</td>
</tr>
</tbody>
</table>

Object 27: ARG Student Comparisons of Hispanics and non-Hispanics for Research Gains
ARG students gained intellectual and communication skills

Students’ reported gains in skills as their strongest research gain. Students gained a variety of skills from their research experience, including intellectual and problem-solving skills as well as communication, oral presentation, and scientific writing skills. The Affinity Research Group model emphasizes communication skills and provides students with multiple opportunities to learn and practice these important scientific skills. The overall mean for all students on the skills scale was 3.4 out of 4.0.

ARG students gained confidence and interest in their field

Participation in research helped students to gain confidence in their abilities, become more independent as learners, and increased their interest in computer science. The overall mean for all of the items related to personal growth was 3.28 out of 4.0, indicating that students made strong gains in this area, although not as strong as higher rated areas such as skills and career clarification. Gains in confidence and interest are particularly important for minority students because their persistence in their majors is more closely linked to their enthusiasm for their discipline than it is to their GPA (Grandy, 1998).

ARG students became more interested in graduate school

Students rated gains in career and educational preparation as one their top gains areas. The overall mean for items related to the clarification or confirmation of career goals was 3.31 out of 4.0—the second highest mean of any gains scale. Therefore, students strongly believed that research helped to prepare them for graduate school and/or a career and helped their decision-making process about their future goals.

Additionally, 72% of students felt that their research experience had influenced their thoughts and impressions about graduate study, increasing their likelihood of pursuing terminal degrees. Students had the opportunity to expand on their answer in an open-ended comment. The most common response (44% of students) was that students had learned what graduate school and research are like from working with graduate students during their research experience.

“I now know how the working environment, research expectations and team communication is like.”

“I now understand that graduate school for Computer Science majors involves a significant amount of research. Therefore I am now more interested in continuing to perform undergraduate research to be better prepared for graduate school.”

Greater knowledge about graduate school also instilled confidence in students that they could successfully complete the degree; thirty-six percent of students described increases in confidence or interest in computing as a result of the their participation in Affinity Research Groups.
“Working close to Graduate students helps me feel more comfortable with the possibility of attending graduate school.”

A few students (12%) had already decided to attend graduate school before participating in an ARG; therefore, research did not influence the decision. However, participation in research helped to reinforce their decision as they realized that they were on the right educational path.

I found the research interesting first of all. I've always had graduate school in the back of my mind but it was through the experience of the research fellowship that reinforced my wanting to pursue graduate studies.

A few students also commented that their faculty research mentors had played a key role in their increased interest in graduate school.

With the advice from my faculty mentor and after discussing career options we came to the conclusion that graduate studies is the best course for me.

No students reported that they had been negatively influenced about graduate school from their research experience. Indeed, poor research experiences can give students negative impressions of graduate study and “turn them off” from graduate school (Thiry, Laursen, & Hunter, 2010). Therefore, it is encouraging that students only reported positive impressions of graduate study from their experiences in ARGs.

**Research experience and faculty mentors inspired students to pursue graduate school**

Students enrolled in or interested in attending graduate school noted a range of influences on their decision to pursue a graduate degree. Students’ faculty research mentor and the research experience itself were their primary influences to attend graduate school. The data suggest that research experiences and supportive mentoring are essential for encouraging underrepresented minority students to pursue graduate school.

Parents and family were also important influences in students’ educational decisions, and to a lesser extent, graduate students or undergraduate peers. See figure below.
Object 28: Influences on ARG students’ Decision to Pursue Graduate School

In sum, participation in research helped students to confirm, clarify, or refine their career and educational interests and goals. Students’ research experience was the most influential factor in helping them to decide whether to enroll in graduate school. Students benefited from observing graduate students at work and learning about the roles and responsibilities of graduate students.

Participation in research had little influence on students’ aspirations to be a professor

In contrast, few students reported that participation in research had influenced their thoughts or intentions to be a professor. In fact, 72% of students commented that their research had no influence on their aspirations to be a professor because they had never considered it as a career path. Other students felt the goal was too distant and that they needed to focus on near-term goals before contemplating the professoriate.

“At this stage, the idea of ever becoming a professor is quite distant, although it does not mean I will not consider it. My view is to concentrate on the closer goals, namely completing my undergraduate degree, and then concentrate on graduate degree. Not until somewhere during my graduate studies I could consider a doctoral degree.”

However, some students (18%) were motivated and inspired to become a professor as a result of their participation in research. These students decided that they enjoyed teaching and helping other students and that the professoriate would allow them to help and mentor students in their career.

“I really feel that my research within the computer science field had motivated me more to this career choice. By helping others within the research group gives me a feeling of accomplishment and enjoyment. This would really be wonderful to work with and help other aspiring computer science students.”
Affinity Research Groups modeled effective strategies for teamwork and collaboration

Affinity Research Groups are deliberately designed to provide structured mentoring opportunities for students, and to help students develop research skills, disciplinary knowledge, and teamwork skills. ARG students reported strong gains in developing collaborative relationships and teamwork skills, although this was their fourth-highest rated gains area. Students were asked a series of questions about the collaboration among their research group. The overall mean for the questions on this scale was 3.28 out of 4.0. Students felt that they were an essential part of the research group and that they contributed to decisions that impacted the direction of the research group. Students also valued their research mentors, reporting that they felt comfortable talking to their mentor or professor about problems. Students also felt that they had the appropriate amount of guidance that they needed on a project.

In an open-ended question, students documented their processes for resolving disagreements within their research groups. By far, the most frequent response (60% of students) was the use of discussion and debate to resolve differences. Students emphasized that they resolved conflict as a group with each person contributing and debating. Students did not depend on a leader or faculty advisor to solve their problems for them.

“Essentially, as a group we have all talked about said problems and discussed ways to better the group, manage time, and what could be done to better achieve our goals quicker and better than before. These new suggestions that are made come from the group itself, not just the group leader.”

To a lesser extent, students (30%) described a process of analyzing and examining options, choosing the best solution and developing a plan to implement it. Many students emphasized that they chose the solution that would be best for the project as a whole, rather than what might be best for a particular individual in the group.

“People provide arguments for their sides until one side’s argument is shown to result in the greatest net positive effect for the project, or particular aspect thereof.”

Therefore, ARG students felt that they were valued members of their research group who contributed to the work and direction of the group. Students also felt comfortable with their research mentors and peers.

Students participated in professional computer science research communities

Affinity Research Groups also socialize students into professional computing communities of practice, thereby helping students to develop identities as computer science researchers. An important step in develop an identity as a researcher is communicating research results to the larger scientific community. Thus most ARG students had the opportunity to disseminate their research results in a professional forum of peers and experts. Almost all ARG students attended a professional conference within the past year. Less often, students had the opportunity to present or publish their results; however,
our prior research on UR has shown that these accomplishments are rare for undergraduates (Hunter et al., 2007; Seymour et al., 2004). Nevertheless, almost half of ARG students presented a poster at a conference in the past year, 13% of students authored or co-authored a journal manuscript, and 15% presented a conference paper. Therefore, ARG students seemed to have had ample opportunities to engage in authentic research that led to publishable results.

<table>
<thead>
<tr>
<th>Professional activity undertaken in the past year (n=53)</th>
<th>Number of students</th>
<th>Percentage of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended a professional conference</td>
<td>41</td>
<td>77%</td>
</tr>
<tr>
<td>Authored or co-authored a journal paper</td>
<td>7</td>
<td>13%</td>
</tr>
<tr>
<td>Presented a conference paper</td>
<td>8</td>
<td>15%</td>
</tr>
<tr>
<td>Presented a poster at a professional conference</td>
<td>25</td>
<td>47%</td>
</tr>
</tbody>
</table>

Object 29: Affinity Research Group professional activity

Comparison to national data: Do CAHSI research opportunities compare favorably to related programs?

While it is difficult to imagine a “control group” of students to compare with ARG students at CAHSI institutions, it is possible to compare ARG student gains to other students who also are involved in undergraduate research in the sciences. In this report, we compare ARG student gains for those at CAHSI institutions with a large sample of students who engage in undergraduate research across the United States. The comparison sample of students represented a variety of STEM disciplines. They were predominantly from research-extensive universities, although students from primarily undergraduate institutions, master's degree granting institutions and UR programs designed for underrepresented minority students, were also represented. We compare CAHSI student means on parallel survey items from the Undergraduate Research Student Self Assessment (URSSA) to a sample of 573 undergraduate researchers6. Our hypotheses regarding these comparisons were:

1. The ARG CAHSI respondents will have more opportunities to engage in academic activity than those in the comparison study, because of CAHSI-related venues for presentation, and funding for travel.

6 Data were obtained in a related project at Ethnography and Evaluation Research at the University of Colorado at Boulder [http://colorado.edu/eer/research/undergradfaqs.html](http://colorado.edu/eer/research/undergradfaqs.html)
The ARG CAHSI respondents will report similar gains in research skills and knowledge as those from the comparison study. See tables below. Those with statistically different scores at the two tailed (research gain) or one tailed (professional activity accomplished) 95% confidence interval are marked with **.

<table>
<thead>
<tr>
<th>Research gain (4-point scale)</th>
<th>CAHSI Mean (s.d.)</th>
<th>National sample of summer REU students Mean (s.d.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication skills [t= 7.705]</td>
<td>3.40 (.885)**</td>
<td>2.39 (.902) n=428</td>
</tr>
<tr>
<td>Career Preparation [t=0.1016]</td>
<td>3.31 (.487)</td>
<td>3.30 (.697), n=469</td>
</tr>
<tr>
<td>Personal and professional gains [t= 0.9891]</td>
<td>3.28 (.455)</td>
<td>3.17 (.795), n=483</td>
</tr>
<tr>
<td>Intellectual gains [t=0.6269]</td>
<td>3.19 (.497)</td>
<td>3.12 (.796), n=492</td>
</tr>
</tbody>
</table>

Object 30: Researcher’s Self-reported Gains as Measured by URSSA

<table>
<thead>
<tr>
<th>Professional Activity Accomplished</th>
<th>Proportion of ARG CAHSI Students</th>
<th>Proportion of National Sample Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended a Professional Conference [z=8.114]</td>
<td>77%**</td>
<td>23%</td>
</tr>
<tr>
<td>Authored or Co-Authored a Journal Article [z=1.647]</td>
<td>13%**</td>
<td>6%</td>
</tr>
<tr>
<td>Presented a Paper or Poster at a Professional Conference [z=6.517]</td>
<td>51%**</td>
<td>14%</td>
</tr>
</tbody>
</table>

Object 31: Researcher’s Self-report of Academic Research Activity

Comparisons were made using two-tailed t-tests for the measure of gains (based on hypotheses that there would be no difference in gains) and using one-tailed z-tests to compare proportions of students who have participated in the above academic research activity (based on the hypothesis that CAHSI students would have more opportunities to participate in academic research activity). Comparisons show that ARG students at CAHSI schools are much more likely to report communication skill development than other students in other research for undergraduate positions. This could be attributed to the ARG model and its focus on communication between members of the research group.

CAHSI students were much more likely than the comparison groups to attend professional conferences, author or co-author a journal article, and present a poster or academic paper. These activities are vital to students’ academic achievement and support students’ advancement in their academic fields.
Conclusion

Participation in research has numerous benefits for students and the Affinity Research Group model has boosted students’ interest in computing careers and graduate school and their confidence in the field. In keeping with the ARG model’s emphasis on teamwork and communication, students learned to work collaboratively within their research group and gained skill in democratically resolving disagreements among group members. Many students also had the opportunity to attend professional conferences and a sizeable minority disseminated their research results through conference papers or peer-reviewed journal articles. Clearly, Affinity Research Groups have contributed to the professional socialization of undergraduate students and their aspirations to advance in computing fields.

Development Workshops

CAHSI students are advancing their academic careers across the academic computing pipeline as a result of their participation in the CAHSI annual meetings. Students near the beginning of the career path applied for scholarships (26%, 13 students), inquired about graduate school opportunities (46%, 23 students), and submitted applications for graduate school (12%, 6 students). Also, advanced students sought academic positions following their time with CAHSI (14%, 7). Percentages are reported in comparison to all student respondents, though it is important to note that none of the students would be in a position to complete all listed activities.

<table>
<thead>
<tr>
<th>STUDENT ACADEMIC ADVANCEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have applied for academic employment following my CAHSI 2009 Conference participation.</td>
</tr>
<tr>
<td>I have applied for graduate school based on the information from the CAHSI 2009 Conference.</td>
</tr>
<tr>
<td>I have inquired about graduate school opportunities based on information obtained at the CAHSI 2009 Conference.</td>
</tr>
<tr>
<td>I have applied for academic scholarships following the CAHSI 2009 Conference.</td>
</tr>
</tbody>
</table>

Object 32: Students’ Reported Activities Following CAHSI Event—Academic Advancement

Over one third of students who responded to the survey have since searched for corporate careers following the CAHSI annual meetings based on information received at the conference (34%, 17 students).
students). Also based on information from CAHSI, students applied for industrial professional positions (20%, 10 students).

**Object 33: Students’ Reported Activities Following CAHSI Event—Industry Advancement**

Students who responded to the CAHSI meeting survey were most likely to contact other students following their participation at the January 2009 meeting (52%, 26 students). To a lesser degree, students made contact with faculty (27%, 13 students) and industry professionals (22%, 11 students). Additionally, 11 students volunteered to become CAHSI advocates at their schools.

**Object 34: Students’ Reported Activities Following CAHSI Event—Communication**

STUDENT INDUSTRY ADVANCEMENT

I have applied for industry employment following my CAHSI 2009 Conference participation.

I have searched for corporate careers based on information received at the CAHSI 2009 Conference.

STUDENTS’ COMMUNICATION WITH CAHSI MEMBERS

I have contacted a student I met at the CAHSI 2009 Conference.

I have contacted a faculty member I met at the CAHSI 2009 Conference.

I have contacted an industry professional I met at the CAHSI 2009 Conference.
Dissemination of ARG outside CAHSI- evaluation of workshops to new adopters

Affinity Research Group workshops were held in national venues to disseminate the ARG model to non-CAHSI participants. Data from two university workshops, one student SACNAS workshop, and one SACNAS faculty workshop are reported here, constituting 40 responses.

Overall workshop experience- organized, resource-rich, and relevant

Students and faculty alike saw the workshop as well organized (90%, 36 participants), full of resources (88%, 35 participants), and relevant to their studies or careers (88%, 35 participants). Workshop participants found the presentation of material to be clear (90%, 36 participants).

Expanding professional networks, learning from colleagues

The majority of workshop participants found the workshop gave them an opportunity to learn from colleagues (88%, 35 participants) and to expand their networks through interaction in the workshop (90%, 36 participants). A majority of participants would in turn recommend the ARG workshop to colleagues (90%, 36 participants).

Workshop helped to achieve goals

Getting better at communicating with a team, solidification and clarification of best practices in research, and academic critique were listed as skills developed or knowledge gained. Some faculty stated they will be better prepared to incorporate undergraduates into research work, and undergraduates said they were learning how to better facilitate team work. Students found the critique of academic posters a valuable exercise, as they needed to know how they will be judged in the future.

Dissenting opinions

A few participants consistently marked low scores for the workshops. Two of them may have been clerical errors, as the open-ended responses indicated they learned a lot from the workshops. Those participants with a negative opinion of the workshop indicated they found the collaborative method condescending, had anxiety when working in groups during professional development, and/or needed more guidance during group work activity.

Fem Prof and Mentor Grad- Targeting Promising Students for Doctoral Study

The purpose of this section is to summarize evaluation findings regarding Fem Prof over the past year to describe and analyze the benefits of the National Science Foundation Demonstration Project, specifically regarding the following aspects: Student recruitment, Research mentoring, Career path.
mentoring, and Feminist empowerment. We provide recommendations based on data regarding participants’ experiences. Data were collected from the following sources:

- Surveys of student participants, research mentors, and Fem Prof coordinators
- Interviews with student participants and Fem Prof coordinators
- Participant observation at national meetings, conferences, campus events, and workshops
- Focus groups with student participants

**Fem Prof Program Goal 1: Recruitment**

Recruitment of women into the Fem Prof program has been challenging at both UHD and UPRM, as so few women are enrolled in computing majors nationally and locally. Both schools have targeted each woman in computing majors, and UPRM has expanded to cover young women in electrical engineering. The dearth of females have led to smaller numbers in the 2009 cohort year thus far, though all coordinators report continued efforts to recruit.

Fem Prof participants are spreading the word, holding events on campus for recruitment of new students. Faculty are attending computing courses and presenting the program to prospective students, and seeking out the students during their course schedules in an effort to increase participation. As CAHSI initiatives take hold in the Fem Prof institutions (e.g. PLTL, CS-0, ARG), coordinators may see larger cadres of female students to recruit into Fem Prof.

**“Opting out” of Fem Prof—Two Students withdraw from the Program**

The lead evaluator had an opportunity to speak with two students who withdrew from the program at the fall 2009 Grace Hopper conference. Both chose to formally discontinue their participation based on experiences within and outside of the program. This section briefly documents their decisions to withdraw from the program. Note that both women were traveling with the Fem Prof group of students and faculty, indicating the two past participants and the current group of participants continue collegial relationships.

Yolanda* received a scholarship from the Anita Borg foundation to attend the Grace Hopper conference. She had attended the previous year and enjoyed the conference, leading her to actively seek funding to attend in 2009. Yolanda stated that in her summer research experience at another campus, she learned her strengths and weaknesses as a computer scientist. She found that she is skilled when following instructions or following strict procedures, but that developing new programs and fulfilling loose programming requirements with limited direction was not something she could do with ease. In her REU,
she had difficulty developing new ideas and determining a plan of action for developing code. For the most part she worked with a pair of undergraduate students with limited guidance from faculty, and felt “lost” most of the time. She said “I (saw) that I didn’t have all the skills (I needed) to go to graduate school.” Her outside research experience led her to decide that she was not capable of developing new knowledge through research. It is important to note that research experiences can “de-motivate” students when they are not well guided or facilitated in a way that promotes self-efficacy in the field.

According to Tea*, her personal experiences with industry internships and her new-found knowledge about what is required to earn a PhD led her to decide the path was not for her. “You need to like to study to go to graduate school,” Tea said. She realized through the program that she did not enjoy studying enough to continue through graduate school. Tea said “Working at a small company...in an information technology department would be a better fit for me, and that's what I want to do when I graduate.” Her attendance at Fem Prof program events helped her make an informed decision regarding her career path. She says Fem Prof leaders directed her to industry opportunities of interest at the Grace Hopper conference, and support her decision.

Fem Prof Program Goal 2: Research Mentoring

Research skill development

On average, students demonstrated moderate gain in developing a range of research skills: critical thinking, problem-solving, taking extra care with techniques and data collection, creative thinking, presenting/defending ideas, and solidifying knowledge through teaching/presentation. One exception is the ability to understand how to frame research questions, where 54% of the students indicated good gain.

Confidence and pride in research efforts

According to Fem Prof research mentors, the majority of the students demonstrated confidence gains – 91% experienced at least moderate gain in their ability to do science, and 82% in presenting/defending ideas. Similarly, 82% of the students took ownership of elements of their research project. All students showed at least moderate gain in taking pride in their accomplishments.

Fem Prof Goal 3: Career Path Mentoring
Career Path Progress: Five Students Accepted to Programs, Continuing Students Aspire to Attend Graduate School

All of the five Fem Prof women who graduated this year were accepted into doctoral degree programs in 2009. The goal of Fem Prof is to reach students before their final year as undergraduates, but five promising and interested seniors (fourth year students at UHD, fifth year students at UPRM) joined in 2008. Two pairs of students were accepted to graduate school together in 2009-2010, one pair at a local institution.

Evaluation results show a shift in thinking that some students made as they engaged in Fem Prof. Some of their statements indicate different goals for their futures after being exposed to research, academic conferences, and support for applying to graduate studies. A few students expressed regret that they had to rush to complete their applications and GRE preparation; as students in their final years of study, the women were not members of the targeted group of juniors and fourth year students Fem Prof hoped to recruit. Their accomplishments are thus more impressive—as one Fem Prof student put it, “I can’t imagine what the next years’ students will be able to accomplish.”

Fem Prof Program Goal 4: Feminist Empowerment

Throughout the Fem Prof program, we have focused on feminist empowerment as a construct of interest. Research questions that address this focus are: Are Fem Prof students becoming more cognizant of male dominance in the computing field, and of how that dominance may affect their academic paths and careers in the field? Are Fem Prof students developing strategies for coping with male dominance in the computing field? Qualitative data uncover the critical incidents that both focus student attention on issues of gender discrimination and encourage the Fem Prof women to take on proactive, empowered stances toward gender discrimination in the computing fields.

Denying and Discounting Gender Bias—“Why are we always talking about this?”

Throughout interviews and focus groups in 2008 and 2009, we found some Fem Prof students would rather avoid the topic of gender and its impact on their academic and professional careers. When asked (in some cases for the third time) about any instances in which they felt men and women were treated differently in class, many would quickly restate the answer they provided in previous discussions, explicitly mentioning that this question was asked on previous occasions.

The impression made was that this topic was covered already, and that students felt the same as they had before. Titus (2002) writes about students engaged in social justice curriculum and programming. She states students often discount or deny that bias exists, treating the subject matter as
“no longer a problem”. In the beginning of the Fem Prof program, many women took this stance. **Two events seemed to change these perceptions, causing a shift for some women in how they view being female in a male-dominated discipline—attending the Grace Hopper conference as a Fem Prof cohort, and presenting a panel at the annual CAHSI conference.** The Grace Hopper conference was the first national event that showed Fem Prof students the struggles faced by technical women, as well as the possibilities for women in computing. In essence, the conference showed students that **gender matters in their field.** Data suggest the experience of leading a panel on gender bias seemed to empower female presenters (as well as their peers) to discuss matters of gender bias in computing.

**Mentor Grad – Encouraging Students to Advance**

For the most part, students illustrated an increase in several BPC goals, often crediting CAHSI for their progress. Interviews with students uncovered a self-reported increase in interest in computing education, coping with STEM program demands, sense of community in the department, and opportunities for career-enhancing activities. These four goals are discussed below.

**Interest in Computing Education**

When discussing their interest in computing education, students described how Mentor Grad gave them access to knowledge about computing education and computing careers, something of particular importance to first-generation college students. Furthermore, students recognized the role of professors, graduate students, research projects, and courses in providing them with access to information about graduate work and careers.

“Well, pursuing a master’s degree is something that I always wanted. ...I didn't have much information about it because most of my family has never even gotten a bachelor’s degree. So, I really didn't have anybody to go to who had a first-hand experience (with graduate school). So the research program actually gave me that, you know, I saw that opportunity there. I saw all of that information that I was seeking for graduate school.”

“My mentor is great, he taught me a lot about grad school and things I can do to prepare but even if I didn’t have a mentor like Dr. Kross*, I think that going to symposium provide a lot of tools for you to find out about opportunities out there. The program gives you better access.”

Students report that Mentor Grad helped them to decide to continue on to graduate school and emphasized the critical role that professors play in that decision process.

“The program definitely helped nudge me in that direction. It made me certain that's what I want to do, before that it was just a thought and didn’t commit to it; I wasn’t planning on it.”

“So the program 'Mentor Grad' really kind of put the seeds in my mind to go to graduate school because previous to, um, talking to Dr. Goff* about it I really wasn’t thinking about, um, graduate school ...I wasn’t thinking that it was a possibility for me to be a professor.”
The importance of graduate school was frequently mentioned; however, students also recognized the importance of working in the computing field and how their internships helped them to see that they need hands-on experience outside of academia.

“I want to say, you know, the ultimate goal would be to get your masters degree. I want to pursue that I do, ahh not immediately… I think would feel much more confident if I had much more knowledge than I do right now. Going out there and actually doing (computing) work on the outside would give me that confidence that I am looking for.”

Although some students mention that conversations with professors encouraged them, others discuss how they were discouraged to pursue graduate work by faculty outside of their institutions. This finding points to the need for systemic change in the computing culture that goes beyond the work of one BPC alliance, and in turn for the need to counsel students through negative feedback. One student reported that a professor in her department encouraged her to be a professor; however, after talking with a professor from another university she changed her mind.

“I was interested in becoming a college professor. Dr. Paul* actually talked to me about it and it sounded like something I would be interested in doing. …The flip-side of that is when I went to a meeting this year Dr. Paul wanted me to go to, I talked to a computer science professor and he was actually pretty negative about, about me becoming a professor because he felt like I was too old.”

When students spoke about their interest in pursuing graduate work schools that offer specialized computing programs, such as game development, were especially appealing.

“I’m looking forward to applying for a Ph.D. because some of the schools, like the University of Southern California or UH main campus – they’re going to have a game development field for computer science.”

Another theme that became evident in interviews with CAHSI students was that students readily connect the skills they are gaining in school with real world applications of their degree. In other words, whether students are continuing on with graduate work or heading into a computing career, the direct connection between their education and a job is clear.

“When I was undergrad there were a lot of classes that I still wanted to take and I really felt that I wanted to push myself even farther. An undergrad advisor recommended to go into grad school to better acquaint myself with programs I’m learning. (He said that graduate school) would also give me higher advantage when I get out there and start looking for jobs.”
Students reported a range of reasons that prompted their interest in computing. Some students said that they have always been interested in computing and that their high aptitude for the academic coursework has helped them to be successful. Some students report that individual drive is critical for succeeding in the computing major, rather than recognizing any outside support as having an influence.

“The whole computer gaming aspect caught my interest—to see how you could apply everything you learned into an interactive experience for other users.”

Other students report that support and encouragement from professors was a major reason why they chose, or chose to continue with, their computing degree:

“When I began computer science my undergrad advisor was the first professor I had, and she pushed me, said I had a lot of potential because I am a problem solver and good at breaking things down into basic blocks. She was really the one who pushed me and helped me to continue with my computer science career.”

Coping with Demands of Computing Degree

In terms of learning to cope with the demands of their computing degrees, students once again identify the support of professors as significant. Having approachable professors and mentors was repeatedly mentioned as important. In addition, some students also noted how professors vary in making themselves available for students.

“It is mainly the support of my professors. I appreciate Professor Tilly* was the professor that actually made me keep on moving forward even though it was difficult at the very beginning and I am glad she did. I am progressing and my professors are there for me.”

“In our department they have tutoring for people who need help with computer science. There’s a tutor lab for that. …If I have any questions or doubts I just go up to them. Uh, sometimes the professors are available, like if you have questions they’ll, you know, ask you. Some of them, they’re just not there are all.”

“I have no problem approaching (my professor), asking him questions, he’s a good resource. I can talk to him about anything— he’s a good mentor for me.”

Seeking out help from department resources was another coping strategy that some students identified as a way to handle the challenges of a computing degree. Students mention how they sought help from professors and tutor labs in the department. Many students emphasized that it was essential to take responsibility and the initiative for being successful in their computing degrees.

“Since I had taken like a 20 year break I talked to a professor who let me audit his calculus 1 class. He was so good at teaching calculus 1. He was reviewing the lower
level math for other students in calculus 1. So, I attribute my math success after that for calculus 2, differential equations to that calculus one class."

“No matter who the person is, I am not afraid of anybody I just want to make sure I do well in school and that I get the help I need. Whatever you do not understand you go and ask the proper person who might know the answer or at least guide you (to the answer).”

Sense of Community

Many students shared similar responses when discussing their sense of community, asserting that it is cultivated through more involvement in activities, research, and academic courses. Most indicated an increase in their feeling of “fitting in” within the computing major, especially because many did not feel a sense of community when first entering the program, and had to make an effort to be included or to feel a sense of belonging.

“I've been part of the [computer department club] for the past 2.5 years… you have to make an effort to do things with the clubs or the other members in order to feel the sense of community.”

“I was the new kid and it didn't take very long to socialize, so I've expanded my social circle that way, now I know a lot of the people at the same level of computer science. As far as professors, I tried to get more involved with volunteer work and have established relationships with at least three to four professors.”

Some students reported that they feel a sense of community because they belong to the department both socially and academically. They described having many friends in their department, helping others in the community, and feeling comfortable asking peers and professors for assistance.

“I feel that I am [part of the campus computing community], I like to spend a lot of time in the computer lab and whenever I see a student, usually an undergrad or a group of students having trouble, I like to go over there and offer to help. I think that's the way I feel that I'm a part of computing community, by being there assisting others.”

Finally, many attribute this evolving community feeling to their involvement in Mentorgrad.

“I chose to participate in research on campus and in CAHSI because I thought it would be interesting to get involved in community-oriented experiences, especially to have a chance to work with other people, and meet more people.”

Career-enhancing Activities
Students also found CAHSI to be valuable in terms of enhancing their careers. Many students indicated an increase in career-enhancing activities through CAHSI, especially due to attendance at conferences. They detail that, conferences are beneficial because they provide great networking opportunities, educational seminars, and detailed information about graduate school.

“The conferences are great, and they have given me opportunities, and I look forward to going to them. They’re focused towards what I need in terms of computing. [The biggest benefit of conferences is] the knowledge that you can pick up just talking to someone – for example, tips on cleaning up your resume.”

Finally, one student indicated that conferences have been useful because they have seminars specifically for women in computing, to help them succeed in the field.

“I got to go to a couple conferences, with CAHSI and FemProf. They sent me to Grace Hopper. I think that would be a great opportunity for other females who are just coming in as students to get an idea of what type of occupations women have in computing, and how to succeed in our industry.”

Interviews with undergraduates involved in CAHSI’s Mentor Grad initiative paint a picture of supportive computing departments where students feel a part of social and academic activities. Students and professors serve as mentors, and CAHSI workshops give them academic opportunities that support their advancement.

Beyond the PhD—Promoting Hispanic Junior Faculty and Industry Professionals

Professionals in the computing field are also targeted by CAHSI initiatives. The alliance supports early and mid-career Hispanic professionals with networking opportunities, funding, mentoring, technical and career related information, as well as training opportunities. In order to understand the role of CAHSI in promoting Hispanic computing professionals, CAHSI evaluators interviewed a sample of five Hispanic industry and faculty professionals engaged in the alliance. This section begins with one faculty member’s story, then describes the benefits of CAHSI participation across all five Hispanic computing professionals interviewed.

Graciela’s Story: CAHSI community supports scholarship and student advancement

An assistant professor from a commuter school in an economically depressed community learned about the CAHSI annual meeting and requested funding to attend with her two students. At the meeting, Graciela presented her technical work along with her students at the poster session. She met multiple mentors, most of them Hispanics in the field, who continue to provide support and advice. She learned
about a workshop for faculty and students held at Berkeley labs, and decided to attend the event with her students.

Based on information gained at CAHSI, one student applied for and received scholarships to attend college, and is no longer balancing full time employment with a heavy evening course load. The three students are now considering graduate school, something they never thought about before their time at the CAHSI annual meeting at Google. Through their participation at Berkeley, they met and worked with other faculty members from around the country who are experts in their field.

“If I had to compare, if I wouldn’t have had the help, not only the funding help but the reception of the people and the network in CAHSI I don’t think I would have made it here.” —Junior faculty member

On campus, Graciela found funding for her students to help her in her research, which lessened her work load and provided students with on-campus work opportunities. She has been featured in the campus publication for her work with students, and was a keynote speaker at the Women in Science event at her school. She brought her students along for her presentation, because, she says “we are a team, and I want the focus to be on what students do, not just on what faculty do.” She also received course materials from a CAHSI faculty member, and plans to start a new research course for undergraduates on her campus. Graciela views CAHSI as instrumental to her professional development, and to her students’ success.

Benefits of Participation—Expanding Academic and Industry Networks

“For me CAHSI was a life changing experience because of the networking connections made and the information that was gathered. Meeting Ann Gates was incredible, Steve, and Miguel— we collaborate a lot…I kept in touch with a faculty member who gave a presentation and she’s been helping me with the personal side of things, the life balance, because no one tells you how to do those things.”

All of the interviewees mentioned that their involvement with CAHSI led to their expanded networks of computing professionals. The alliance’s tangential communities, like Latinas in Computing, related Broadening Participation in Computing (BPC) alliances such as the Empowering Leadership Alliance, as well as CAHSI leadership’s personal acquaintances and colleagues across the country expand the pool of mentors for early career professionals.

One woman mentioned she felt her role in CAHSI was as the link between multiple communities—she would connect professionals and students to one another. Professionals were particularly impressed with the collective experience and prestige of CAHSI leaders, whom they considered mentors as well as leaders in the technical field. Another female professional in industry stated that expanding her network at the Google annual meeting allowed her to meet her peers.
“(At the Google meeting, I was) able to meet people outside of work that are in the industry and maybe doing and thinking the same things (as me). They are about my age with the same concerns I have. I got to meet a lot of people at CAHSI that were in the same boat as I was.”

Benefits of Participation—Feeling comfortable, like they belong

“(My participation in CAHSI) makes me feel I am a piece of the puzzle and I fit. I guess I am more emotional than the male researchers so I need to know that I fit in, to feel I fit in to keep on going and do my stuff.”

Professionals mentioned the comfort they felt in the company of CAHSI leadership and the extended CAHSI community. This notion of comfort and feeling like he or she belongs is noted in the research as a necessary component for the retention of underrepresented computing professionals. One woman mentioned that communicating with CAHSI and Latinas in Computing was like an inoculation against the discomfort and isolation she sometimes felt in her job. With the understanding gained at CAHSI meetings of the societal, educational, and systematic barriers Hispanics face in computing, one professional gained a broadened perspective of the problems faced at work and a new view of how to interact with co-workers who were expressing naïve ideas about Hispanic computing professionals as well as women in the field.

“(Through my participation in CAHSI) I have seen Ann Gates as a successful researcher. It is the first time I have seen a Hispanic woman who is the best. It tells me that it can be done. It can be done. If Ann did it, it can be done. There are no barriers there.”

Benefits of Participation—Curriculum Vitae -enhancing opportunities

For the most part, industry professionals see their participation with CAHSI as leading to indirect professional benefits (e.g., mentoring, service opportunities, feelings of belonging). However, when they were able to share their technical skill and knowledge with CAHSI audiences, they report direct professional benefits that may help them advance in their careers.

“I know (participating in CAHSI) is something my managers think is a good thing to do…It would be good to get people together on the technical side where people (from industry and academia) were working together. That would give managers a better impression of what we are doing with our time.”

While industry professionals increased their networks, benefited from mentoring and the opportunity to provide service, professionals in academia experienced these as well as other more direct benefits of participation in CAHSI. For example, CAHSI funded research opportunities for their students, allowing the junior faculty members to progress faster in their research efforts and produce more scholarship than they would on their own. Faculty also attended multiple conferences (e.g. Tapia, SACNAS, Grace Hopper,
CAHSI annual meeting) where they presented technical work along with their students, elevating their reputations as scholars and educators.

Recommendations for supporting Hispanic professionals engaged in CAHSI

The following actions and resources may assist CAHSI in better serving early career Hispanics in computing:

- **Extend research funding to graduate students** to better support junior faculty in their research efforts
- **Provide early career professional resources** such as short videos or tip sheets regarding career “soft skills” (having difficult conversations with managers) and successful career path milestones (what professionals should be doing at each point in their careers to be successful)
- **House resources for internal and external audiences online** to support sharing, feedback, critique, and better communication and organization.
- **Promote and/or seed technical, research focused collaboration** between industry and academic members of CAHSI.

Issues in Increasing/Measuring the Increase of Students Earning Degrees in Computing

Pipeline programs and studies are complex. BPC alliances are spread across multiple contexts, and hope to change the attitudes, aspirations, and everyday practices of faculty and students. The issues in supporting and measuring “success” are many.

Hispanic-Serving Institutions often serve first generation students who may be less prepared for and/or less motivated to continue schooling, particularly when computing salaries for undergraduate degree holders are often in the $50,000 range. Many CAHSI students have to work—often long hours—to support their schooling and their families. Student success and achievement can be significantly impacted when students hold several jobs or work full-time while pursuing their degrees. Fem Prof results show that with strong mentorship, multiple on-site and off-site research opportunities, and multiple avenues for professional development, students may develop aspirations for graduate degrees, though many of the students in the Fem Prof program had fewer financial concerns than the typical CAHSI student.

CAHSI goals will take time to achieve—the average freshman could hope to become a professor in 9 or 10 years—yet evaluation must be ongoing from the first year of implementation. Once students matriculate to graduate programs, they are, to date, difficult to track, particularly when they move out of the CAHSI constellation of institutions. On a similar note, each school “marks” student demographics differently. For example, NMSU does not track the country of citizenship for non-US citizens, and UHD does not indicate citizenship standing on its documents. In Texas, students who graduate from Texas
high schools can attend Texas colleges at in-state rates, and so citizenship is difficult to discern. Border towns bring issues of citizenship into question as well, as Juarez or Tijuana residents might work in El Paso and Las Cruces, for example, contributing to US technology development.

**BPC Goal: What is CAHSI doing to support a positive culture or climate?**

A goal of the BPC initiative is to “create sustainable changes in culture or practices at the institutional, departmental, or organizational levels that contribute to broadening participation in computing.” From our perspectives as evaluators in the initial years of a transformative education initiative, we view our role in terms of exploring how CAHSI computing departments are supporting a positive, inclusive culture or climate. 7 In this section, we highlight the research regarding effective practices in higher education for supporting a positive, inclusive culture or climate, and describe how CAHSI evaluation data suggests (or does not suggest) that departments are indeed developing into diverse, inclusive, academically focused computing communities.

Researchers and policy makers have studied higher education “best practices” for decades (Astin, 1975; Kuh 2008), with particular focus on elements of higher education that promote rich learning environments for retaining and engaging students. Four elements of higher education schools and departments of particular relevance to the CAHSI initiative are:

- Promoting academic dispositions that enhance classroom learning
- Explicit development of learning communities
- Seeding or facilitating faculty-student interaction
- Mainstreaming mentoring

We discuss these research-based best practices for developing positive learning climates in higher education institutions in the following sections, and tie these to CAHSI.

**Promoting academic dispositions that enhance classroom learning**

The opportunity to engage in meaningful, experiential, “hands-on” work fosters the skills, knowledge, and temperament that enhance students’ classroom learning. Student learning and development is complemented and enhanced by student participation in “real-world” co-curricular

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7 It is difficult to measure cultural change in many cases, because the students from whom we gather data have such short experiences with CAHSI departments, and many were not students at CAHSI schools when the initiative began. When possible we include data regarding PIs and faculty member’s perspectives regarding change in student behaviors, attitudes, or achievement.

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activities such as undergraduate research, internships, student teaching, or professional jobs (Thiry, Laursen & Hunter, 2010). Recent research on student outcomes from participation in undergraduate research has demonstrated an array of personal, professional, and intellectual benefits to students. Through participation in undergraduate research, students increase their communication skills (Bauer & Bennett, 2003; Hunter et al., 2007; Kardash, 2000; Seymour et al., 2004), technical and laboratory skills (Lopatto, 2004; Seymour et al., 2004; Ward, Bennett & Bauer, 2002); teamwork skills (Ward, Bennett, & Bauer, 2002); and critical thinking, problem-solving and scientific thinking skills (Hunter et al., 2007; Kardash, 2000; Merkel, 2001; Seymour et al., 2004). Students perceive these gains as transferable skills sets that will benefit them in their coursework and in their future careers (Hunter et al., 2007; Kephart et al., 2008).

CAHSI initiatives such as Affinity Research Groups and Peer-Led Team Learning offer students the opportunity to engage in meaningful, authentic work that fosters deep learning and contributes to classroom success and retention. Affinity Research Groups differ from the traditional undergraduate research model through the deliberate development of leadership, teamwork, and communication skills through structured mentoring and group interactions (Kephart et al., 2008). Likewise, peer-led team learning emphasizes cooperative learning and the development of teaching, communication and leadership skills along with deepened conceptual understanding of course material for peer leaders. Participation in ARGs helped CAHSI students to develop the intellectual and technical skills that will contribute to their success and advancement in their coursework. Technical knowledge and research skills were students’ top gains from ARGs (the only areas cited by a majority of students as one of their top three gains). Hispanics also cited higher gains in both of these areas than majority students. Being a peer leader helped CAHSI students to deepen their computing knowledge and gain confidence and skills that will enhance their academic achievement. Eighty-three percent of peer leaders reported that they increased their computing knowledge, and 100% of peer leaders reported that they have enough computing knowledge to effectively help students. One-hundred percent of peer leaders also felt that they had increased their communication and teaching skills.

**Explicit development of learning communities**

Departments and institutions that explicitly develop structured communities (through a cohort model for students attending courses, through study groups, or within courses) find students are more engaged in their learning, experience greater academic and social support, and are more likely to be retained in higher education (Astin, 1975; Kuh, Kinzie, Schuh, & Whit 2005; Tinto, 1997). Research in higher education finds that students who work on campus are more likely to complete their studies (Astin 1975), and it follows that providing jobs on campus might support learning community development, as time on campus leads to additional contact with peers.
CAHSI has explicitly developed learning communities through the adoption of Peer Led Team Learning (PLTL) and Affinity Research Groups (ARG). The PLTL communities are inclusive by design, as they do not focus on “at-risk” students, marginalizing those who are less prepared or traditionally less successful in computing courses but on the class as a whole. ARGs leverage the different levels of experience apparent in a research group to foster positive interdependence on one another within the group. Some additional findings that support the notion that CAHSI’s explicit development of learning communities creates an inclusive, positive learning climate in computing are highlighted below.

- PLTL evaluation data show that classroom learning communities impact students’ perceptions of support in the major and career—in fact 94% of PLTL students in spring of 2009 report an increase in feeling supported following PLTL participation, and average scores on perceived support exceeded comparison groups of majority students.
- Data collected (in the form of survey responses) indicate CAHSI funded (or contributed to the funding of) 53 research positions and 22 PLTL leader positions on campus from Spring 2009 through summer of 2009. All PIs note that without CAHSI, they would have fewer employed students on their campuses.\(^8\)
- Principal Investigators and faculty from CAHSI institutions describe resurgence in computing-related clubs and the institution of new groups that meet on campus, including a local computer science club and a new gaming club

Seeding faculty-student interaction

When faculty and students interact regularly, students gain more knowledge and skills than when interaction is limited to classroom participation (Astin, 1993; Endo & Harpel, 1982; Kuh & Hu, 2001). CAHSI initiatives have built in student and faculty interaction—PLTL leaders meet regularly with course instructors to go over activity planning, ARG students meet with graduate students and faculty to discuss research issues, findings, and next steps, and students who engage in CAHSI scholars, fellownet and papernet have substantive interaction around academic content and goals. Evaluation findings suggest that CAHSI seeds faculty-student interaction.

- Preliminary data from student interviews suggest the time faculty spend with students has increased with CAHSI initiatives, particularly with travel to conferences such as the CAHSI annual meeting, Grace Hopper, SACNAS, and Tapia. Students say these trips help them get to know professors better and feel more comfortable with them.

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\(^8\) Our reported numbers are conservative, and based on the number of students from whom we gathered data in spring and summer of 2009.

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• A quarter of students who attended the CAHSI annual meeting contacted a professor following their participation in the meeting, indicating conference participation seeds faculty-student interaction.

• Students engaged in Fem Prof, the model for CAHSI Scholars/Mentor Prof, state they have more interaction with faculty since beginning participation in the program, which promotes the professoriate for high achieving undergraduates. They interact with faculty in workshops, trips to conferences, planning meetings, and recruitment events, and receive feedback regarding their academic and professional efforts.

D. mainstreaming mentoring

CAHSI initiatives develop webs of support for students in computing departments, encouraging not only paired mentoring relationships (such as faculty student matches) but also student to student opportunities for mentorship. Higher education research has continuously supported the notion that mentoring is beneficial to students and faculty for supporting psychological and professional needs (Hall & Sandler, 1983; National Academies Press, 2009; Tillman, 1995; Wright & Wright 1987; Zachary, 2005). Opportunities for all students to engage in mentorship support an inclusive, positive departmental culture.

• For example, open-ended survey items from PLTL students indicate that 88% of students found it likely that they would have access to a mentor in their computing department, and 86% found it likely they would have access to a role model in their computing department after participating in the initiative.

• Following the CAHSI annual meeting, most students indicated they had informal mentoring support from faculty (76%). This figure compares favorably to a recent study by MentorNet, which indicated of the 1,876 science technology engineering and math students surveyed currently engaged in Mentor Net, only 62% had an important mentor in their undergraduate years (www.mentornet.org). Not only do students report they are being mentored, they are also serving as mentors for other students—65% of students who attended the CAHSI annual meeting report they serve as a mentor for a younger (or less experienced) student.

• A vignette regarding mentoring captures the orientation of the CAHSI PIs towards the practice. During a CAHSI business meeting, a junior faculty member began to describe her research areas of interest. The PIs in the room digressed from the meeting topic at hand, and started to name others in the computer science research field who also studied in the areas. They asked the junior faculty member if she knew these contacts, and offered to make introductions.
BPC Goal: Include complementary (social science or educational) research that informs the design of Alliance activities

The formation and development of a social science network has been a struggle for CAHSI. Interviews with key stakeholders suggest a lack of a clear role for social science experts, lack of funding to support social science research at CAHSI schools, and lack of regular communication among social scientists listed in the network and CAHSI leaders. In some cases, the difference between evaluation of a program and social science regarding key programmatic ideas was not clear to PIs.

However, CAHSI initiatives are grounded in strong research from education, computing, and social science disciplines, in some cases complementary to or built from the work of the social science network. Evaluators, who are trained in the social sciences, have collaborated with PIs and social scientists already engaged on CAHSI campuses to disseminate CAHSI findings within social science networks (e.g., American Educational Research Association, AAAS Understanding Interventions, International Conference of the Learning Sciences). Similarly, CAHSI PIs are actively engaged in computing education conferences, and disseminate within that community with regularity. It would behoove CAHSI to redefine, reconfigure, and reexamine the social scientists’ roles before seeking additional funding. One idea CAHSI PIs put forth was to engage social science graduate students on CAHSI campuses, and put CAHSI forward as a research site for exploration. It may also make sense to incorporate those who are already engaged in social science at the CAHSI institutions in a social science network.

CAHSI-SACI: adding campuses to the alliance

At the time of this writing, a BPC demonstration project proposal was under negotiation with the National Science Foundation to add three schools to the CAHSI family: Miami Dade College, University of Texas, Pan American, and California State University San Marcos. Pending funding, they will participate as full members of the CAHSI alliance, adopting key initiatives of the alliance, adding to leadership and planning meetings as well. This addition will allow CAHSI to reach more students—combined, these three schools graduated 60 Associate degrees, 47 Bachelor degrees, and 25 Master’s degrees in computing fields in 2007-2008.

A tension that has been apparent in planning meetings as CAHSI has discussed growth is negotiating quality and commitment in the adoption of programs with expanding to reach more schools and, through them, more Hispanic students. The schools chosen to become members of the core community have had faculty participation in ARG and CS-0 training, faculty attendance at CAHSI annual meetings and meetings on site at related conferences (e.g. Tapia conference CAHSI meeting, SACNAS-CAHSI meeting), and are connected through computing networks to the CAHSI PIs. “CAHSI as la familia”
is a feeling and an approach to the alliance that supporters and members hope to sustain with growth, according to interviews with PIs.

**BPC Goal: CAHSI: Serving as a Visible Model/Repository for Effective Practices to Broaden Participation**

This section describes the ways in which CAHSI is becoming a visible model for effective practices to broaden participation in computing fields. We focus on the expansion of CAHSI to other institutions, the dissemination of CAHSI initiatives and findings, the visibility of CAHSI in CAHSI departments and on CAHSI campuses, and the adoption of CAHSI curriculum, materials, and courses at other institutions, and within other BPC alliances.

**Starting at home: Developing support and awareness through CAHSI advocates**

A new initiative was developed in the latest round of funding to boost campus awareness of CAHSI opportunities. Each campus has at least one student and one faculty advocate for CAHSI. Under the leadership of Miguel Alonso, a new SACI PI, advocates will document their recruitment efforts, including one main event per semester. The recruitment is aimed at increasing student knowledge of academic opportunities that CAHSI offers. PI's impressions were that some of the students were receiving the benefits of CAHSI (in CS0 and PLTL, for example, which serve all students enrolled in target courses) with no knowledge of the broader scope of the BPC Alliance. The evaluators will collect data from advocates (expected December 2009) regarding their efforts on campuses, the perceptions of CAHSI communicated by their peers, and the number of students and faculty they communicated with regarding CAHSI. Custom posters were developed for CAHSI institutions to use to promote the effort. Institutional website visibility of CAHSI is an area for improvement—not all schools have permanent, CAHSI-related information or links to the main site. Principal Investigators recount how their departments and their administration perceive CAHSI. One PI mentioned that his faculty are not all involved in CAHSI, but because he is the department chair, they have an awareness of the alliance. His impression of their attitudes is that they see that PLTL impacts the preparedness of students in later classes. Two faculty members were aware of university administrators leveraging the CAHSI effort, one for policy changes across engineering and for receiving additional opportunities to develop academic engineering programs. Others are not sure their administration is aware of CAHSI and what it does. A previous suggestion to contact all university presidents with a targeted publication about CAHSI was mentioned this fall as a possible solution to uneven knowledge about CAHSI at the administrative level.

**CAHSI Creating tiers of membership and support**

CAHSI is developing relationships (e.g. Memoranda of Understanding) throughout the Hispanic STEM community; the academic Hispanic community, and within BPC. At this writing, CAHSI has been
developing informal and formal relationships with ten organizations, sharing the initiatives widely through these multiple networks. Memberships to CAHSI have been tightly controlled as membership often relates to funding for initiative implementation and travel. However, CAHSI and their collaborators are creating tangible benefits for all parties—for example, GEM is allocating a set of scholarships for CAHSI participants. This practice ensures a wider recruitment base for GEM and additional, outside funded academic opportunities for CAHSI students. These substantive collaborations are a promising first step towards sustaining CAHSI financially. See figure below.

Object 35: CAHSI Connections to other Alliances

Dissemination and Opportunistic Allotment of Resources

CAHSI faculty members have spread (or have plans to spread) the main initiatives over 11 states via in person training or presentations. CAHSI faculty and evaluators have shared their knowledge of effective practices in at least 8 professional venues, including HACU publications, American Educational Research Association, the Understanding Interventions Conference supported by AAAS, and multiple Frontiers in Education conferences. Up to this point, faculty members from other institutions have learned of CAHSI via professional networks, interaction at conferences, and other chance encounters. CAHSI stakeholders arrange for training, conversations, and/or sharing of resources. This method of
dissemination has assured that the learners are committed to the effort, though it lacks a systematic attempt to disseminate broadly, and perhaps, means that the resources reach “the choir”, or the faculty who are already promoting equity and pedagogical change in computing. As CAHSI continues to grow a more strategic dissemination plan may be in order. See figure below.

**Object 36: CAHSI Dissemination**

**Distribution of materials, resources**

The CAHSI website has been dynamic, with varied degrees of usability, according to interviews with faculty. Its multiple purposes have been a challenge—the website needs to be the face of CAHSI for students and the public as well as a portal for sharing internal and external resources. The current iteration of the website has downloadable web resources available for CS0, PLTL, and ARG. CAHSI stakeholders’ impressions are that more funding for web developer and full time program manager have been instrumental in CAHSI organization and web improvement. Evaluators are attempting to gather information from those who download materials from the site, to better understand how CAHSI is becoming a model of effective practices. NCWIT, a prominent BPC alliance, has published two promising
practices resources that feature CAHSI initiatives, and the Anita Borg Institute highlighted CAHSI’s mentoring efforts.

Possible next Steps: A community of research excellence

A new research opportunity has emerged for CAHSI institutions through the Center for Excellence at Purdue University regarding Command, Control and Interoperability in collaboration with UHD, one of the institutions chosen to collaborate in this Center. UHD hopes to bring in research expertise from CAHSI institutions to address the visualization research questions brought to bear in issues of homeland security. Evaluators intend to follow this new opportunity, to inquire about ways in which the collaboration influences the following: a) connections of students from CAHSI schools with Research I schools, b) research funding opportunities garnered by students or professors at CAHSI schools, c) presentation and/or publication opportunities for students and faculty engaged in CAHSI.
References


http://www.nap.edu/catalog.php?record_id=12192


Tinto, V. (1997). Classrooms as communities: Exploring the educational character of student


**U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics.**


Appendices:

1. Increase (or contribute to increasing through any of the following methods) the number of U.S. citizens and permanent residents receiving post secondary degrees in the computing disciplines, with an emphasis on the proportion of students from communities with longstanding underrepresentation in computing: women, persons with disabilities, and minorities (African Americans, Hispanics, American Indians, Alaska Natives, Native Hawaiians, and Pacific Islanders).

2. Engage the computing community in developing or implementing innovative strategies and methods to improve recruitment, retention, and advancement of targeted students and professionals at the undergraduate, graduate, and career levels, especially with respect to academic careers.

3. Create sustainable changes in culture or practices at the institutional, departmental, or organizational levels that contribute to broadening participation in computing.

4. Serve as visible models or repositories for effective practices to broaden participation.

5. Include complementary (social science or educational) research that informs the design of Alliance activities.

6. Increase the duration and scope of the Alliance award, by introducing additional targeted student groups, partners, and/or projects (in collaboration with middle and secondary schools, government, industry, professional societies, and other not-for-profit organizations), leveraging existing efforts both across and within underrepresented communities.

The CAHSI Alliance measures the effect of the activities on the participants

Outcome indicators (we know CAHSI is successful if we can show):

BPC Primary Goal: Increase (or contribute to increasing through any of the following methods) the number of U.S. citizens and permanent residents receiving post secondary degrees in the computing disciplines, or contribute to the advancement of computing professionals.
1. IPEDS data and institutional research office data regarding student graduation and/or enrollment rates, particularly for underrepresented groups in CAHSI schools that demonstrate (see note at end of document):

Favorable comparison over time

Favorable comparison to Taulbee survey results of national computing degree production

Favorable comparison to similar schools in similar regions (public or private non-profit schools in CA, FL, NM, and TX)

2. Using Lent’s model of career theory (Social cognitive career theory, measured using Lent’s computing career survey, obtained from Bob Lent in 2009), determining whether specific CAHSI course initiatives influence the following:

A.) Self-reported increase in student confidence & interest in:

BA computing

MA/MS computing

PhD computing

B.) Self-reported increase in knowledge or awareness of:

Computing careers

Benefits of computing careers

C.) Self-reported increase in coping with STEM program demands, including opportunities for mentoring

D.) Self-reported increase in sense of community in department, or feeling of “fitting in” within the computing major
(with comparison of above data to published results of students in STEM fields when applicable)

3. Institutional Research data from all CAHSI schools that show:
   - Favorable comparison of student success rates in PLTL courses since implementation of CAHSI
   - Favorable comparison of student success rates in CS1 following CS-0 participation
   - Favorable course taking patterns since the inception of CAHSI (e.g. fewer repetitions, shorter time to graduation)

4. Self-report and CAHSI advocate report of change in students’ behaviors needed for application to graduate school:
   - Taking GRE
   - Inquiries about graduate school
   - Applications for grants, scholarships, etc.
   - Sending applications to graduate school (with comparison of target group to national averages, when applicable, e.g. rates of students taking GRE test)

4. Self-report and CAHSI advocate report of change in students’ “vita-promoting” behaviors needed for success in academia:
   - Presenting technical papers
   - Presenting technical presentations
   - Publishing articles
   - Serving as a tutor/peer leader
   (with comparison of target groups to other REU programs, when available)

5. Self report of increase in career-enhancing activities, behaviors, or roles (e.g. leadership roles, publication, presentation, funding for students leading to increased research productivity or advancement) provided junior faculty and early-career professionals (especially Hispanic professionals) via CAHSI.
6. Documentation of dissemination of CAHSI resources (e.g. training, materials, presentations, publications) outside of CAHSI, and relevant evaluation of dissemination when available (e.g. training evaluation data).

7. Documentation of shifting outsider perceptions or more broad recognition of CAHSI via interviews with computing professionals.

BPC Goal: Serve as visible models or repositories for effective practices to broaden participation.

8. Student self report of student attendance at or engagement with other alliance activities, such as:
   
   Attendance at Tapia
   Participation in GEM workshop
   Engagement in STARS Alliance project

9. Documentation of additional funding (proposed and obtained) leveraged to support CAHSI activities, including:

   Department funds
   Institution funds
   Scholarship funds (via MOU with other groups, SHPE, Hispanic Scholarship Fund, GEM)

BPC Goal: Increase the duration and scope of the Alliance award, by introducing additional targeted student groups, partners, and/or projects (in collaboration with middle and secondary schools, government, industry, professional societies, and other not-for-profit organizations), leveraging existing efforts both across and within underrepresented communities.
10. Documentation of CAHSI’s establishment of related BPC demonstration projects, connections with other BPC alliances, and outreach activities that extend beyond the intended CAHSI target groups.