SCALING AND ADAPTING CAHSI INITIATIVES (SACI):
RECRUITING, RETAINING, AND ADVANCING HISPANICS IN COMPUTING

YEAR 1 EVALUATION REPORT

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The Scaling and Adapting CAHSI Initiative (SACI) was created to extend the reach of CAHSI to three additional institutions, California State University- San Marcos, University of Texas-Pan American, and Miami Dade College. At the same time, SACI aims to adapt the initiatives originated within CAHSI to fit the learning environments and student populations served by SACI. The express goals of SACI are:

- SACI Goal 1: Increase the number of Hispanic, female, and other underrepresented students who enter and complete degrees in computing areas.

    - Sub-goal 1a: Improve undergraduate success in computing disciplines.

    - Sub-goal 1b: Assist students in their transition to and success in graduate school through mentorship.

- SACI Goal 2: Develop and sustain competitive academic and research programs at the partnering institutions.

In this report, we document details of SACI institutions' baseline enrollment and degree completion in an effort to understand undergraduate success throughout the institutions (Sub-goal 1a). This data will be compared with 2010-2011 and 2011-2012 data, and pending long term funding, beyond the three years of this grant to determine whether and how the SACI initiative increases the number of Hispanic, female, and other underrepresented students who enter and complete degrees in computing areas. Following the discussion of baseline data, we detail data collected from the first CS-0 course developed by SACI faculty member Miguel Alonso, titled IN-COMMAND CS-0: An INtroduction to COMputing through Mobile ApplicatioN Development [CS-0]. The CS-0 course ties directly to Sub-goal 1a, in that the course aims to ease students into computing through engaging, culturally relevant activity. In future reports we plan to document the fall 2010 course at California State University, San Marcos as well.

Next, we address SACI Sub-goal 1b as we describe how undergraduate research opportunities are beginning to assist students in their (potential) transition to and success in graduate school through our analysis of initial Affinity Research Group surveys. We note that students in some cases began the research in August 2010, and this survey was implemented in October 2010. However, even within this short time frame students describe the ways in which they are being prepared for graduate school in this experience. In addition, we supplement this data with UTPA information regarding a research day event and its impact on undergraduates' ambitions for and actions toward graduate school.

Developing and sustaining competitive academic and research programs at the partnering institutions is an objective of SACI. In important element of a vibrant research program is the student research experience. To describe achievements towards this goal we detail research efforts by students in the ARG program as well as the effect of the research day activity on students' aspirations regarding research.

SUB-GOAL 1A: IMPROVE UNDERGRADUATE SUCCESS IN COMPUTING: PART 1

SACI hopes to increase the numbers of Hispanics earning degrees in computing fields. In order to measure the program's impact, evaluators developed understanding of trends within current representation in computing. In this section, we describe the current trends in computer science enrollment and graduation at Associates' Bachelors' and Masters' levels of education, when applicable.

CSU-SAN MARCOS

CSU-San Marcos is a rural campus serving nearly 10,000 students. The student body is predominantly undergraduate (90%), female (61%), white (46%, compared to 27% Hispanic/latino), full-time (70%) students. The majority of undergraduates are of traditional age (78% are 24 years old or younger) and nearly all are California state residents (99%). Completion of degree in 6 years time is slightly higher for Caucasian/white and Asian students (50%, 53%) than for all other ethnicities- for example, 44% of Hispanics, 41% of African Americans, and only 33% of American Indian/Alaskan native students graduate within 6 years.

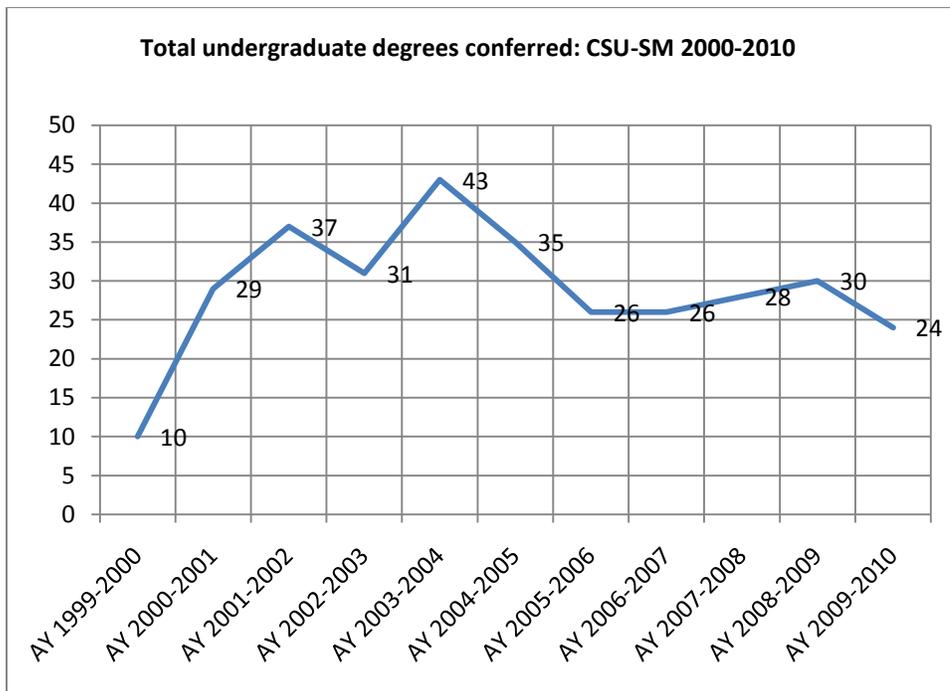*Graduating computing scientists: trends 2000-2010*

Figure 1: CSU-SM degree production 2000-2010

Like the rest of nation, CSUSM has experienced a drop in degree production, with a slight leveling off of computing degree completion in the past five years. This trend is common in the United States, though the decline was a bit later here than experienced in other schools.
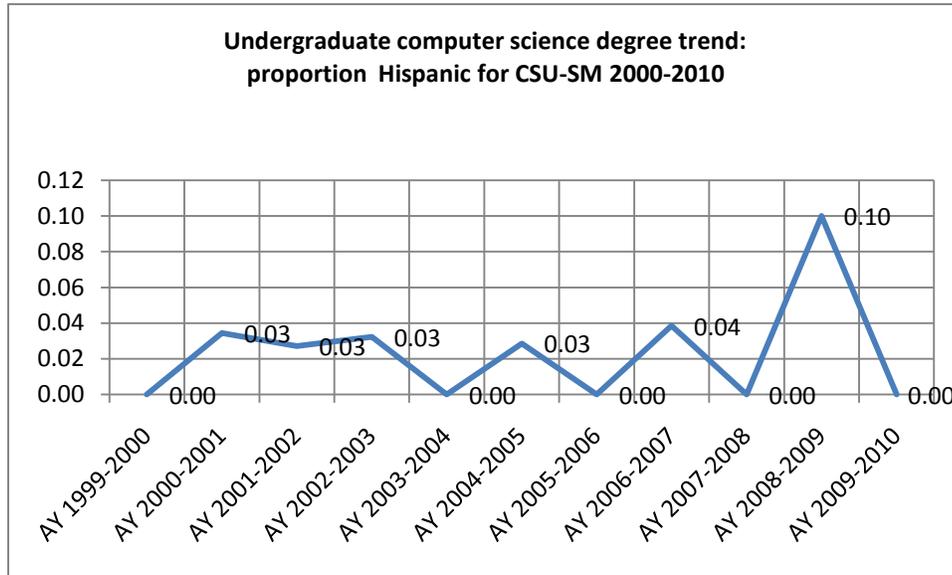

Figure 2: Hispanic degree production CSU-SM 2000-2010

While CSU-SM is an Hispanic-Serving Institution, very few of its graduating computing students are Hispanic—in half of the years for which we have degree completion data we found no Hispanic graduates in the computing area, and other years show up to three Hispanic student graduates.
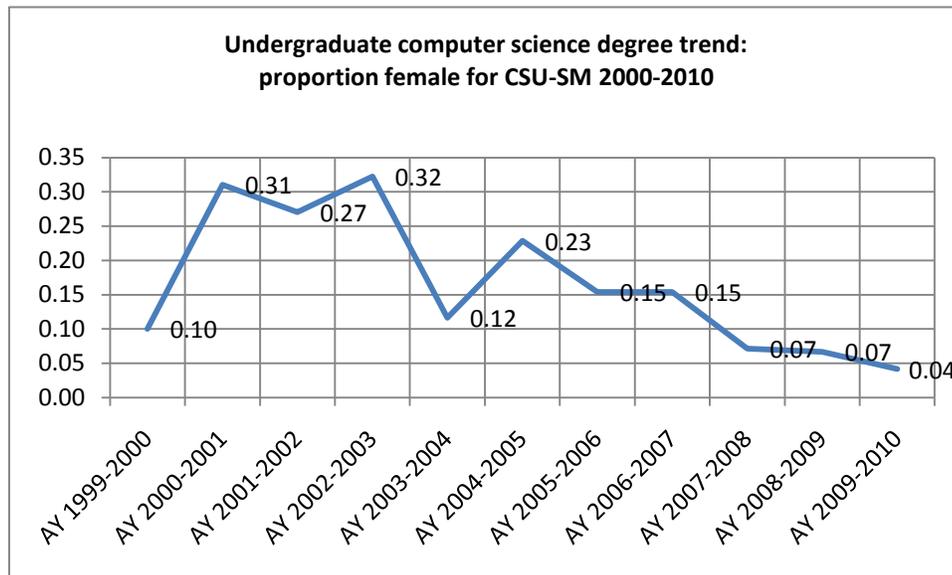

Figure 3: Female computing graduates CSU-SM 2000-2010

CSU-SM has a male-dominated computing program, it seems, and one that is increasingly so. Our last year of degree completion shows one woman graduated out of 25 total degrees awarded. In a school with a 61% female student body, the low representation of women is particularly

astonishing, though it is possible that CSU-SM's offering of technology-related business degrees may have an impact on this computer science enrollment trend—women tend to be better represented in these technical programs. This trend of losing women in computer science programs also permeates United States' computing departments and one addressed through initiatives that improve learning environments for all students.

Enrolling computing scientists: Trends 2000-2010

Total number of undergraduate Computer Science Students Enrolled at CSU-SM 2000-2010

266 277 291 283 237 220 177 176 160 167 106

AY 1999-2000 AY 2000-2001 AY 2001-2002 AY 2002-2003 AY 2003-2004 AY 2004-2005 AY 2005-2006 AY 2006-2007 AY 2007-2008 AY 2008-2009 AY 2009-2010
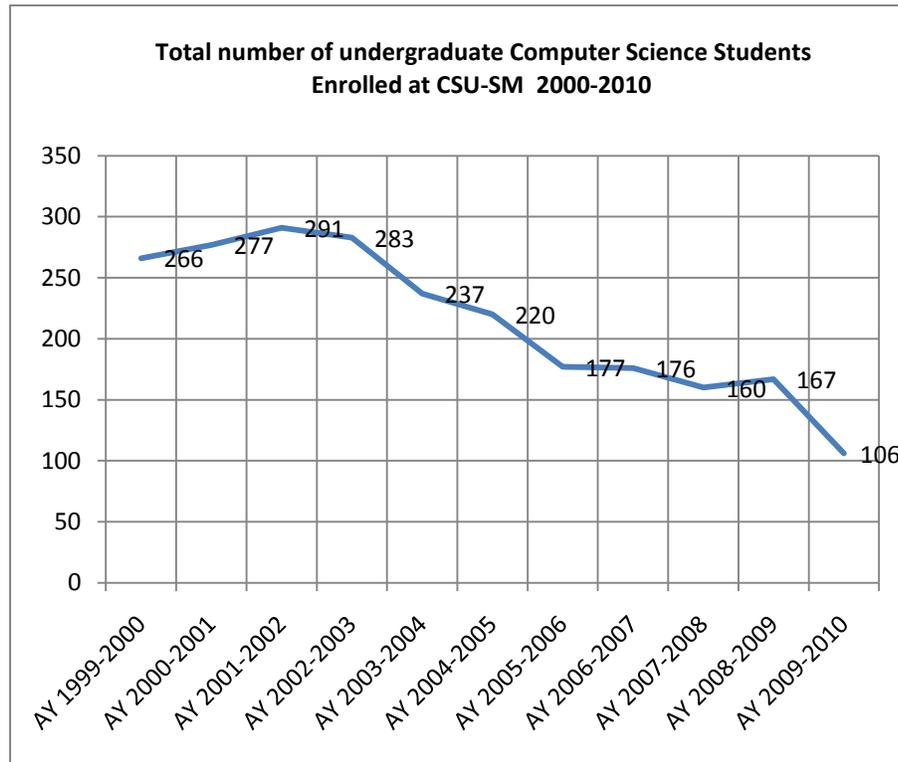
Figure 4: Enrollment trends CSU-SM 2000-2010

As expected, the trend in enrollment is a bit ahead of the degree completion curve, though it shows a similar steep decline. Note that 2009-2010 numbers are nearly 1/3 of the enrollment numbers experienced in 2001-2002.
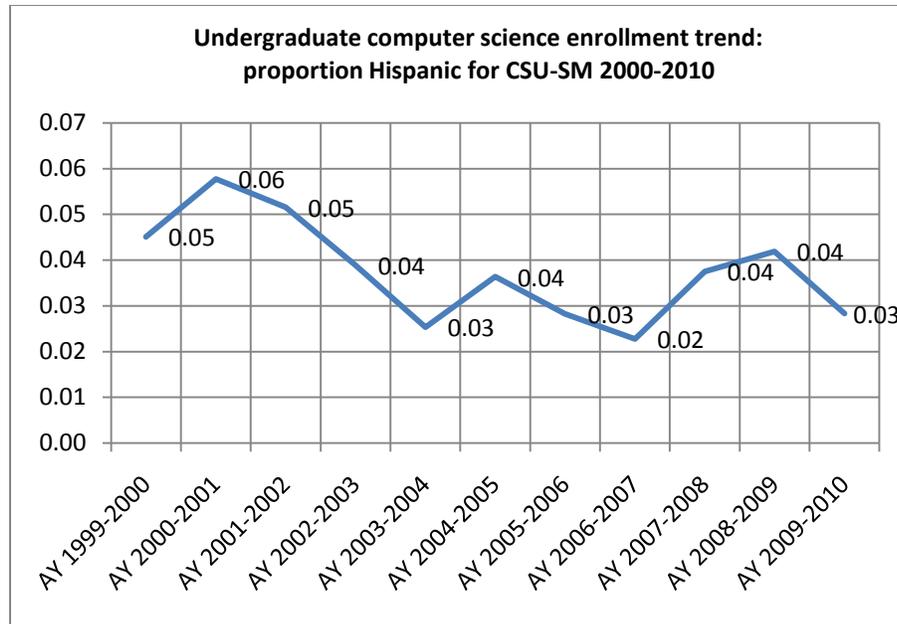
Figure 5: CSU-SM Hispanic student enrollment in computing 2000-2010

Again, enrollment of Hispanics in computing is relatively low, though an encouraging sign is the similarity of proportions enrolled to those receiving degrees. This trend may indicate Hispanics who do choose computing complete the degree at similar rates to students overall (i.e. barriers to Hispanic students who choose the major may not be significantly different from the student body as a whole at this department).
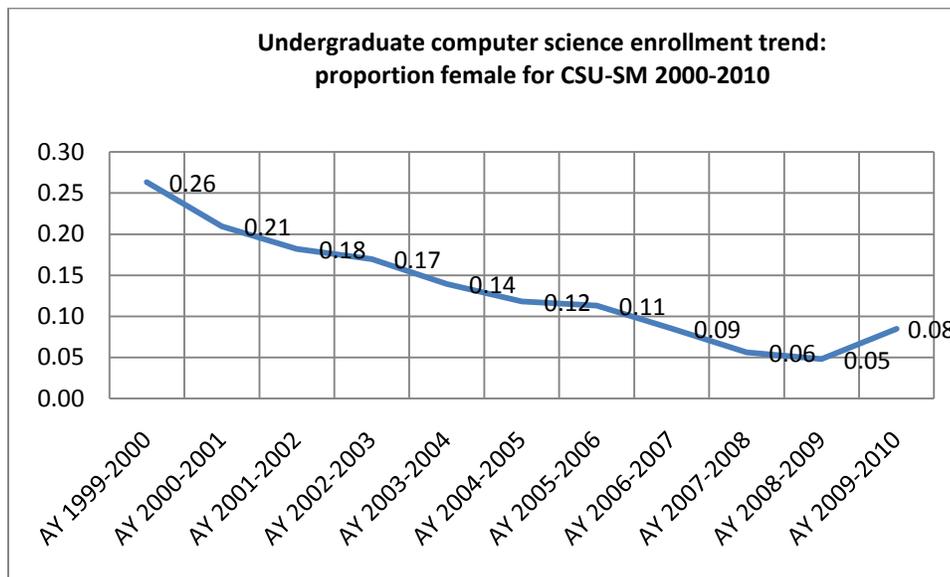

Figure 6: CSU-SM female student enrollment in computing 2000-2010

CSU-SM has seen a steep decline in the enrollment of women in computing at the institution.

In its master's degree program, CSU-SM has had more success recruiting and retaining women, though its record with Hispanic students is similar to that of its undergraduate program. In eleven years, the Master's degree program has graduated 76 MS students, and 32 (42%) of them have been female while only four (5%) were Hispanic, though three of these were Hispanic women. Like in undergraduate degree production, peak rates of graduation took place near the early to mid 2000s, and rates of completion of leveled off to single digits.

Overall, it is clear that California State University- San Marcos has room to improve regarding its recruitment and retention of undergraduate computer science students, as do most colleges and universities in the United States today—degree production is only 65% of what it was in 2002 while the need for technically advanced professionals grows. While MS degree production is relatively strong for women, the share of degrees earned by women in undergraduate computing ranged from a high in 2003 of 32% to 4 % in 2010 of total computer science degrees earned. These rates are from 50% to 7% of what would be expected given the high female to male ratio on the campus. The trend for Hispanic computer science production has been steadily low, ranging from 0 to 10% of degrees earned. The average of 2.4% over the last 11 years is only one-tenth of the expected proportion of Hispanic degree earners in computer science, as Hispanics make up over a quarter of CSU-SM enrollment.

UNIVERSITY OF TEXAS PAN AMERICAN

University of Texas-Pan American is a larger university settled in the mid-sized city of Edinburg, Texas. The campus serves over 18,000 students, the majority of them are undergraduates (87%), though the campus has MS and PhD degree offerings as well. Nearly all students receive financial aid (87%) of some kind. Three quarters of students are attending full time (74%), and over half are female (57%). Like the other SACI schools, the majority, but not all, students are of traditional age (78% are 24 and under), and nearly all are Texas state residents (97%). The overwhelming majority of students are Hispanic at UT-PA (89%). Just over a third of enrolled Hispanic students had earned bachelor's degrees in 6 years (36%), a rate that is a great deal lower than for Asian students (55%) and non-resident alien students (61%), though higher than the same rate for white students (27%).

Graduating computing scientists: Trends 2000-2009[1]

Total undergraduate degrees conferred: UTPA 2000-2009
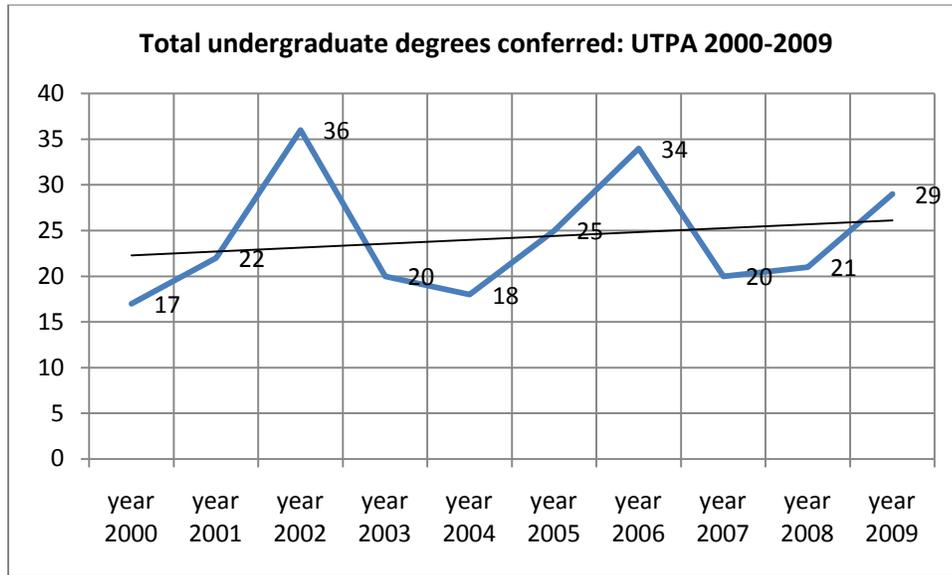
Figure 7: UTPA undergraduate degrees 2000-2009

It is difficult to discern a pattern from UTPA computer science degree production—the numbers have fluctuated indicating a possible peak every four years. The trend of this department is upward according to our data.

Undergraduate computer science degree trend: proportion Hispanic for UTPA 2000-2009

Figure 8: Hispanic undergraduate computing degree earners: UTPA 2000-2009

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[1] UTPA and MDC had data available through 2009 at the time of collection, while CSU-SM had 2010 data available

The vast majority of students at UTPA are Hispanic, and while rates of computer science degree production are slightly lower than expected, they do approach parity. While 87% of students enrolled at UTPA were Hispanic in 2009, 72% of computing graduates were Hispanic; in other words, 83% of the expected number of Hispanic students graduated with degrees in computer science.
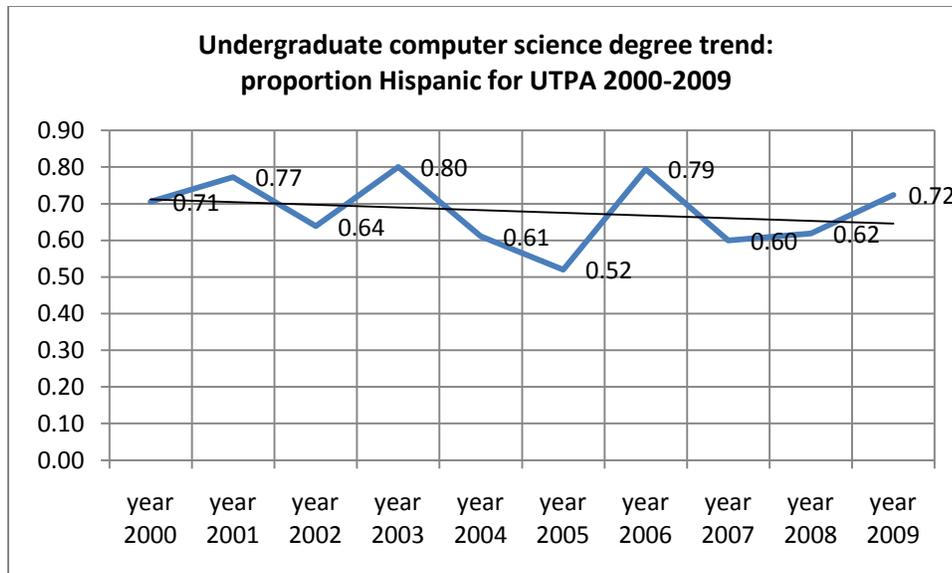
Undergraduate computer science degree trend: proportion female for UTPA 2000-2009
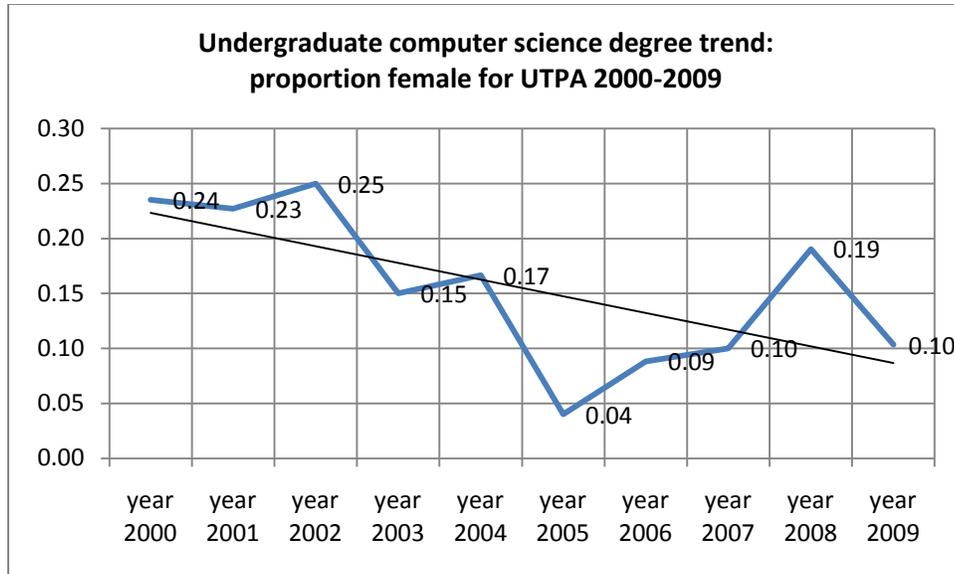
Figure 9: Female undergraduate computing degree earners: UTPA 2000-2009

In the past ten years, the rate of female student degree earners has declined dramatically for UTPA undergraduates, as it has for many departments in the United States. In 2009, the proportion of female students earning degrees was 1 in 10, from a high of 1 in 4 students in 2002.

Enrolling computing scientists: Trends 2000-2009

Total number of undergraduate Computer Science Students Enrolled at UTPA

Figure 10: Total computing student enrollment: UTPA 2000-2009

The overall trend in enrollment for UTPA computer science is downward, from a high of 355 students in 2002 to 226 students in 2009.

Undergraduate computer science enrollment trend: proportion Hispanic for UTPA 2000-2009
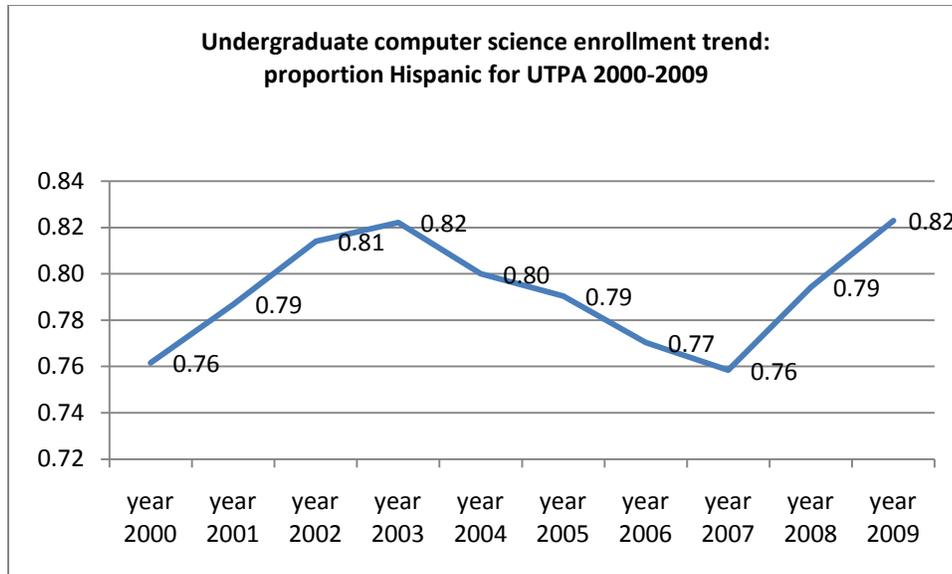
Figure 11: Hispanic students enrolled in computing: UTPA 2000-2009

Rates of enrollment in computing for Hispanic students are similar though a bit lower than degree production, with at least three fourths of computing students indicating their Hispanic ethnicity over the past ten years.
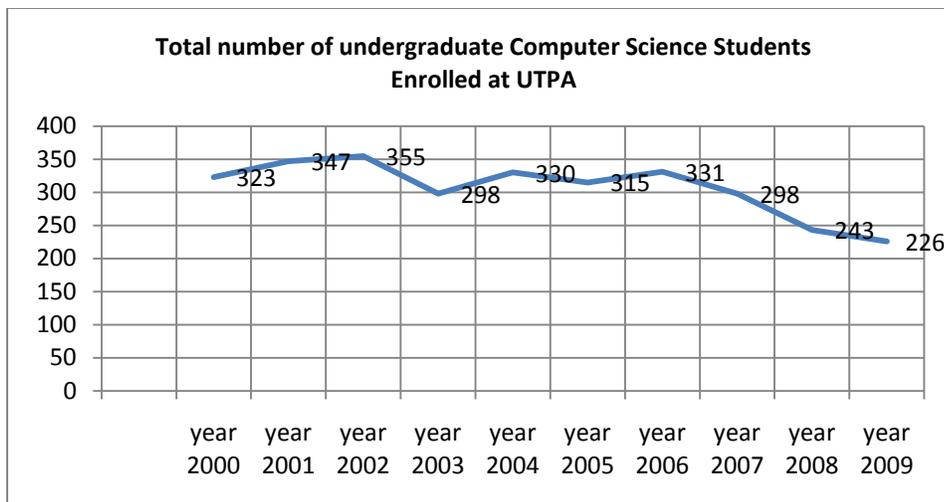
Undergraduate computer science enrollment trend: proportion female for UTPA 2000-2009
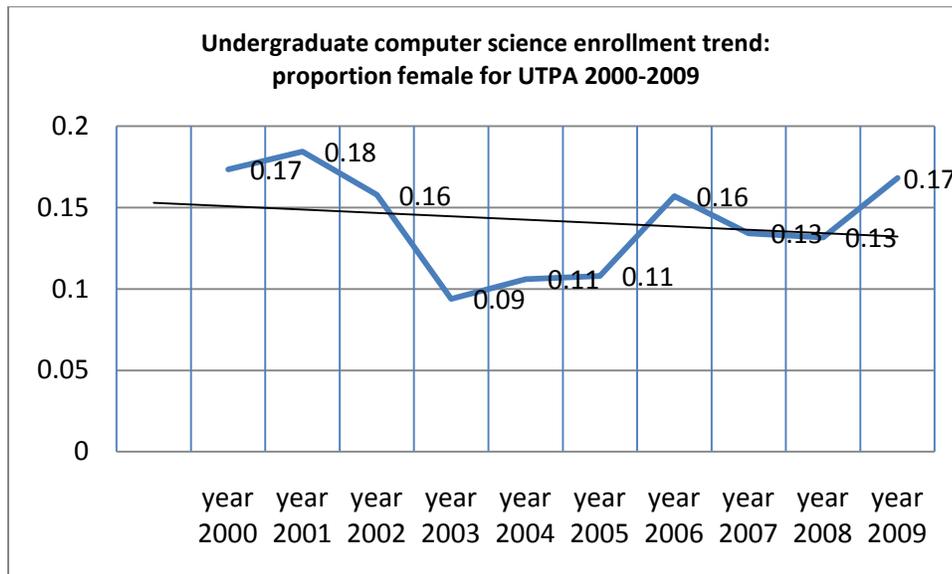
Figure 12: Female students enrolled in computing: UTPA 2000-2009

The proportion of enrolled females trends a bit higher than the proportion of graduates who are female- a possible indicator of differential success for men over women.

Enrolling, graduating post-baccalaureate computing scientists: Trends UTPA 2000-2009

In the past ten years, UTPA has conferred 145 Master's degrees in computing. While the rate of female degree production far surpasses undergraduate rates for women at UTPA, there exists room

for improvement—33% of MS degrees were earned by female graduate students from 2000-2009, though women make up over half of degree earners at UTPA. The rate of completion for Hispanic students in the computing Master's degree program is alarmingly low (39%) given the demographics of this institution. Enrollment data show, however that in 2009, 56% of enrolled MS students were Hispanic. At the same time, enrollment for women has decreased over time, to an enrollment of 10% women in 2009.

UTPA is a largely Hispanic institution with a cyclical graduation trend in the past ten years. While UTPA is poised to graduate a large number of Hispanic computer science students, the department is not yet at parity with the proportion of Hispanic students served by the university as a whole, and is vastly lacking in female participation. The SACI initiatives may assist the department in reaching parity by retaining Hispanic students via research experiences as well as advancing Hispanics by cultivating an interest in graduate school.

MIAMI DADE COLLEGE

The largest institution in SACI is Miami Dade College (MDC), a four-year institution that grants many 2-year and certificate degrees in the greater Miami area. MDC serves nearly 60,000 undergraduate students. Two thirds of students (68%) receive financial assistance in their first year, though less than half of all enrolled receive financial assistance. The majority of MDC students attend part time (62%), and more than half are female (60%). More than two thirds of MDC's population is Hispanic/Latino/a (69%) while the remaining students indicate they are black/African American (17%) Caucasian/white (8%). Ninety four percent are Florida residents. Six out of ten students (63%) are of traditional college age (24 years old and younger).

Miami Dade College has six degree programs related to computing. Data in this section focus on individual program statistics as well as overall degree enrollment and production.

Total undergraduate degrees conferred: MDC 2000-2009 (summed across six programs)

174 179 182 157 211 177 159 163 180 139

year 2000 year 2001 year 2002 year 2003 year 2004 year 2005 year 2006 year 2007 year 2008 year 2009
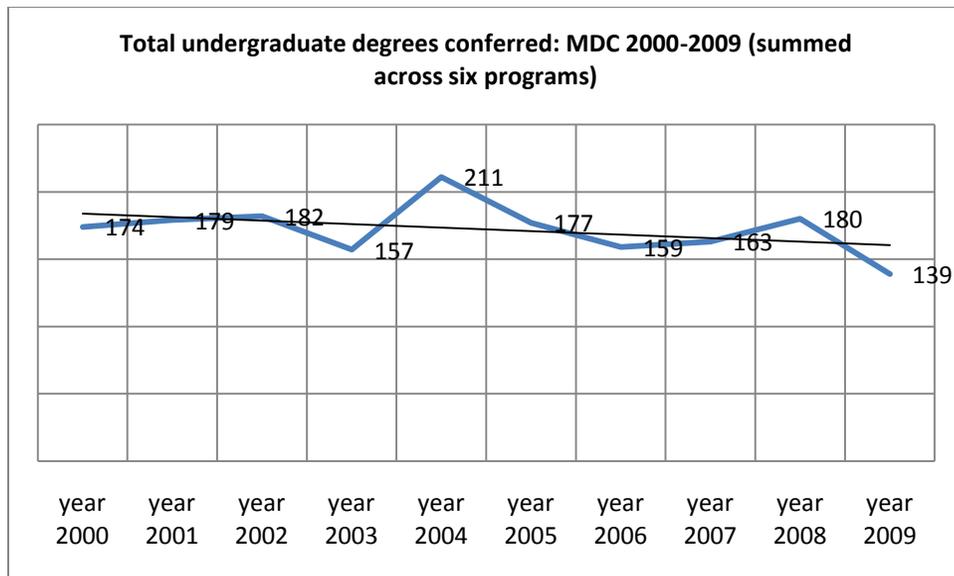
Figure 13: MDC degree production 2000-2009

Trends in undergraduate degree production show relatively steady results with a shallow decline over the past ten years- a difference from a peak of 211 degrees in 2004 to the latest figures, where MDC produced only 139 graduates, roughly two-thirds the number of graduates in 2004.
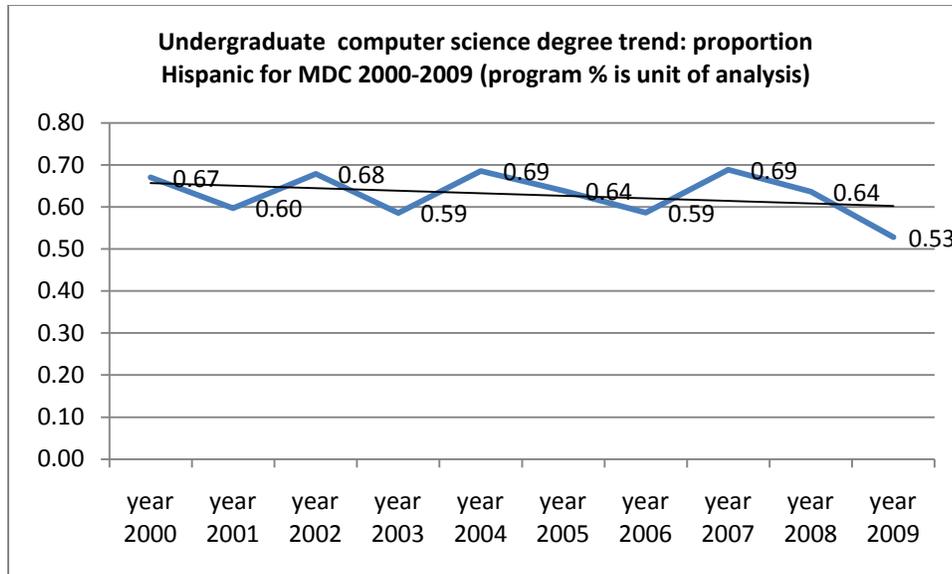
Figure 14: Hispanic computing graduates: MDC 2000-2009

At MDC, the proportion of Hispanic students receiving degrees in computing areas is near the proportion of student enrollment at the college, though this trend has been on the decline in the past two years to an all-time low of 53% in 2009 (compared with 69% Hispanic enrollment overall).
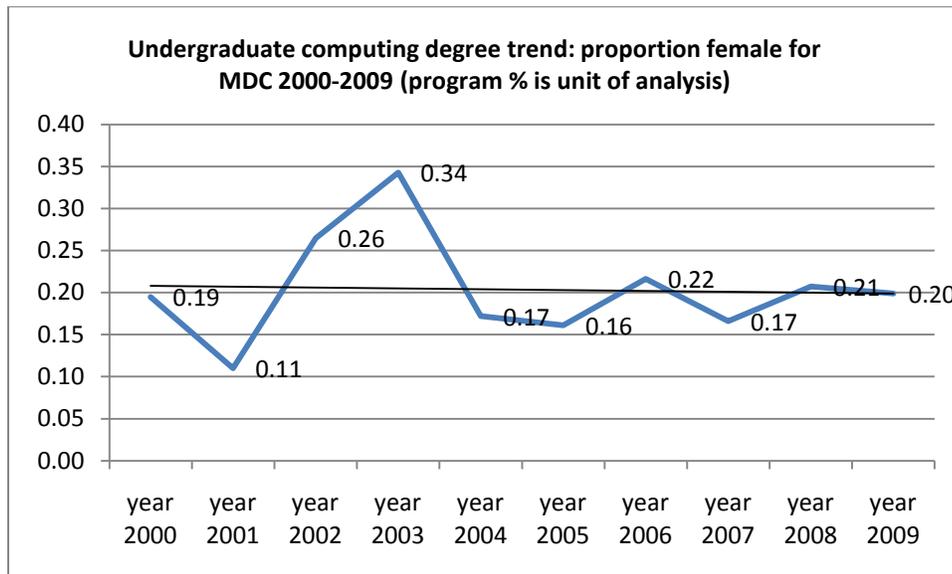
Figure 15: Female computing graduates: MDC 2000-2009

As in other schools, the rate of female participation in computing has remained low and in fact dropped from an early-mid 2000s peak, in this case from 34% of degree earners to 20%, or 59% of the peak female participation. At MDC, female participation seems to have leveled off around 20%.

Enrolling computing scientists: MDC 2000-2009
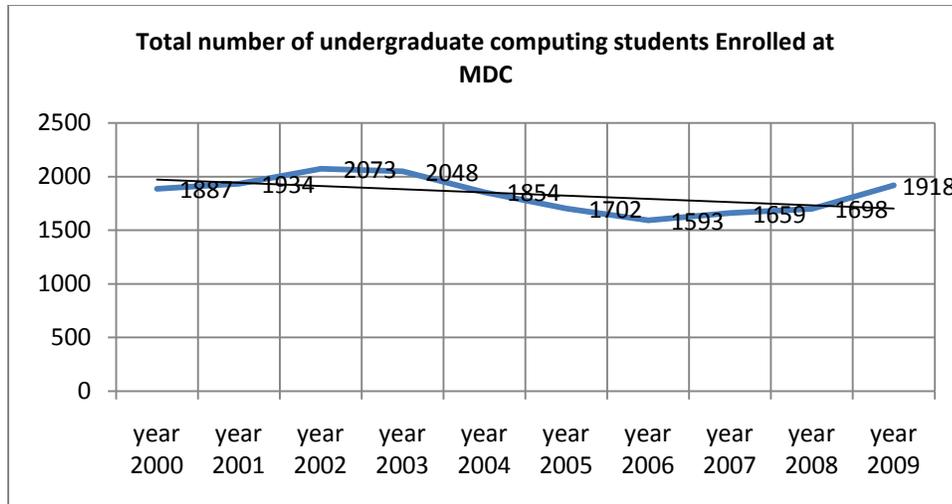
Figure 16: MDC undergraduate degree enrollment 2000-2009

A shallow decrease in enrollment has been experienced at MDC, though the last three years show an uptick in enrollment for computing degree programs. The sheer number of students in computing at MDC is of note- the community college-turned four-year institution boasts an average of 1,847 students enrolled in one of the six computing departments each year. Miami Dade College has developed a number of computing degree programs that appear to change with marketplace needs. This flexibility may have allowed the college to recruit and retain technical students while other programs faltered. The following three graphs show the proportion and number of students enrolled in each of the six programs at 5 points throughout the past ten years.
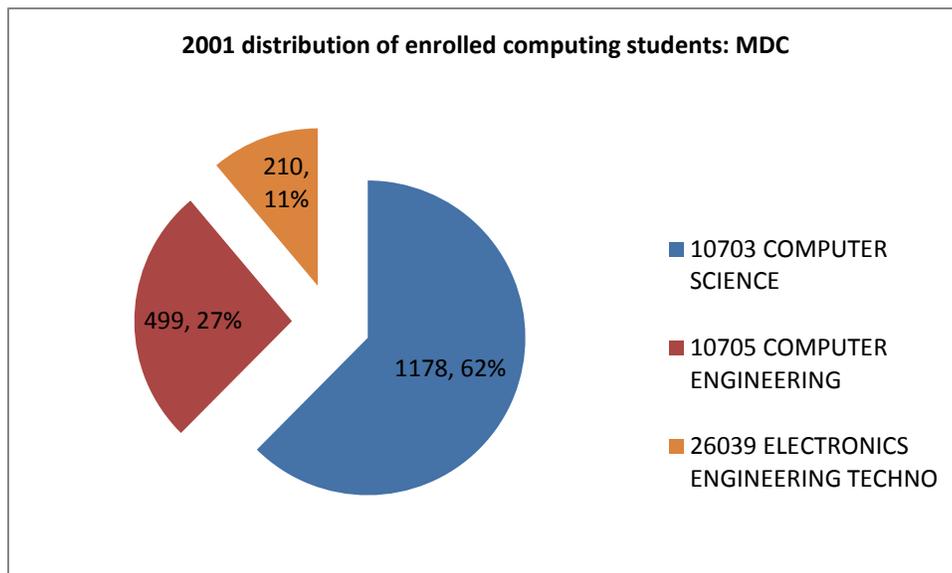
Figure 17: MDC 2001 enrolled students among three technical programs

2004 distribution of enrolled computing students: MDC

- 10703 COMPUTER SCIENCE
- 10705 COMPUTER ENGINEERING
- 25055 COMPUTER INFORMATION TECH
- 25064 COMP PROG + ANALYSIS-GAME DEVL
- 25065 COMP PROG + ANALYSIS-BUS APPL

676, 37%
599, 32%
193, 10%
229, 12%
140, 8%
4, 0%
13, 1%
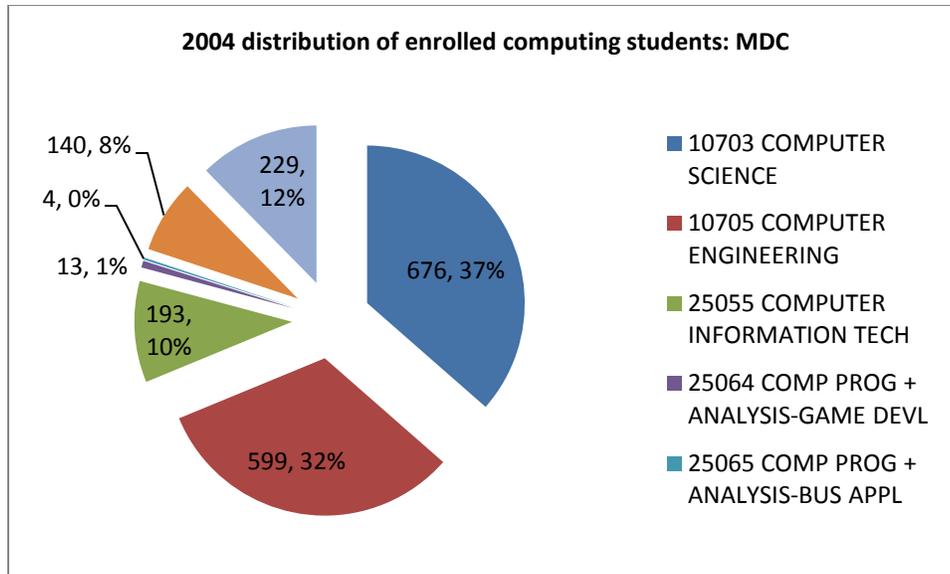
Figure 18: MDC 2004 enrolled students among five technical programs

2009 distribution of enrolled computing students: MDC

- 10703 COMPUTER SCIENCE
- 10705 COMPUTER ENGINEERING
- 25055 COMPUTER INFORMATION TECH
- 25064 COMP PROG + ANALYSIS-GAME DEVL
- 25065 COMP PROG + ANALYSIS-BUS APPL
- 26039 ELECTRONICS ENGINEERING TECHNO

634, 33%
624, 33%
202, 10%
210, 11%
99, 5%
91, 5%
58, 3%
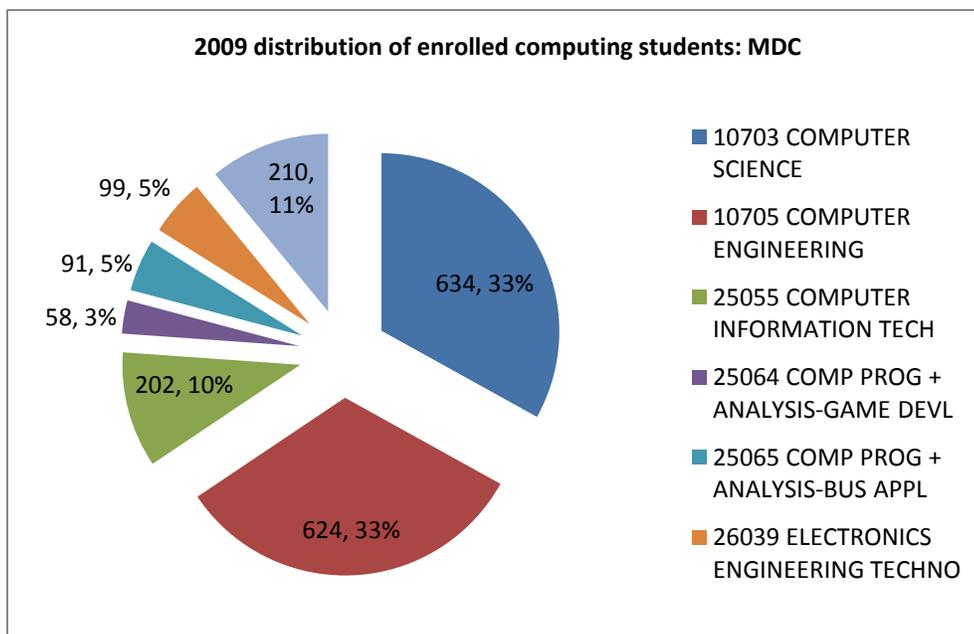
Figure 19: MDC 2009 enrolled students among six technical programs

MDC has been successful in graduating and enrolling students in technical areas, and their development of new programs over the past ten years may be assisting the college in keeping enrollment relatively steady. Hispanics earn degrees slightly below what would be expected, given the overall rate of Hispanic enrollment throughout the college, and the number of women who enroll and graduate from MDC is much lower than would be expected given their representation in the student body, and female enrollment, while near the national average, also shows room for improvement.

In addition to understanding SACI institution baseline data, we describe evidence from course-based initiatives that intend to improve success of underrepresented students in computing. In Part 2, we present data from the CS-0 course taught in the summer of 2010 to show the benefits of SACI initiatives for students, especially Hispanic students.

Computer Science Zero (CS-0) at Miami Dade College is a weeklong summer course for undergraduate students to develop applications for Google's Android mobile phone. In summer 2010, ten students with little to no prior programming experience designed and tested applications (apps) for Google's Android platform. Students used a software development environment, complete with a software emulator for the phone to develop the application and a real platform running the Android OS to demonstrate the application. Students were exposed to the main aspects of app development, such as setting up the development environment, Graphical User Interface (GUI) design through the Extensible Markup Language (XML), Multimedia and Graphics programming, Java programming and OpenGL. At the end of the weeklong session, students initiated the development of a Sudoku application for the Android System.

CS-0 REACHED HISPANIC STUDENTS

Students in the Miami Dade CS-0 summer course were primarily Hispanic (88%), male (63%), and college sophomores (88%). All students were computer science/computer engineering majors. Students also reported the educational background of their parents or closest parental figures. Most students' parents had attended some college or earned a college degree. For example, almost all students reported that their mothers or closest female parental figure had completed some college, or earned a 2-year or 4-year degree. One student reported that his mother had earned a graduate degree while one student reported that his mother did not finish high school. Students reported similar rates of college attendance for their fathers or closest male parental figures. One student reported that his father did not complete high school. The majority reported that their father had attended some college, or earned a 2-year or 4-year degree. Because financial pressures often factor into the educational pathways of CAHSI and SACI students, students were asked about their employment status outside of school. Almost two-thirds of CS-0 students (63%) reported that they do not work outside of school, while individual students reported that they worked 1-10 hours a week, 31-40 hours a week, or more than 40 hours a week. Thus a minority of students worked many hours in outside employment.

Students involved in the weeklong course took a survey based on social cognitive career theory (SCCT), which posits that individuals base career decisions on their confidence, interest, and perceived sense of mastery in a field (Lent, et al 2005). Students were invited to complete the online survey at the end of the summer. Several follow-up emails were also sent to remind students that had not yet completed the survey. Ten students completed the post-course survey.

Following the course, students reported increased interest in computing careers and in the computing major, increased confidence that they could succeed in the major, and perceived academic support in their department. Students commented that the structure of the course and real-world problem solving associated with developing apps contributed to their learning.

CS-0 POSITIVELY INFLUENCED STUDENTS' CAREER AND EDUCATIONAL GOALS

Participating in the week-long CS-0 summer session increased students' commitment to their major and to completing an undergraduate degree. Fully 100% of students reported a positive increase (slight to strong increase) in their intention to remain enrolled in their discipline over the next semester, to obtain a college degree in their major, earn a bachelor's degree, and work in

computing after graduation. Students were slightly less committed to enrolling in graduate studies (67% reported increase in intention to pursue a master's degree and 33% reported an increase in intention to pursue a Ph.D.) or joining the professoriate (22% reported a slight increase in intention; none reported a strong increase in intention). The figure below demonstrates the item means for survey items related to changes in students' career and educational goals. Items were rated on a 10-point scale (1=strong decrease in intention, 10=strong increase in intention).

Change in career intention (as a result of this course)

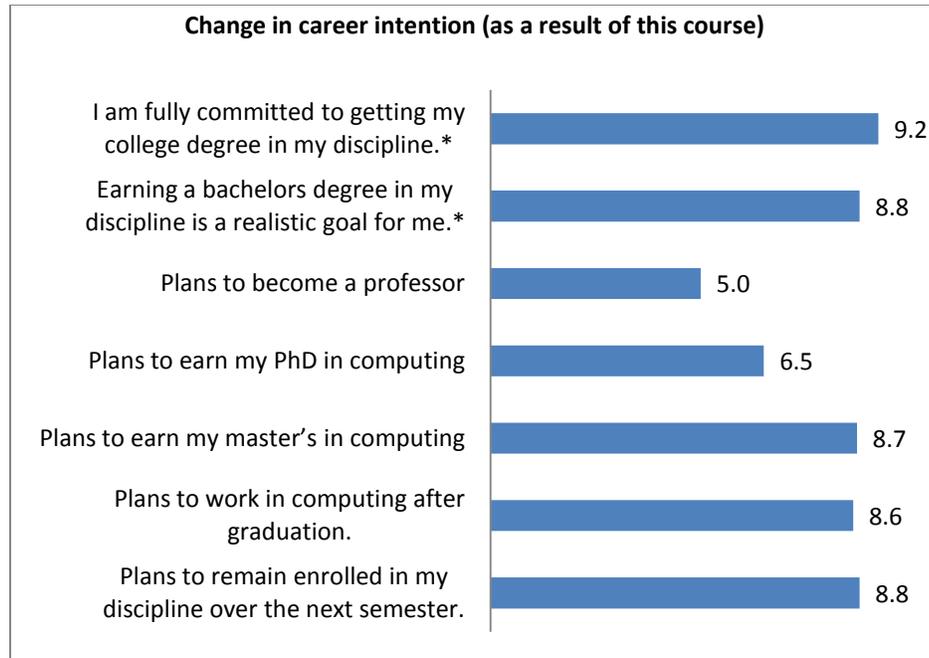| Item	Mean
I am fully committed to getting my college degree in my discipline.*	9.2
Earning a bachelors degree in my discipline is a realistic goal for me.*	8.8
Plans to become a professor	5.0
Plans to earn my PhD in computing	6.5
Plans to earn my master's in computing	8.7
Plans to work in computing after graduation.	8.6
Plans to remain enrolled in my discipline over the next semester.	8.8

Figure 20: Student mean scores of career intention survey items—CS-0 at MDC

Students were also asked to comment on what contributed to the change in their career or educational path. Only one of the ten students wrote in a response. This student noted that he discovered a love for computers from the CS-0 course.

This change was due to the fact that I realized Civil Engineering was not my passion. My true drive comes in Computers. Everything about them and it only took me one week to notice this.

STUDENTS GAINED CONFIDENCE IN THE DISCIPLINE

Students also rated the impact of the course on their confidence that they could achieve their career goals. In the terminology of social cognitive career theory, this sense of mastery of computing is called *self-efficacy*. Students reported substantial increases in their self-efficacy in computing because of the CS-0 course. For example, 100% of students reported a slight or strong increases in confidence that they could excel in their discipline over the next semester, complete all the math requirements for their major with a grade of B or higher, and complete the upper-level courses in their major with a grade of B or higher. Almost all students also reported an increase in their confidence that they could program a computer—one student reported a slight decrease in confidence. The figure below illustrates the means for these self-efficacy items.
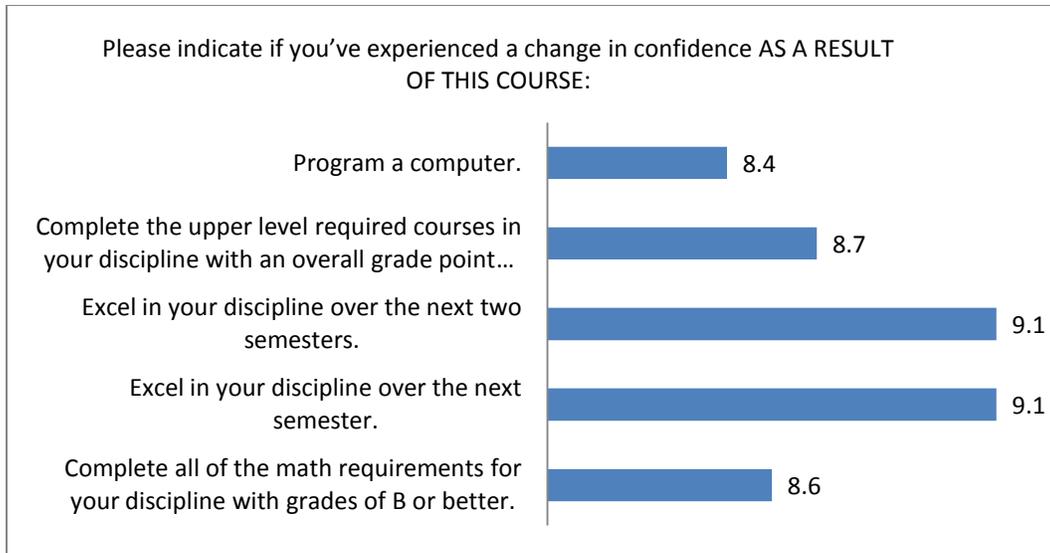
Figure 21: Student mean scores of self-efficacy survey items—CS-0 at MDC

CS-0 REDUCED BARRIERS TO ACADEMIC SUCCESS

Because of the CS-0 course, students perceived greater social support and fewer barriers in their major. For instance, 100% of CS-0 students felt that after taking the course they were more able to balance their work/academic and personal lives, and to find effective ways to study despite competing demands on their time. Thus the CS-0 course seemed to enhance students' sense of work-life balance and improve students' study skills. Most students felt that they were better able to cope with a lack of support from an advisor or professor (78%), complete a degree despite financial challenges (89%), overcome communication problems with professors (89%), and persist in their major even if they perceive the environment to be unwelcoming (89%). Thus, CS-0 students report that they are more prepared to cope with difficulties often faced by Hispanic students in postsecondary education.

AS A RESULT OF THIS COURSE, how confident are you that you could:

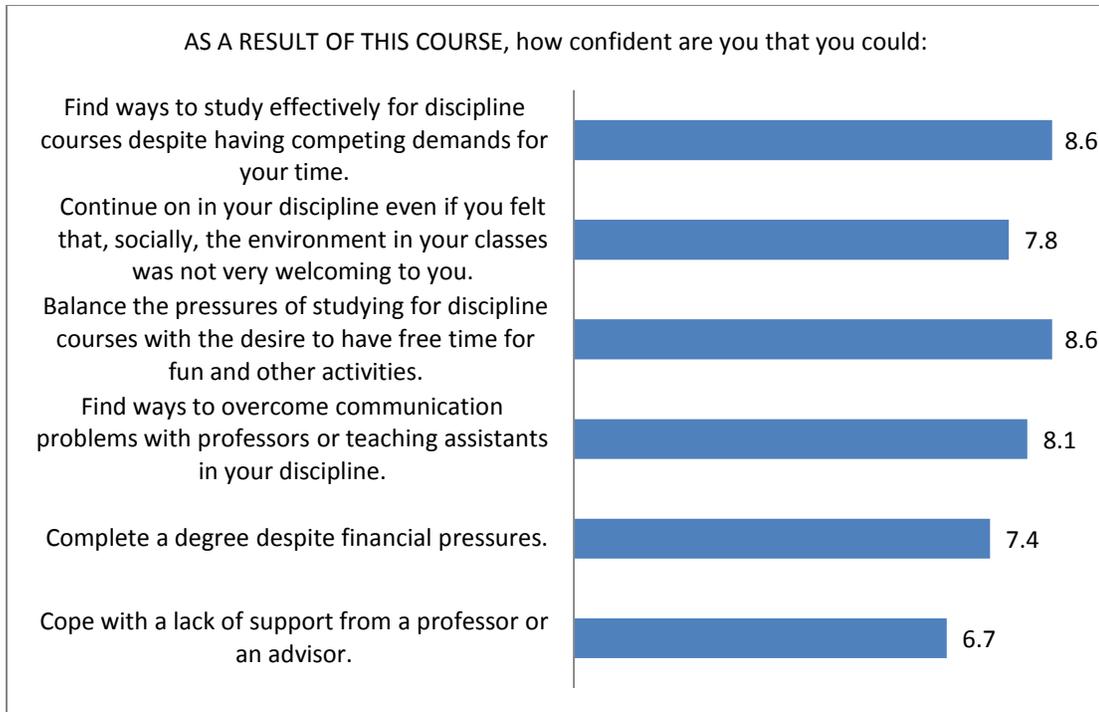|	
Find ways to study effectively for discipline courses despite having competing demands for your time.	8.6
Continue on in your discipline even if you felt that, socially, the environment in your classes was not very welcoming to you.	7.8
Balance the pressures of studying for discipline courses with the desire to have free time for fun and other activities.	8.6
Find ways to overcome communication problems with professors or teaching assistants in your discipline.	8.1
Complete a degree despite financial pressures.	7.4
Cope with a lack of support from a professor or an advisor.	6.7

Figure 22: Student mean scores of coping self-efficacy survey items—CS-0 at MDC

STUDENTS GAINED A POSITIVE VIEW OF COMPUTING CAREERS

Another tenet of social cognitive career theory asserts that students will be more likely to pursue careers in certain fields if they value those careers and associate those careers with positive outcomes. In the terminology of social cognitive career theory, these expectations of a future career are called *outcome expectations*. Students reported that the CS-0 course positively influenced their outcome expectations of a computing career. There were no negative responses (slightly disagree to strongly disagree) to any of the items on the outcome expectations scale. For instance, 100% of students slightly to strongly agreed that the computing field will allow them to receive a good job offer, earn an attractive salary, do work that is satisfying, have a career that is valued by their family, do work that is exciting, and serve as a role model for others. Thus, CS-0 students strongly believed that a career in computing would yield many positive outcomes. The data presented demonstrates the means for survey items related to outcome expectations of the computing field.
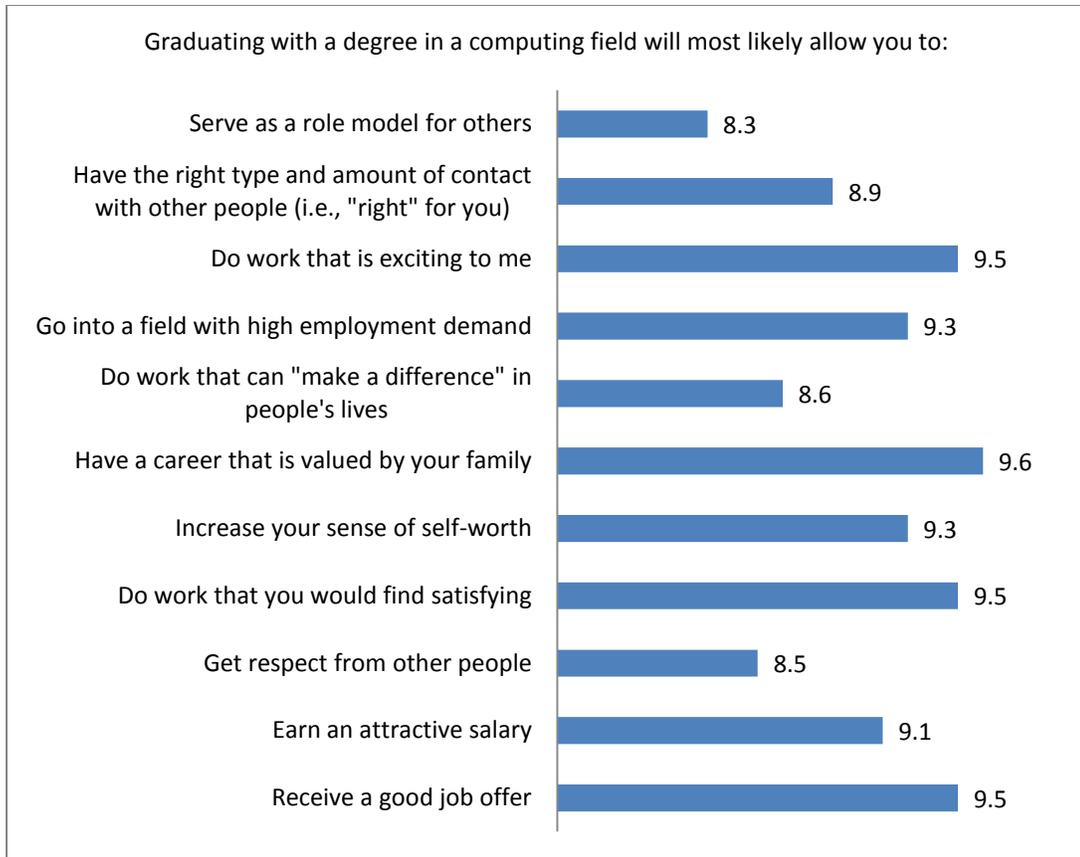
Figure 23: Student mean scores of outcome expectation survey items—CS-0 at MDC

STUDENTS GAINED INTEREST IN COMPUTING

Students reported that the CS-0 course increased their interest in computing and technology applications. Fully 25% of students reported that they already had strong prior interest in computing and, therefore, the course had simply helped to maintain that strong interest. The rest of the students reported that their interest had slightly or strongly increased. No students reported that they experienced a decrease in interest from the course. In keeping with the curriculum of the CS-0 summer course, the strongest increase in interest was related to "learning new computer applications." The figure below illustrates the means (10-point scale) for the survey items rating students' interest in computing.

Figure 24: Student mean scores of computing interest survey items—CS-0 at MDC

STUDENTS LEARNED FROM REAL-WORLD PROJECTS

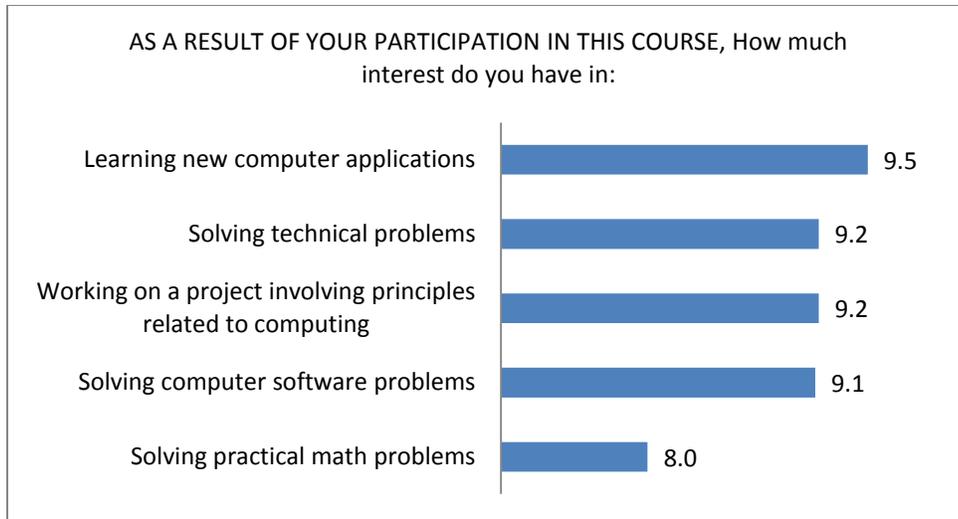In open-ended questions, students were asked to name a project or assignment that they were proud of, and they were also asked why the project was meaningful to them. All of the CS-0 students listed real-world projects or assignments as the most meaningful aspect of the course. Typical student responses to this question were: "coding Sudoku," "creating a binary digital clock," or "making the app myself." Students cited these projects as meaningful because they were challenging and involved effort and problem-solving. Following are typical student responses describing why these real-world applications were meaningful to them:

We had to work on it with a group and problem-solve ideas to make a theoretical idea a reality.

 It taught me the patience you need to have when creating a digital system from the drawing board using the bare minimum in electronic parts.

Had errors on every step of the install, yet managed to solve all of them and get it installed.

STUDENTS ARE MORE LIKELY TO PERCEIVE THAT THEY HAVE ROLE MODELS AND SUPPORT

 After the CS-0 course, students were more likely to perceive that they had role models or mentors in their discipline and support in the pursuit of their studies. Three-quarters of students reported that they were more likely to have a role model in the discipline, and have access to a mentor that could offer advice and encouragement. Almost all students (88%) reported that they were more likely to feel that there are "people like me" in the discipline. All students (100%) reported that their close friends and relatives were "proud of me for making this decision." A few of the items were negatively worded, meaning that these are outcomes that are undesirable. Students rated the possibility of these undesirable outcomes as less likely after completing the CS-0 course. For instance, almost all students (88%) reported that it is unlikely that they will worry that their chosen career path requires "too much time or schooling." Likewise, 100% of students were unlikely to feel that they "don't fit in socially with the other students in their discipline." Because these items are negatively worded, a low mean on the 10-point scale is actually the desirable response. The figure below illustrates the means for the items related to academic and social support in the major.
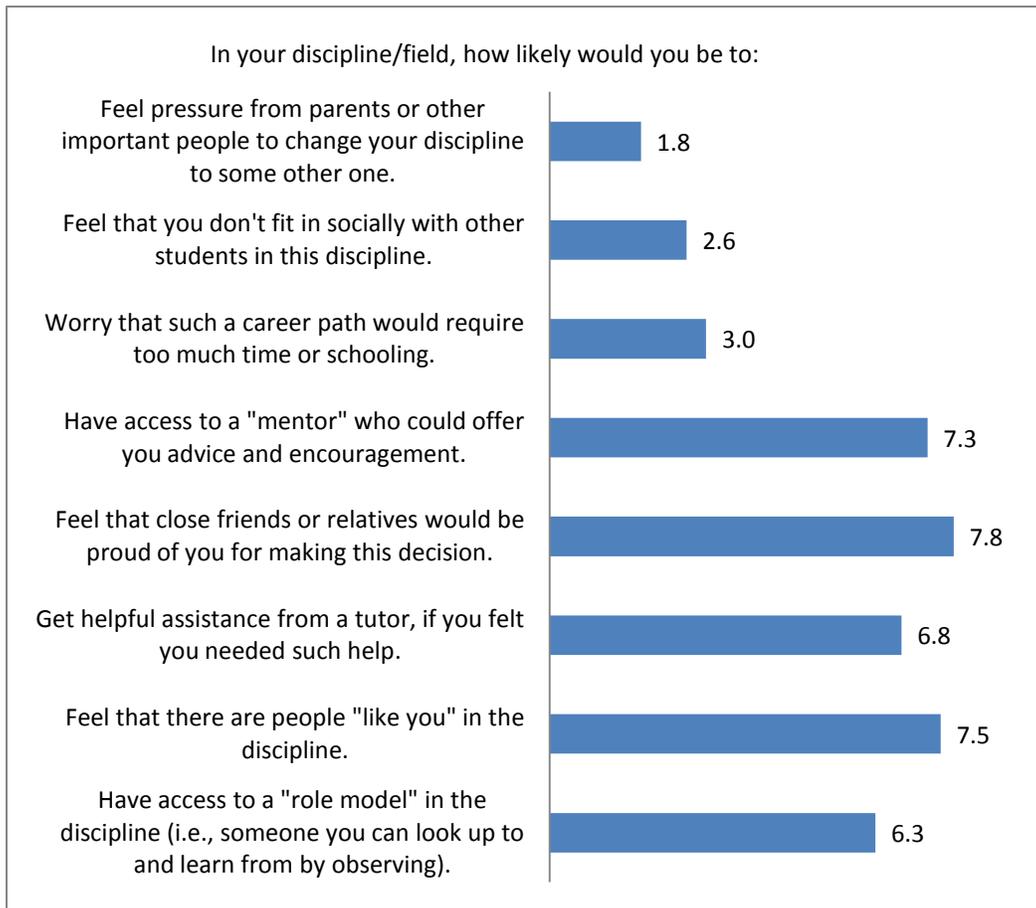
In your discipline/field, how likely would you be to:

Survey Item	Mean Score
Feel pressure from parents or other important people to change your discipline to some other one.	1.8
Feel that you don't fit in socially with other students in this discipline.	2.6
Worry that such a career path would require too much time or schooling.	3.0
Have access to a "mentor" who could offer you advice and encouragement.	7.3
Feel that close friends or relatives would be proud of you for making this decision.	7.8
Get helpful assistance from a tutor, if you felt you needed such help.	6.8
Feel that there are people "like you" in the discipline.	7.5
Have access to a "role model" in the discipline (i.e., someone you can look up to and learn from by observing).	6.3

Figure 25: Student mean scores of perceived support survey items—CS-0 at MDC

In conclusion, students received many positive benefits from participating in the summer CS-0 course at Miami Dade College. Students became more committed to their major and their pursuit of an undergraduate degree. Students also gained a more positive view of computing careers and increased their interest in computing. They also perceived more academic and social support in their major. Students credited the authentic projects and problem-solving within the course as providing a window into "real-world" computing and increasing their confidence that they could succeed in their major. These data suggest the CS-0 initiative may impact student success in the major.

SUB-GOAL 1B: ASSIST STUDENTS IN THEIR TRANSITION TO AND SUCCESS IN GRADUATE SCHOOL THROUGH MENTORSHIP: PART 1

UTPA RESEARCH DAY EVALUATION

One element of SACI aiming to assist students in their progression to graduate school is the Computer Science Student Research Day (CSSRD) at UTPA. The goals of the UTPA research day conference include: providing opportunities for students and faculty networking, serving as a forum for advanced discussion of computing and computing careers, and encouraging high school and undergraduate students to further their education in computing fields.

Approximately six weeks after the UTPA research event, attendees received an invitation to take an online survey, to address their attitudes and opinions about the CAHSI event as well as to ascertain how the meetings influenced subsequent attendees' behaviors regarding engagement with research and advancement in their computing professions or studies. Surveys were sent via email invitation, with 3 email reminders occurring over the following weeks. The delayed response was employed to avoid the "halo effect", in which participants tend to mark experiences as highly enjoyable when they have little time to reflect upon the experience. Sixty attendees completed surveys of the 300 who attended (20% response rate).

The research day did indeed attract the target populations of students: 36% indicated they were female, and 80% were Hispanic. In addition, students ranged in age from high school through graduate school, indicating the event made strides in outreach and recruitment to future students as well as supporting current undergraduates. Students were asked of their impressions of the conference in three items.

Students were likely to recommend the SACI UTPA research day to peers. All of the participants who had expectations regarding the event found those expectations were met, at least to a degree. While a quarter of participants did not have expectations (16, 27%) regarding their experiences at the research day, nearly the same number found the research day event exceeded their expectations (14, 23%). The remainder of participants say that their expectations were met (18, 30%) or somewhat met (10, 17%). The vast majority of participants would recommend the SACI UTPA research day to their peers (90%, 54 overall, 48% strongly agree, 42% agree). Two participants said they would not recommend the event to their peers. Nearly all (97%) of the survey participants plan to return to the SACI UTPA Research Day, assuming timing is right, while two are undecided whether the event will be worth their time next year. Note, none of the respondents declined participation next year.

PREPARING FOR GRADUATE SCHOOL FOLLOWING THE RESEARCH DAY

Rather than focus exclusively on attitudes and aspirations regarding graduate school, we chose to ask research day participants what actions they had taken towards graduate school preparation. Wed found that items vary from 38% to 58% of participants who have taken steps or plan to take steps towards graduate school following their participation in CSSRD at UTPA. See table below.

Table 2: CSSRD event participants' preparation for graduate school

Please list the activities you have engaged in (or PLAN to engage in) following the CSSRD event.				
Answer Options	**Yes, I have done this**	**I plan to do this**	**I have not done this/don't plan to do this**	**Not applicable**
I have applied for academic scholarships following the event.	3	14	17	18
I have asked about graduate school opportunities based on information I received at the event.	3	16	17	16
I signed up for the GRE following the event.	1	12	17	22
I have made first steps to prepare for the GRE following the event.	1	10	18	23
I have applied for graduate school based on the information from the event.	2	16	13	21

New student researchers were asked to reflect on their research experiences in computing after a few weeks in the program. Students came from all three SACI schools, were nearly all Hispanic (8, 73%), and represented all grade levels. Eight were men (73%). Preliminary results show that a few students are beginning to see the benefits of continuing their education.

INCREASED ASPIRATIONS FOR GRADUATE SCHOOL/RESEARCH CAREERS

One student researcher said her experience is influencing her decision to follow a research path in computing.

"The biggest benefit, I believe is that the involvement in the research project has increased my desire to continue along this path. It has caused me to want to continue in the research field and to bring my education to the highest level possible and to continue to work in a team setting. There have been no big costs as a result of my involvement."

STUDENTS DESCRIBE FORMAL AND INFORMAL MENTORING FROM PROFESSORS, PEERS

Nearly all students (73%, 8 of 11) stated they had a formal or informal mentoring relationship in their department. In fact, three students mentioned the power of peer support as well as faculty mentoring; indicating research students are building a sense of community in their departments.

"The faculty and the students in the Engineering department at (school) all share common interests in Engineering and I feel that these influential relationships act to assist me towards achieving my educational goals."

"I would have to say that I do not have a formal relationship with a mentor, however I do have a great professional relationship with my fellow students."

"The biggest benefit is working with fellow students and developing lasting relationships outside of class."

KNOWLEDGE DEVELOPMENT FOR SUCCESS IN GRADUATE SCHOOL

The most commonly cited benefit of participation in ARG research other than "research skill" was "technical knowledge"—8 of 11 respondents marked this as one of their top three gains from the research experience. One student described the effect of the research experience in his academic career.

"The biggest benefit of participating in this research is the knowledge that I'm gaining and how it connects to my major."

Preliminary data from ARG researchers at SACI schools suggest some of the undergraduate researchers aspire to graduate school, most feel supported by mentors, including peers, and the majority views the experience as developing their technical knowledge.

SACI GOAL 2: DEVELOP AND SUSTAIN COMPETITIVE ACADEMIC AND RESEARCH PROGRAMS AT THE PARTNERING INSTITUTIONS: PART 1

RESEARCH DAY AT UTPA SUPPORTS RESEARCH INTEREST, RESEARCH DISSEMINATION

Students who participated in the UTPA research day described getting excited about the research performed on campus, and mentioned the work of multiple graduate students and faculty on campus. Students commented on the applicability of computing to multiple areas, such as biology, mathematics, and health, and expressed that this view of computing was new to them.

"I was impressed by the infusion of mathematics throughout most of the presentations. There is a strong link between mathematics and computer science."

"The video game that had to do with red and white blood cells (was my favorite) because it was interesting and it had something to do with a real life event that would be awesome to explore."

"I liked of the talks that was about sequences. I think that it is very interesting how computer scientist can help on the research of very complex things like DNA."

When asked to describe their favorite panel, poster or talk, students mentioned multiple topics, from biotechnology, Artificial Intelligence, and assembly, to videogames. Their responses indicate a vibrant research community, as experienced by students at the event. In addition, students described research related activity in which they engaged following the research day: in particular, network development and seeking research opportunities for themselves on campus. See table below.

Table 1: CSSRD student participants' research and networking behaviors following the event

Please list the activities you have engaged in (or PLAN to engage in) following the CSSRD event.				
Answer Options	**Yes, I have done this**	**I plan to do this**	**I have not done this/don't plan to do this**	**Not applicable**
I have contacted a faculty member I met at the event.	14	9	14	15
I have contacted a student I met at the event.	18	12	11	11
I have applied for academic scholarships following the event.	3	14	17	18
I have asked about research opportunities on campus following the event.	12	14	16	10

UTPA Research Day Professional Development Participant Activity

- None of the listed activities
- one to two of the listed activities
- three to four of the listed activities
- five or more of the listed activities

Number of Research Acitivties Planned or Accomplished (n=49): 9 | 12 | 14 | 14

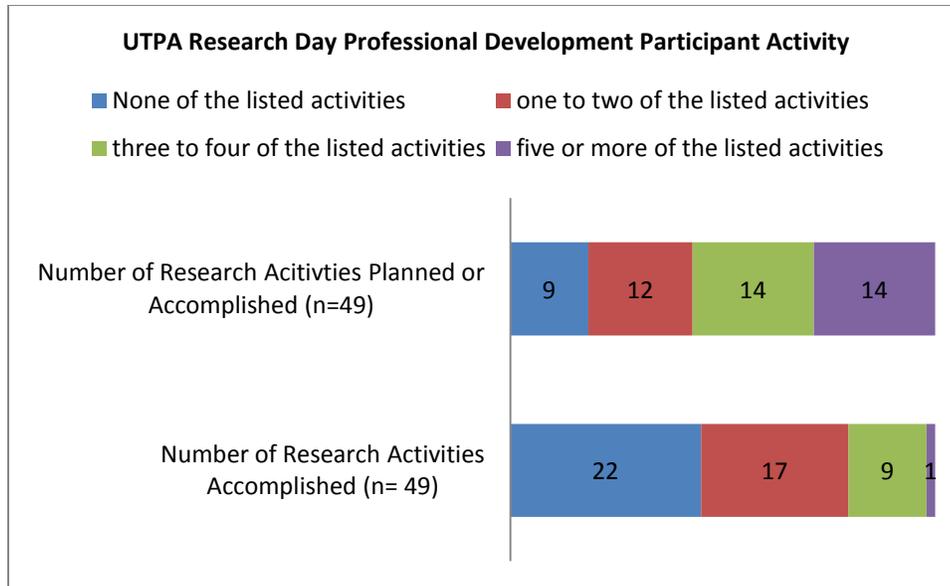Number of Research Activities Accomplished (n= 49): 22 | 17 | 9 | 1

Figure 26: Total student activity and planned activity following CSSRD

Most of the participants surveyed had accomplished or planned to accomplish one of the research and academic tasks presented (40, 82%). In fact a good portion planned to do at least three of the activities listed (28,57%) and 55% had already accomplished at least one of the activities known to prepare students for graduate study. These data indicate the event may support the goals of SACI, particularly the goal to develop and sustain competitive academic and research programs at SACI schools.

SACI GOAL 2: DEVELOP AND SUSTAIN COMPETITIVE ACADEMIC AND RESEARCH PROGRAMS AT THE PARTNERING INSTITUTIONS: PART 2

ARG RESEARCHERS EXPLAIN THEIR RESEARCH GOALS

Survey participants were asked to describe their research projects and role within the research group. Students seem to focus on a wide variety of computer science application areas, including weather, smartphone applications, disabilities, language identification, applications of resistors, and semantics. Descriptions varied in the precision and technical vocabulary used. While some students mentioned personal connections to the work they were doing, others described societal impact. These responses indicate students are beginning to communicate not only the content of their research efforts, but also beginning to communicate the importance of their work. Two responses are provided below.

"The basics and semantics of languages within a given context. Language is a many-faced creature with many double meanings and ambiguities. A computer language must have a basic understanding of the context that we as Natural speakers often take for granted. An attempt to understand and translate language to a form that computers can manipulate and present would be a great boon to a wide variety of computing applications."

"The research project that I have been working on involves the use of computational technology in a way that may improve or assist a person with specific disabilities and aid in the development of technology that could help solve a problem. The questions that we address are how can this technology benefit someone? And, how can we develop and improve on computer driven communication to help solve a problem and expand on those ideas? We also discuss the benefit of a team research environment where a combination of skills helps to progress our research."

In describing their roles in the research process, students mentioned their explicit tasks as well as the structure of the group in which they work (when applicable). The interrelatedness and interdependence described in the research role responses indicate that some students are experiencing the cooperative learning element of the ARG model. For some schools, funds are such that only one or two students are incorporated into research programs, and so such cooperation is less feasible.

STUDENT RESEARCHERS GAIN RESEARCH, TECHNICAL, TEAM, AND COMMUNICATION SKILLS

In a survey, researchers marked the top three gains they were making in their academic careers because of their research experiences. We note that the average number of skills marked was four, rather than three, indicating to us that the set number was not able to capture their experience completely. The top mentioned element was research skills, not surprisingly, though technical knowledge was also widely noted by researchers, as were problem solving and team skills. See figure below.
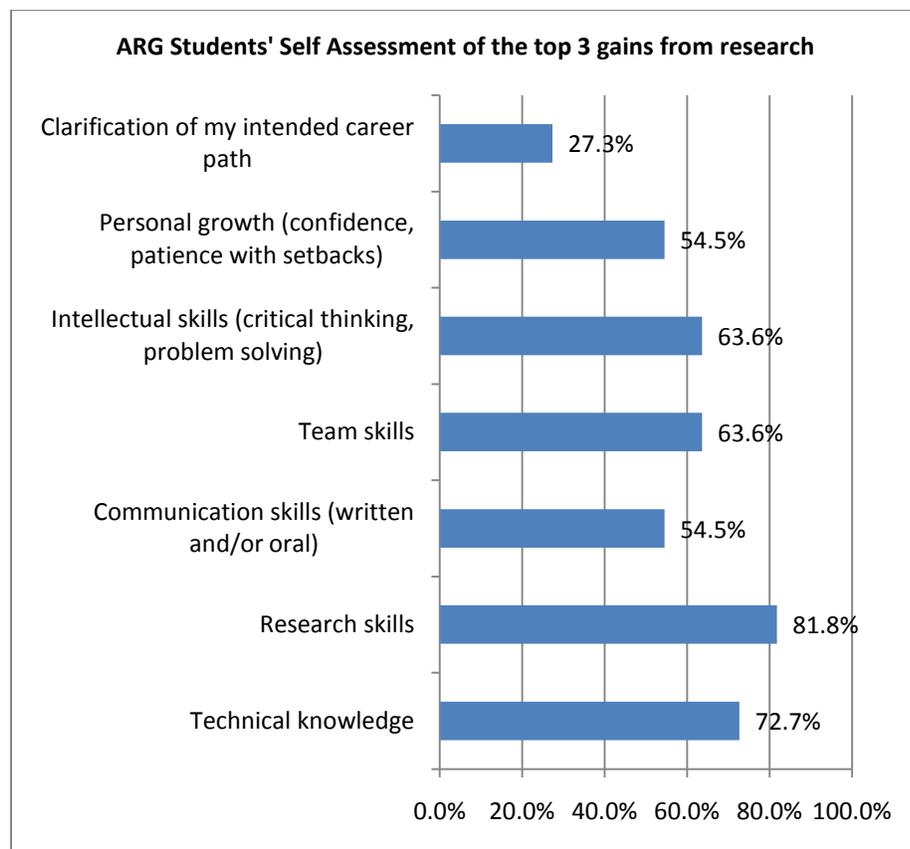

ARG Students' Self Assessment of the top 3 gains from research

Category	Percentage
Clarification of my intended career path	27.3%
Personal growth (confidence, patience with setbacks)	54.5%
Intellectual skills (critical thinking, problem solving)	63.6%
Team skills	63.6%
Communication skills (written and/or oral)	54.5%
Research skills	81.8%
Technical knowledge	72.7%

Figure 27: ARG students' gains from research

SUMMARY OF SACI YEAR 1 RESULTS

An analysis of graduation and enrollment data at SACI institutions indicate that each institution could benefit from educational initiatives that support underrepresented students in computing—in fact most departments are experiencing a decline in enrollment and graduation, and so educational initiatives that recruit and retain *all* students may prove beneficial to SACI schools. Preliminary data

from the first year of SACI activity indicate that coursework such as CS-0, research experiences for undergraduates, and research day events are beginning to support student success and advancement as well as assist SACI schools in developing robust research and academic programs in computing.