Internships and Underrepresented Student Persistence in Technical Education—the CompTechS Program

Year 1 – Findings
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Executive Summary

The CompTechS Program in the Occupational Training Institute at Foothill-De Anza Community College District was funded in June 2007 by the Advanced Technological Education Program of the National Science Foundation to study the impact of the program on student persistence in the IT field, especially for low income and underrepresented groups.

The research cohort for the year one study consisted of 56 students who were in the CompTechS program for varying periods of time between June 2007 and December 2007. The total unduplicated number in any of our target groups (low income, women, underrepresented minorities) was 42 students. The primary sources of data were the following:

1. Completing student exit surveys and interviews conducted by staff
2. Completing student interviews conducted by evaluators
3. Foothill-De Anza CCD institutional data bases and student information systems
4. Past student survey conducted online.

The first year findings are organized around the following research questions.
1. How do students in the program assess the value of the internships and learn-by-doing methodology?

- Students gave high ratings to their CompTechS experience and overall made very positive comments about the impact of the program on their professional goals.
- Almost all students gave highest marks to the helpfulness of the campus refurbishing lab. .
- Completing students reported gaining new skills and knowledge (67%) and gaining industry experience (22%) as the best things about the program
- Completing interviewees consistently said they increased their confidence, feelings of technical competence and readiness for the workplace. All of the interviewees said they would recommend the program, and had in fact had already recommended it to friends.
- Past students' predominant theme was the clarification of goals they realized based on their experience in the campus or industry internship.

2. What is the impact of the internship experience on success, persistence in the major and plans for careers or transfer?

- Of the 56 students in the year one research cohort, 44 were enrolled at community colleges and 6 in universities at the beginning of Winter 2008 quarter/semester. From June 2007 to January 2008, the persistence is 89%. Additionally, one was working full-time in field increasing to 91% persistence in computer and technical fields. It is too early to draw conclusions about persistence with the limited first year data, but these factors look promising.
- In computer related coursework, the CompTechS student success rate (a grade of C or better) was not significantly different from as other De Anza students.

However, the success rate in overall coursework approaches a significant difference, with 76% of the CompTechS student grades/coursework successful in Fall 2007 compared to 70% of De Anza students' coursework overall.

- Career plans - Six of the 18 completing students reported in their exit survey that they had changed goals from the beginning of their time in the program.
- Past students who completed before June 2007 reported their career goals – 87% had a computer related or technical career as a goal.

3. What are the motivating factors that impact attraction, persistence and success? Students appreciated the supportive staff, the flexibility of work hours in the lab and friendly environment. They liked the acquisition of new or improved skills best about the program, with resume building and industry experience also being important.

4. Did students' attitudes improve toward computing fields? The most significant improvement reported by students was their feeling of confidence and competence in technical fields.

5. What are the differences in the impacts of the industry internship as opposed to the campus internship? We saw no statistically significant differences on any of the variables. Thus, the results indicate that for this initial cohort of students that participation in the Campus Lab only versus both the Campus Lab and Industry Internship did not influence enrollment patterns or probability of success in coursework. Further, it did not influence the perception of the students on the value of the program in clarifying their goals or of the programmatic components.

6. How does the impact of the methodology (learn-by-doing and internships) vary for different student populations? The results suggest participants in the program had very similar experiences regardless of their gender and ethnicity. While the participant's experiences may be unique to each individual, they are not shaped by their physical characteristics. The same was true of low income students, though there were some differences, such as better success rates in non-technical courses. Generally more data is needed to determine patterns in specific ethnic groups.

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Introduction

The CompTechS Program in the Occupational Training Institute at Foothill-De Anza Community College District was funded in June 2007 by the Advanced Technological Education Program of the National Science Foundation to study the impact of the program on student persistence in the IT field, especially for low income and underrepresented groups.

The CompTechS (Computer Technical Support) program provides about 50 students a year with paid internships in a computer refurbishing lab on the De Anza College campus and also places qualified interns in local industry. Through the hands on experience in the production environment of the lab, students gain valued hardware skills, clarify career goals, and are counseled about useful courses and certifications to meet their goals.

The computers to be refurbished in the lab are acquired through the solicitation of used computers from local companies and the community, providing a socially responsible means of retiring computer equipment. At the same time, the program bridges the "digital divide" by recycling refurbished computers to disadvantaged students – 210 refurbished computers were given to financial aid recipients, Equal Opportunity Program and Services (EOPS) and CalWORKS (public assistance) students in the last year.

From Fall 2004 to Fall 2006, students in the refurbishing lab and industry internships continued coursework and degree programs at a rate of about 70%. With this high rate, we proposed to the National Science Foundation to further study this persistence rate which runs contrary to existing trends. During an overlapping period the CIS and CTIS (Computers, Technology & Information Systems) programs at both colleges declined from an enrollment of 16,513 in 2003-04 to 7,314 enrollments in 2004-05. This decline was attributed to the downturn in the high-tech economy and the general perception that jobs were being outsourced. So the outcomes of the CompTechS program were significant.

Our hypothesis is that the program will increase persistence and participation of students, including low income students, underrepresented minorities and women in continued computing related coursework and degree programs by:

1) providing the incentive of paying jobs (internships),
2) using a learn by doing methodology to acquire valued technical and job skills,
3) increasing confidence (self-efficacy) through exposure to the work environment, and
4) reinforcing factors found to contribute to persistence by students.

Methodology

The Research Questions

This report presents findings to the research questions posed in year one. The intention in year two is to develop a model that frames the findings around student characteristics and program features that contribute to the student experience and outcomes – especially persistence in the field though continued study or employment. The research team hopes to examine/describe the key features of the program that yield positive outcomes.

Table 1: Research questions for year one and source of data

Research Question	Data Sources, Methods
1. How do students in the program assess the value of the internships and learn-by doing methodology?	Completing Students and past students surveys and interviews
2. What is the impact of the internship experience on success, persistence in the major and plans for careers or transfer?	Institutional databases. Application and interview. Exit/completer surveys. Quantitative analysis
3. What are the motivating factors of the program that impact attraction, persistence and success?	Program staff and evaluators; student surveys and interviews
4. Did students' attitudes improve toward computing fields?	Student survey and interviews
5. What are the differences in the impacts of the industry internship as opposed to the campus internship?	Institutional databases Students, Quantitative analysis
6. How does the impact of the methodology (learn-by-doing approach and internships) vary for different student populations?	Past student survey, Quantitative analysis

The primary sources of data for the year one research were the following:

- Completing student exit surveys and interviews conducted by staff,
- Completing student interviews conducted by evaluators,
- Foothill-De Anza CCD institutional data bases and student information systems
- Past student survey conducted online.

Demographics

For the purpose of our research, we analyzed data collected from the overall cohort of 56, as well as target groups of low income, women and underrepresented minorities, including Hispanic, African American, Pacific Islander, Filipino based on historical difficulties of these groups documented in the literature. In addition, research on Asian subgroups has suggested that Southeast Asians (i.e., Vietnamese, Cambodian, Laotian) have more obstacles to success and are less prepared academically (Government Accountability Office, 2007) [1]than Chinese, Japanese, Koreans and Asian Indians. So we also looked at these Southeast Asian groups as part of our target for year one. Most of these students were covered in the low income group, which are defined by receiving financial aid. In California, the community colleges are relatively low cost at $13/quarter unit. Those qualifying for financial aid are categorized as low income. Financial aid recipients included those receiving public assistance through CalWORKS, a Temporary Assistance to Needy Families program that provides financial support to parents/caregivers while helping them to find jobs. Also included were EOPS (Equal Opportunity Program and Services) students that receive college support services for low-income and educationally disadvantaged students, funded by the State of California.

Table 2: CompTechS Financial Aid Status and Ethnicity

Ethnicity	Financial Aid	No Aid	Total #	Ethnic Group %
African American	2	0	2	4%
Latino	1	2	3	4%
Pacific Islander	0	1	1	2%
Cambodian	0	1	1	2%
Vietnamese	9	2	11	20%
Chinese	12	4	16	29%
Japanese	1	1	2	4%
Korean	0	1	1	2%
Asian Indian	1	1	2	4%
Other Asian & Midl East	2	2	4	7%
White, Non-Hispanic	4	6	10	18%
Declined to State	2	1	3	5%
Total	34	22	56	100%
Percent	61%	39%		100%

An additional group of past students who completed before June 2007 were surveyed to acquire baseline data on impact of the program on educational and career goals, and their reflection on the experience. In August 2007, we contacted 109 past students and got a response rate of 29%, 32 respondents. We had no data on financial status of this group, but do have gender and ethnicity, where reported, and the demographics were similar to the year one research cohort.

[1] US Government Accountability Office, *Higher Education: Information Sharing Could Help Institutions Address Challenges Some Asian American and Pacific Islander Students Face*, Report to Congressional Requesters, July 2007. www.gao.gov.new.item/07925.pdf

Analysis

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Analysis of the data collected for the research was conducted in two stages. The initial stage focused on descriptive analyses resulting in simple descriptive statistics such as percentages, frequencies and means. These analyses were sufficient to answer a number of the research questions. They were also used to validate the data collected and insure its consistency.

The second stage of analyses was inferential in nature. Two types of relational analyses were conducted. The first type investigated group mean differences on selected programmatic or performance measures. Typically Analysis of Variance was used for this purpose. The second type of analysis examined relationships between categorical variables; typically Chi-Square tests were applied in these situations.

Results – Year One

The research cohort for the year one study were those 56 students who were in the CompTechS program for any period of time between June 2007 and December 2007. The CompTechS program accepts students into the program throughout the year – and students complete the on-campus portion after 144 hours in the refurbishing lab. If they don't go into an industry internship, they then exit the program to make room for others. The 56 students had internships in the campus refurbishing lab or in industry, or both, during this period.

The total unduplicated number in any of our target groups (low income, women, underrepresented minorities) was 42 students, or 75% of the year one cohort. Ten students out of the 56 were women, 18%. Sixty-one percent of our cohort were receiving financial aid as compared to only 20% in the overall De Anza College student population.

How do students in the program assess the value of the internships and learn-by-doing methodology?

Students gave high ratings to their CompTechS experience and overall made very positive comments about the impact of the program on their professional goals.

Data was analyzed from three different sources for this question:

- Exit surveys and interviews with staff for 18 students who left/completed the program from June 2007 through December 2007.
- A past student survey by those who had completed the program earlier than June 2007. There were 32 responses.
- Interviews done by the evaluators with six (6) recent program completers.

Exit Surveys and Interviews

Eighteen (18) students completed the program from June – December 2007, and did an exit survey and short interview with the program coordinator. Of this group, three were female (17.6%), with an addition three Latino, African American and non-white (17.6%). Therefore 35% were low income or from underrepresented groups.

The helpfulness of the campus refurbishing lab received the highest marks from almost all students.

Table 3: Ratings of the CompTechS program by completers

Component	Rating on 1-6 scale, w/ 6 as high
Helpfulness of the program to your career goals	5.1*
Helpfulness of the hands-on lab	5.5
Helpfulness of the industry internship	4.9 (12 responses)

*One response was dropped, as it was based on personal problems/issues rather than program features. Twelve of the 18 completing students had an industry internship.

Best aspects of the program

Interestingly, when asked to identify the best aspect of the CompTechS program in their exit survey, students reported gaining new skills and knowledge (12 responses – 67%) and gaining industry experience (4 responses - 22%), rather than getting paid (2 responses -11%). Though getting paid often attracts students to the program, by the end of the program they felt that their gained knowledge and skills was the best part.

Another frequently mentioned best aspect was being able to build their resumes. Helping others gain access to computers and helping others in the lab were two additional responses.

Table 4. Student valuation of learning and industry experience – Exit surveys

The Best thing about the CompTechS Program
Improved skills/learning. Hands-on aspect – 12 responses Learned to take computer apart. Got references in the industry. Learning software (lab only) Learning computer's internal components (lab only) Building images and other things he learned about computers. Working with Joe and co-workers- learn new technology Learning new things Hand-on experience (lab only) Hardware exposure, working inside computer, hands on experience. Learning to install software.(lab only) Hands on Training (lab only) Hands on training in computers, networking, repairing and application troubleshooting Hands on experience- Joe able to answer all questions. People learned hardware

Industry experience, Contacts/references, resume built – 4 responses
Getting experience in professional environment
Internships in local companies.
Working for a great company.(only company)
It gave me the confidence to go back to the IT working environment.

What needs improvement?

Patterns of responses regarding what needs improvement were less pronounced, and did not constitute any dissatisfaction with the program. The opportunity to work on more current and advanced equipment was most prevalent (5 responses); opportunity for more hours (4 responses); and more space in lab (3 responses). Two responded that nothing needs improvement, and others left the answer blank. Other individual responses did not constitute any specific pattern, ranging from opportunity for interns to socialize to better pay.

The nature of the program, because of the recycling and refurbishing of donated used computers, makes it less likely for students to work on current equipment in the lab. Those who progress to industry internships do.

The Past Student Survey

The thirty-two (32) responses to the former student survey, those that completed before June 2007, shed light on the student experience and its value to them. This survey confirms that the learning, confidence building and resume building were highly important. However, the predominant theme was the clarification of goals that students realized because of their experience in the CompTechS program. These students were able to anecdotally report on positions they landed as a result of their experience or increased confidence. Representative quotes are below.

Table 5: Student clarification of goals and employment – Past Student survey

Program Gave Direction or Influenced Concentration
• Well before working for CompTechs I was not really sure about my major but after working there and getting a hands on experience on refurbing used computers I realized that this is what i wanted to do as a major and i decided on pursuing my bachelor's in computer engineering.
• CompTechs internship program influence my career goals completly. Before I enrolled in this program I was not sure if i wanted to focus more on hardware or software part of the computer industry. Now I am more confidence about the decision that I took to be a Software developer
• It helped me see that the computers that I know and love are really where I should be working and studying. I was wandering around without knowing exactly what I wanted to do, till I got my intership.
• what courses to take and certifications that would be important/valuable
• It motivated me to acheive my A+ certification.
• It showed that I need some more coding experience.

Led to Employment
• It made me feel more confident working in a real environment.....plus job experience helped land a job • It helped me get my foot in the door. I had no training in the field, but I had been fixing computers for years, so the program got me into a job that became my career in about a month. • The CompTechS provided an entry point into the workforce. My goal was to find a job. • CompTechS boosted up my confidence, enhanced my skills -- after working with CompTechS program I was able to grab position in Wells Fargo as a Software QA Analyst... • After graduating from San Jose State University with a B.S. in Computer Science, I was jobless for nine months despite sending out resumes. ..... I came across the CompTechS program in the school newspaper and enrolled. Susan quickly found an internship at a database company..... Now I work in the Information Systems department at a hospital. I am exactly where I want to be. The experience at the database company provided the needed work experience to obtain my current job. Susan and the CompTechS program helped me get that experience and I will be forever grateful.

Additionally comments from students indicate their realizing benefits of teamwork and collaboration: “It further cemented my view that when you collaborate within a diverse group of people, you can solve just about any problem.”

Evaluator Interviews with Completers

The project evaluators interviewed six completing students over the telephone to see if responses to outside evaluators would be different than to the project staff. No differences were found. The data was consistent across all interviewees that they increased their confidence, feelings of technical competence and readiness for the workplace. All of the interviewees said that they would recommend the program and in fact had already recommended it to friends.

What is the impact of the internship experience on success, persistence in the major and plans for careers or transfer?

A primary data source for retention was, and will continue to be, the institutional data on student enrollment and success within Foothill-De Anza CCD. In addition, the institutional researcher at De Anza College licensed a student tracking system that allowed for tracking enrollments for students who completed the program and their studies within FHDA and transferred to four-year public institutions within California. The 56 students who had been in the program from June through December 2007 were the research cohort for year one.

As well as their persistence in computer related courses and technical (STEM) courses, we realized the need to examine students’ persistence from quarter to quarter in general education. Students on a degree or transfer track may have quarters without any technical courses. This is especially true of part-time students who take fewer units per quarter.

Because of our special interest in the persistence of target groups of low income students, women and underrepresented minorities, we examined data specific to these groups. Aside from our target group's persistence and success, we looked at the overall CompTechS group, plus a comparison group of all De Anza students outside of the CompTechS program.

Persistence

Of the 56 students in the year one research cohort, 46 were enrolled in FHDA in Fall quarter and 6 were enrolled in four year universities. At the beginning of Winter quarter 43 were enrolled at FHDA and 6 in universities and one at City College of San Francisco. So from June 2007 to January 2008, the persistence is 50 out of 56 in coursework, 89%.

Table 6: Persistence in coursework by the research cohort.

CompTechS –Year 1	Fall 2007 enrollment	Winter 08 enrollment	Persistence rate
56 students	46 FHDA , 6 university = 52 enrolled	43 FHDA, 6 university 1 other cc = 50 enrolled	89%

One other, not represented in the 89% (many of whom are also employed), obtained full-time employment in the field as Senior Computer Support. Including the employed, we have 91% who have persisted in the field at this point.

Success

Success is defined as a grade of C or better and "pass" on the table below is synonymous with success. In computer related coursework, the CompTechS student success rate was 69% as compared to 68% percent for other De Anza students, virtually the same rate. However, the success rate in overall coursework does approach a significant difference, with 76% of the CompTechS student grades/coursework successful in Fall 2007 compared to 70% of De Anza students' coursework overall.

The success rate was highest in non-technical courses at 80%. Fifty-two percent (52%) of the courses taken were non-technical. Females in the program did slightly better in computer related coursework than their male counterparts. However, the number of courses was small for females. Southeast Asian students did significantly better that other student groups including Chinese and white students. The African American and Latino students had the lowest success rates. However, these two groups accounted for only 4 students, so one needs to be cautious regarding these conclusions with this first year data.

Table 7: Course Success Rates by Selected Target Groups within CompTechS – Fall 2007

Comparison Group	# of course grades	Pass	Did Not Pass	Withdrew
CompTechS- All	155	76%	15%	9%
Computer-related Courses*	39	69%	21%	10%
Other Tech*	35	74%	11%	14%
All Other Courses	81	80%	14%	6%
Computer-related, Female	7	71%	14%	14%
Computer-related, Male	32	69%	22%	9%
Financial Aid	95	76%	13%	12%
No Aid	60	77%	18%	5%
Comparison Group	**# of course grades**	**Pass**	**Did Not Pass**	**Withdrew**
African American	3	0	33%	67%
Asian Indian	6	83%		17%
Cambodian, Vietnamese	32	87.5%	9%	3%
Chinese	59	78%	14%	8%
Japanese	4	75%	25%	
Latino	11	36%	45%	18%
Other Asian (Nepal, Bangl)	10	80%	10%	10%
White, Non-Hispanic	23	78%	13%	9%

*Computer-related courses are from the following departments: Computer Information Systems, Computer Networking & Electronics, Computers on the Internet, Computer Applications, Computer Aided Design & Digital Imaging. Other Tech courses: Biology, Chemistry, ENGR, Math and Physics.

Demographics of Students – Fall Success Data

The demographics of students enrolled in Fall courses are consistent with the demographics of the research cohort. Fifteen Chinese students were the largest ethnic group at 33% of the 46 students enrolled in FHDA Fall courses and CompTechS. Target ethnicities and women were 41% of the group: African American (2%), Latino (7%), Vietnamese (17%) and seven women (15%) who did not over lap the target ethnicities. Fifty-nine percent (59%) of the 46 Fall students were on financial aid.

Plans for careers and transfer

Data and quotes from the 18 completing students and the past student survey provided insights into impact of the program on career plans and educational goals.

Six of the 18 completing students reported in their exit survey that they changed goals from the beginning of their time in the program. (See table 8, below.) Interesting an additional two students who had come into the program with a goal of Computer Science as a major/career were doubting that choice by the time they finished the program, because others in the lab were "better" compared to them or hearing that computer science courses were "hard." This is contrary to the consistent and substantial data about

increased confidence as a result of the program, but consistent with clarification of goals. Other of the completers reported that they focused their goals more, or confirmed them.

Table 8: Changes to career goals

Student	Career Goal when Started CompTechS	Current Plans
1	Automotive	Computer Science or Engineering
2	Learn about computers	Finish 4 year degree in Network Security
3	See what's available; broaden horizons	Be hired at VM Ware, full-time and work way up in company
4	None	BS in MIS, career in High Tech
5	Graphic Artist, Tech Writer or Software	Computer Science job
6	Networking	Database Developer

Past Student Survey

For the 32 students who had been in the CompTechS program before June 2007, below is a summary relevant to the impact of the program on career and educational goals.

- Current Educational goals: 69% said Bachelors or Advanced degree – and an additional 6% said Associates degree.

- Current Career goals: 56% said Computer Science or computer related. 31% had Science or Technical career goals, including medicine. Only 12.5 % said non-technical field or not sure.

- 90.6% had taken courses since completing the program and 47% were currently taking college courses.

- 66% advanced to, or took, a new position in Computer or Science/technical field. Computer Science or Computer related – 59.4%

About 63% had been in the program 4 months or longer; the rest were in 1-3 months before they got jobs, for the most part. Intern experience: Campus lab – 53%; both Industry & Campus – 31.3%; only industry – 15.6%. The demographics of the past student group were similar to the demographic of the year 1 cohort.

What are the motivating factors that impact attraction, persistence and success?

After the past student survey, we hypothesized about the factors or program features that attracted students, contributed to their success, and motivated them to continue in the program and the field. Since then we looked to exit surveys and exit interviews to confirm motivating factors.

Students made frequent comments about appreciating the supportive staff (the instructional lab coordinator and the CompTechS Coordinator). "The staff's supportive efforts and attitude made it a pleasure to spend time at the lab."

As indicated previously, learning and improving skills, relevant/industry experience and resume building were important benefits reported by students, thus likely motivated students to continue. We believe the paid internships attract students to the program initially, however they don't often cite money as a reason for their interest in the program in application interviews.

The following list of motivating factors was gleaned from student responses and observations:

- Supportive staff
- Resume building, Industry experience and contacts
- Acquisition of new or improved skills
- Flexibility of work hours in the lab
- Convenient location (campus)
- Friendly environment, teamwork
- Helping students have access to computer
- Counseling regarding courses to take within district
- Paid internship

In addition, we have begun identifying best practices that to help others successfully replicate the program:

- Flagging the student in the SIS for preferential enrollment.
- Maintaining small group sizes in the lab encouraged more student interaction.

Four of six completers interviewed by the evaluators mentioned the learning that took place in the low key atmosphere of the lab as motivating them to continue and what they liked best. "It improved my customer skills. It also improved my technical skills, like troubleshooting." One past student focused on the company positions that were available and the motivation to get a fulltime job. Another focused on the "incredible opportunity," in terms of "giving me a great start on my career." In response to the question: What helped motivate you to continue, an answer was, "The atmosphere in that lab, because everyone was eager to learn. It was like a home. It was very organized."

Feelings of being comfortable in the environment, that they were learning and that the experience was worthwhile made students more engaged – contributing to their success and likely their persistence in the field.

Did students' attitudes improve toward computing fields?

When looking at the question of whether students' attitudes toward IT and computing fields improved, we examined student responses and comments in completer interviews and past student surveys.

The most significant improvement reported by students was their feeling of confidence and competence. In interviews conducted by the evaluators, *all* of the interviewees said their experience in the program increased their level of self confidence. In addition, they felt more confident technically and more ready for the workplace. "Yes – it made me feel more confident, gave me the feel for my field and what it's like."

Four comments on the past student survey regarded confidence. For example, one stated "CompTechS boosted up my confidence, enhanced my skills." Students' perception about improved competence and appreciation for industry experience can be construed as having a bearing on level of confidence and these comments were prevalent..

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Although, confidence was the only attitude clearly impacted, it is arguably one of the most important ones.

What are the differences in the impacts of the industry internship as opposed to the campus internship?

To investigate whether there were any differences resulting from the type of programmatic experiences that a student had, we compared group mean differences on a number of measures between those students who had participated only in the campus lab and those students that had been in both the campus lab and in an industry internship. We compared the groups on the following measures:

- Working Status upon program entry
- Enrollment Status Fall 2007
- Enrollment Status 2008
- Probability of Success (grade of C or better) in a Computer Class (Fall 2007)
- Probability of Success in a Technical Class (Fall 2007)
- Probability of Success in any Other Class (Fall 2007)

Additionally for the 18 students who completed the program and responded to the Exit Survey we examined differences on:

- Perceived Helpfulness of Program to Goals
- Perceived Value of Hands-On Lab experience
- Perceived Value of outside Paid Internship

The results of the comparison of the two groups using a One-way Analysis of Variance technique produced no statistically significant differences ($p < .05$) on any of the variables. Thus, the results indicate that for this initial cohort of students that participation in the Campus Lab only versus the Campus Lab & Industry Internship did not influence enrollment patterns or probability of success in their courses. Further, it did not influence the perception of the students on the value of the program in clarifying their goals or of the programmatic components.

This finding would seem to be evidence that the program is not differently effective no matter which programmatic component or components that a student participates in. Further data and additional information such as job placement in the field will add to the robustness of this initial finding.

How does the impact of the methodology (learn-by-doing and internships) vary for different student populations?

In order to investigate whether there were any differences resulting from student characteristics (gender, ethnicity, financial aid status), we compared group mean differences on a number of measures:

- Working Status upon program entry
- Enrollment Status Fall 2007
- Enrollment Status 2008
- Probability of Success (grade of C or better) in a Computer Class (Fall 2007)
- Probability of Success in a Technical Class (Fall 2007)
- Probability of Success in any Other Class (Fall 2007)

Additionally for the 18 students who completed the program and responded to the Exit Survey we examined differences on:

- Perceived Helpfulness of Program to Goals
- Perceived Value of Hands-On Lab experience
- Perceived Value of outside Paid Internship

Overall, the results of these analyses indicate that while there may be a few differences between the students based on their characteristics, generally the results are the same for the students regardless of their characteristics.

There were no statistically significant differences found between the two gender groups on any of the above measures. The results suggest participants in the program had very similar experiences regardless of their gender or ethnicity. While the participant's experiences may be unique to each individual, they are not shaped by their physical characteristics. As we have more persistence data in the coming year and larger numbers of women and targeted underrepresented minority students, we will again look for any significant variance in their rates of persistence.

Most statistical tests failed to show any statistical significance, indicating no relationship between other target groups and the programmatic measures. However, some differences did emerge:

Financial Aid Comparisons – The comparisons between students who received some form of financial aid versus those who did not receive any aid produced two statistically significant differences.

- Students who received No Financial Aid perceived the program as being considerably more helpful to clarifying their goals than did students receiving Financial Aid. The means for the two groups are:

  No Financial Aid (N=7) Mean =5.71
  Financial Aid (N=13) Mean=4.54

  This difference produced an F-value that had a probability of p=. 038.

- The second statistical difference was found on the measure of Probability of Success in an "Other" (non-technical) class. In this case, students on financial aid had a higher probability of success than did students not receiving aid. The means are:

  No Financial Aid (N=15) Mean=68.33
  Financial Aid (N=23) Mean= 89.20

  The difference between these two means produced an F-value that had a probability of p=. 055. (This result is slightly higher than the traditional .05 level of significance, but since this is an exploratory research effort it was included for examination.)

Ethnicity Comparisons – Because of the relatively small number of students from the different ethnic groups, a single group was created using all students that came from any of the ethnic groups of interest (African American, Hispanic, Southeast Asian, Pacific Islander, etc). Students in this combined group were compared with the remaining students who were members of other ethnic groups not targeted (predominantly White and Chinese males) by this research.

- Students not from one of the target ethnic groups had significantly higher probability of success in a Computer class than did students from the target groups. The means for the two groups are:

  Not Target Ethnic Group (N=18) Mean=83.33
  Target Ethnic Group (N=11) Mean=45.45

  The difference between these two means produced an F-value with a probability of p=. 033.

Caution needs to be used in interpreting this difference as well as any of the differences found on the probability of success measures. There are two reasons for this caution:

>The students are self-selecting, that is which students are taking computer courses is entirely determined by the individual students

>The data is from only a single quarter, so it may not be representative of the pattern of data over a longer period of time.

As we augment the data available for such comparison greater confidence can be placed in such findings.

Overall Target Group Comparisons – Students who came from any of the target groups of interest (women, underrepresented ethnicities and low income) were compared to students who did not have any of the target characteristics.

- A single statistically significant difference was found between these two groups of students. Students from the target group had a statistically significant higher probability of success in an "Other" (non-technical) course than did students not from this group. The means for the two groups are:

  Target Group Students (N=28) Mean=90.24
  Not from Target Group students (N=10) Mean=55.00

  This difference produced a F-value with a probability of p=. 002. As mentioned above, this finding has to be interpreted with some caution at this time. It is consistent with the finding for the low income students who are a large part of the combined target group

Conclusions

Student perceptions of the benefits of their experience in the CompTechS program were very positive, whether they were only in the campus based internships in the refurbishing lab, or also in an industry internship. Feelings of being comfortable in the environment, that they were learning technical skills and that the experience was worthwhile made students more engaged – contributing to their success and likely their persistence in the field.

Student persistence in coursework and the field is high at 91%, but it is too early to draw conclusions with only two quarters of data. CompTechS students' rate of success in coursework is as good, or better, than the rest of the De Anza College population. Past students seem to be persisting in technical fields at a self reported rate of 87%. Feelings of confidence and increased competence for students coming out of the program may be contributing factors to persistence.

Since we found no significant differences in the impacts of the industry internship as opposed to the campus internship, there are implications for replication of the program. The on-campus computer refurbishing lab and computer scholarship program are replicable at any campus regardless of the surrounding employer base. That is, even rural campuses can provide the benefits of tech support internships to their students.

Generally the results are the same for the students regardless of their characteristics of gender, ethnicity and only minor differences for those receiving financial aid. Larger numbers in specific ethnic groups will determine patterns in success and persistence that

data suggests at this time. For the few African American and Latino students, their involvement in the program has not positively impacted their success rate in coursework. The composite of all target groups had better success in non-technical coursework as compared to the rest of the CompTechS students, who had greater success in computer related courses.

The program has been effective in equipping students with technical skills and also increasing self confidence. Underrepresented groups in the computing fields are persisting, though more data is needed for specific ethnicities. The issues going forward will be to understand and document the practices that make this program effective. There is merit in developing a model that identifies those factors that allow the program to be scaled to other environments.

Appendices

Past student survey

CompTechS -- Former Intern Survey

1. Which parts of the CompTechS Internship program did you participate in?
    Industry Internship
    Campus Computer Lab Internship
    Both

2. Approximately how many months were you in the CompTechS program?

1-3 months
4-6 months
7-9 months
10-12 months
longer

3. How did the CompTechS Internship program influence or change your career goals?

4. How did the CompTechS Internship program influence or change your educational goals?

5. What are your current educational goals? (Select all that apply)
    Associates Degree
    Certifications
    Bachelors Degree
    Advanced Degree
    Other (specify):
    Not Sure

6. What are your current career goals?
    Career in Computer Science field
    Career in Computer related field
    Career in Science or technical field
    Career in non-technical field
    Other: (specify)
    Not Sure

7. Since the program, have you taken college courses in: (Select all that apply)
    Computer Science, Computer Engineering, or Software Development
    Computer Information Systems

Computer Networking
Computer Applications
Certification Preparation
Other technical (computer related) content

8. Are you currently taking college level courses?
Yes
No
If yes, where? _____

9. During or since the program have you taken a position, or advanced to a new position in any of the following fields?
Computer Science field
Computer related field
Science or technical field
Non-technical field
Other: (specify)

10. What elements of the CompTechS program attracted you to the program, motivated you to continue in it or made it a good experience for you (if applicable)?

Gender? M F

Mark the one that best applies to you:

- Hispanic/Latino
- American Indian or Alaska Native
- Asian
- Black or African American
- Native Hawaiian, Filipino or Pacific Islander
- Multiracial
- White Non-Hispanic/Latino
- Decline to state

Optional: Your first and last name: _____

Optional: Your current employer:_____

Your job title: _____

3. How did the CompTechS Internship program influence or change your career goals?

	Comment Text	Response Date
1.	I learned how working with computers was like and it's just experience you know? I'm not ready to make a choice about career yet, but doing this ConpTechS internship really let me feel what working in this field was like. It's like "oh, now I have another option".	Tue, 8/21/07 11:27 PM
2.	My experience at CompTechS refreshed my hands-on hardware and software skills. It reminded me how much I preferred doing the duties of a PC Tech over those of a Help Desk Technician that talks on the phone 95% of the day.	Tue, 8/14/07 4:56 AM
3.	Job opportunity opened up for server support rather than my direction of network support.	Sat, 8/11/07 12:19 PM
4.	-Gave me a real time Industry experience -Help me in networking w/people in related field -Hand on experience for on-going issues/technology	Fri, 8/10/07 7:01 PM
5.	It gave me the opporunity to increase my quickness and additional hands on.	Fri, 8/10/07 12:19 AM
6.	The CompTechS provided an entry point into the workforce. My goal was to find a job.	Wed, 8/8/07 1:48 PM
7.	It helped me get my foot in the door. I had no training in the field, but I had been fixing computers for years, so the program got me into a job that became my career in about a month.	Wed, 8/8/07 12:11 PM
8.	CompTechS boosted up my confidence,enhanced my skills after working with CompTechS program I was able to grab position in Wells Fargo as a Software QA Analyst and now I'm working for a mid size biotech company Medarex as a Software QA Analyst.	Wed, 8/8/07 9:23 AM
9.	It further cemented my view that when you collaborate within a diverse group of people, you can solve just about any problem.	Wed, 8/8/07 2:48 AM
10.	It helped me to review my old concepts and understand the things better.	Tue, 8/7/07 2:21 PM
11.	It added particle experience to my profile, which helped in landing a full-time job.	Tue, 8/7/07 12:32 AM
12.	I can't remember if the program changed my career goals. I certainly learned a lot about computer hardware and the Windows OS.	Mon, 8/6/07 10:34 PM
13.	Working at CompTechS has reinforced my confidence of establishing a successful career in the technology industry. The experience I gained there has benefit me greatly in my pursuit of challenging technical projects in my job.	Mon, 8/6/07 10:21 PM
14.	It helped me gain confidence to go work for other emplyers.	Mon, 8/6/07 10:15 PM
15.	It helped me find my job	Mon, 8/6/07 7:22 PM
16.	As an intern I found the hands on experience to be highly valuable and influential, and it has helped me to further improve my skills which have aided me throughout my career.	Mon, 8/6/07 7:04 PM
17.	Made me avoid large corporations like the plague (personal preference)	Mon, 8/6/07 6:28 PM
18.	i got a great experience, and at the same time i learn how to interact with people as well	Mon, 8/6/07 5:35 PM
19.	It helps me earn some hand-on experiences with computers and lab equipment	Mon, 8/6/07 4:12 PM
20.	It helped my carreer in the Bay area get started.	Fri, 8/3/07 5:49 PM
21.	Well before working for CompTechs I was not really sure about my major but after working there and getting a hands on experience on refurbing used computers I realized that this is what i wanted to do as a major and i decided on pursuing my bachelor's in computer engineering.	Fri, 8/3/07 3:27 PM
22.	No.	Thu, 8/2/07 9:59 PM

23.	I was there for the Fun of it, and get to meet people with the same hobby and ideas. also learn new techniques.	Thu, 8/2/07 9:54 PM

4. How did the CompTechS Internship program influence or change your educational goals?

	Comment Text	Response Date
1.	Same as above. It was just another option I can take now. I'm not all that ready to make a choice on what I exactly want to do for the rest of my life.	Tue, 8/21/07 11:27 PM
2.	It motivated me to acheive my A+ certification.	Tue, 8/14/07 4:56 AM
3.	Started to deal more with operating systems rather than network.	Sat, 8/11/07 12:19 PM
4.	- Realized the importance of higher education - Helped me out in deciding type of field/comcentration I want to go in future	Fri, 8/10/07 7:01 PM
5.	I was able to my educational knowledge and apply it towardes the program	Fri, 8/10/07 12:19 AM
6.	The CompTechS Internship program had me take a Technical Support for IT Professionals class. That class was very helpful in dealing with irate customers and understanding the processes for a Technical Support organization such as how to increase customer satisfaction and how calls should be distributed.	Wed, 8/8/07 1:48 PM
7.	It helped me see that the computers that I know and love are really where I should be working and studying. I was wandering around without knowing exactly what I wanted to do, till I got my intership.	Wed, 8/8/07 12:11 PM
8.	CompTechs helped me to realize my potential and setting up higher goal to achived.	Wed, 8/8/07 9:23 AM
9.	It showed that I need some more coding experience.	Wed, 8/8/07 2:48 AM
10.	It helped me to review my old concepts and understand the things better.	Tue, 8/7/07 2:21 PM
11.	Gave me real customer service and system/technical support experience, which made me realize that I did not really want to go into support service.	Tue, 8/7/07 12:32 AM
12.	It did not have a significant influence on my educational goals.	Mon, 8/6/07 10:34 PM
13.	I learnt so many things from Joseph Coelho about computers and networks that you are very unlikely to learn in classrooms. I have thus developed a passion for electronics and this motivates me to pursue my degree in electrical engineering at Cal.	Mon, 8/6/07 10:21 PM
14.	CompTechs internship program influence my career goals completly. Before I enrolled in this program I was not sure if i wanted to focus more on hardware or software part of the computer industry. Now I am more confidence about the decision that I took to be a Software developer	Mon, 8/6/07 10:15 PM
15.	My main educational focus has been on the biological field but computers have always been a hobby of mine , but since making this decision CompTechS has not made me changed my mind with respect to the program. However I have talked with other interns who have found the program to be greatly influential and helpful in shaping and changing their educational goals which I think is great.	Mon, 8/6/07 7:04 PM
16.	n/a	Mon, 8/6/07 6:28 PM
17.	it offer me a valuable knowledge that i could not learn in the book, and influence me to learn more about technology	Mon, 8/6/07 5:35 PM
18.	It made me feel more confident working in a real environment. Also, it provided me skills required for my Electrical Engineering major	Mon, 8/6/07 4:12 PM
19.	It helped me focus my carreer goals more rather than take the generalist approach I was taking before.	Fri, 8/3/07 5:49 PM
20.	The program provided more information about the benefits of certifications.	Thu, 8/2/07 9:59 PM

	Examples, CCNA, CCNP, MCSE..etc	
21.	Not so much. Other than just Enlistee in the Army Reserve for Dietician.	Thu, 8/2/07 9:54 PM

10. What elements of the CompTechS program attracted you to the program, motivated you to continue in it or made it a good experience for you (if applicable)?

	Comment Text	Response Date
1.	A deeper understanding of computer hardware/troubleshooting.	Thu, 9/13/07 12:08 PM
2.	Working with computers is something I love doing and CompTechS provided me this awesome place to, well, work with computers.	Tue, 8/21/07 11:27 PM
3.	The staff's supportive efforts and attitude made it a pleasure to spend time at the lab.	Tue, 8/14/07 4:56 AM
4.	Internship	Sat, 8/11/07 12:19 PM
5.	- Flexibility - Good Industry Contacts to give Interns various opportunities to choose from - Helpful staff - Friendly Environment	Fri, 8/10/07 7:01 PM
6.	the open enviornment	Fri, 8/10/07 12:19 AM
7.	After graduating from San Jose State University with a B.S. in Computer Science, I was jobless for nine months despite sending out resumes. I enrolled in classes at Deanza College to enhance my education while still looking for work. I came across the CompTechS program in the school newspaper and enrolled. Susan quickly found an internship at a database company. I worked at the database company as a Technical Support Intern for 9 months. I worked there for another year as a full time employee in the Technical Support department. Now I work in the Information Systems department at a hospital. I am exactly where I want to be. The experience at the database company provided the needed work experience to obtain my current job. Susan and the CompTechS program helped me get that experience and I will be forever grateful.	Wed, 8/8/07 1:48 PM
8.	I liked that they had a bunch of different places to place people in the field once they are qualified. I was able to chose which job matched the skills that I had and that made it really easy to fit right in to the job.	Wed, 8/8/07 12:11 PM
9.	Realtime working experience and support of ComptechS Program members.	Wed, 8/8/07 9:23 AM
10.	The ability to gain more experience with computers and networking, and to meet and work with people form different fields.	Wed, 8/8/07 2:48 AM
11.	Practical training.	Tue, 8/7/07 2:21 PM
12.	What ever i learned when i was in the CompTechs program is really very helful to me. Thanks Joe and Susan.	Tue, 8/7/07 1:19 PM
13.	Computer donation and award to financial-aid student program. Industrial job placements.	Tue, 8/7/07 12:32 AM
14.	Mike Murphy asked, "Are you interested in a job for the summer?" I said yes. Joe was very knowledgeable and I learned a lot from him.	Mon, 8/6/07 10:34 PM
15.	Other than the valuable technical knowledge I have acquired from the program, the friendly working environment really makes my experience there an enjoyable one. I am very grateful to have worked with both Joseph Coelho and Susan Malmgren.	Mon, 8/6/07 10:21 PM
16.	I think the most important element of this program is teaching students how are real world experinces can be. Through this program I was able to participate in an industry intenship with Roche which was an amazing experience that changes my career goals.	Mon, 8/6/07 10:15 PM
17.	Very helpful instructions	Mon, 8/6/07 7:22 PM
18.	The aspect of the job that most appealed to me was being able to work in the lab and being given the flexibility of choosing my work hours according to my school	Mon, 8/6/07 7:04 PM

	schedule, which is very difficult to find out there as virtually all employers don't offer such flexibility to students or interns. The friendly, easy going, and learning rich enviroment were also very helpful to me and were great.	
19.	The main thing the program taught me is that there are too few programs like this, and the ones in place badly need more funding.	Mon, 8/6/07 6:28 PM
20.	N/A	Mon, 8/6/07 5:35 PM
21.	It offers extensive hour working with the lab It has good procedures i.e reveiving donated computers and granting to needy students	Mon, 8/6/07 4:12 PM
22.	It gave me some time to focus my abilities and to network in the industry.	Fri, 8/3/07 5:49 PM
23.	It is necessary to use computers. CompTechS increase my skill level and comfort with computers.	Fri, 8/3/07 3:36 PM
24.	The kind of training and efforts both Susan and Joe are willing to put into the student interns -which not only gave me a healthy working environment but also a great opportunity to learn and enhance my hardware and software skills.	Fri, 8/3/07 3:27 PM
25.	The CompTechs program provides a real hands on experience with highly motivated staff which helps.	Thu, 8/2/07 9:59 PM
26.	repairing computer, used to given to students as an Grant.	Thu, 8/2/07 9:54 PM
27.	Environment, I really enjoyed working with everyone.	Thu, 8/2/07 5:31 PM

Completer interview questions, conducted by evaluators.

CompTechS Exit Interview

We are interested in your experience as a participant in the CompTechS intern program. Specifically, we would like to understand what you did in the program; what types of experiences you had, both positive and negative; what worked well; what could have been improved; and, anything that could benefit future student participants.

The information that you provide will be held strictly confidential and will be combined with the information gathered from other participants. Only aggregate information will be made available to the CompTechS program staff.

1. How did you first learn about the CompTechS program?
2. What attracted you to the program?
3. Tell us about your experiences in the program.
4. What did you like the most about the program?
5. What helped motivate you to continue?
6. What would you change about the program?
7. Would you recommend the program to other students?
    a. If so, why?
    b. If not, why not?
8. Did the program have any impact on your course of studies??
    a. Did it impact what courses you decided to take?
    b. What major you selected?
    c. What college you considered transferring to?
9. Did the program have any impact on your career goals? If so, how did it impact your career goals?
10. Did the program have any impact on:

- Your self-confidence?
- Your feelings of technical competence?
- Your feelings of being ready to be in the workplace?
- What workplace you are interested in?

Exit survey

CompTechS Program Student Survey

Please take a minute to answer the following questions:

Name: _____ **Date:** _____

1. How helpful was the CompTechS Internship Program to you and your career goals?

   Highest 6 5 4 3 2 1 **Lowest**

2. In your opinion, what was the best aspect of the CompTechS Internship Program?

3. What part of the CompTechS Internship Program needs the most improvement?

4. How helpful were the services listed below:

Program Component							
Hands-on Lab	**Highest**	6	5	4	3	2	1 **Lowest**
Paid Internship	**Highest**	6	5	4	3	2	1 **Lowest**
Academic guidance	**Highest**	6	5	4	3	2	1 **Lowest**
Preferential enrollment	**Highest**	6	5	4	3	2	1 **Lowest**
Supportive staff	**Highest**	6	5	4	3	2	1 **Lowest**
Resume building	**Highest**	6	5	4	3	2	1 **Lowest**
Acquiring skills	**Highest**	6	5	4	3	2	1 **Lowest**

Other (please comment)

5. When you entered CompTechS what was your career goal?

6. Now that you have completed the program, what are your career plans?

7. Which classes did you take while in the program that you feel will help you with your career plans?

College	Course #	Title
DA / FH	_____	_____
DA / FH	_____	_____
DA / FH	_____	_____

Thank you for taking the time to provide this information. Use a second sheet if you need more space.