Computer Technical Support

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

Year 3 – 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 three study consisted of 133 students who were in the CompTechS program for varying periods of time between June 2007 and December 2009. The total unduplicated number in any of our target groups (low income, women, and underrepresented minorities) was 92 students (69%). The primary sources of data were the following:

1. Pre-assessments of entering students, refurbishing lab evaluations of students and employer evaluations.
2. Completing student exit surveys and interviews conducted by staff.
3. Student survey regarding valuable features conducted online.
4. Interviews of students, peer mentors and lab instructional coordinators by the project evaluators.
5. Foothill-De Anza CCD institutional data bases and student information systems.
6. Student tracking database of higher education institutions (National Student Clearinghouse, Student Tracker System).

The third year findings are organized around the following research questions and are consistent with the findings in previous years.

1. What is the impact of the internship experience on student success, persistence in technical coursework and careers?

- Of the students in the research cohort, 102 were enrolled at community colleges, in universities, or had graduated in Fall 2009. Their persistence is 77% in academic work. From additional follow-up with former student interns not in this group, we learned from their self report that eight (8) others are working in the field, making CompTechS students' persistence in the field 83%.
- There were no statistically significant differences on the rate of persistence for the target group of 92 students (low income students, women and underrepresented minorities) as compared to the non-target group within CompTechS.
- In computer related coursework, the CompTechS student success rate (a grade of C or better) accumulated over the quarters that students were at Foothill-De Anza after applying to CompTechS was 72% as compared to 70% percent for all Foothill-De Anza students in computer-related courses over a comparable timeframe.
- Females in the program did about the same in computer related coursework as their male counterparts, and the number of courses per each female was similar to the number for each male student.
- The subgroup of Africa American and Hispanic students had lower success rates in computer related classes than other groups in CompTechS. However there was no significant difference in their persistence rate in the field.

2. What features of the program are most valuable to students? What are the key features?

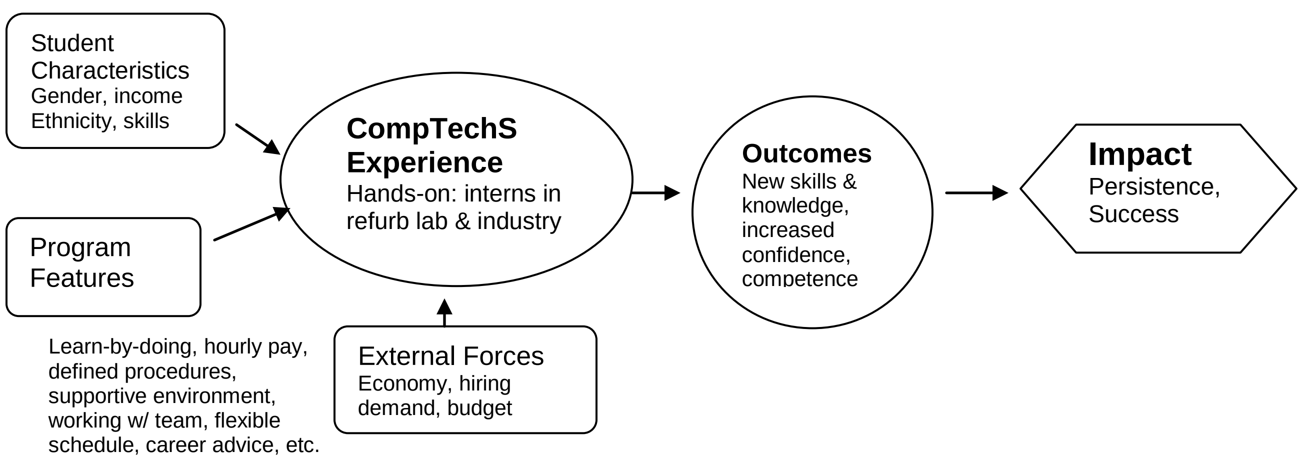
Consistent with all other previous surveys, the learning of new skills and the hands on experience were the most important features of the program to students. The paid part-time job was confirmed as highly important. This has implications for scaling the program to other environments, as the intern salaries impact budget.

For current students, those features that impact their daily experience such as the supportive environment, working with a team and well-defined procedures were next in importance, as opposed to the possibility of being placed in industry, which was highly valued by past students, likely because there were more industry opportunities in the past.

Student interns with one or more target characteristic (female, low income, underrepresented minority) viewed *Supportive Staff* and *Acquiring Skills* as more important than their counterparts did. Females valued *Academic Guidance* more than males did. Completing students surveyed indicated a significant growth in feelings of confidence and technical competence.

CompTechS Program Model

We have made progress in documenting the practices and key features that make this program effective, allowing it to be scaled successfully to other environments.



3. What impact do different CompTechS staff positions and practices have on the experience of students?

Since supportive staff has been a consistent characteristic of the CompTechS program and staff had changed in the last year, the project evaluators conducted phone interviews with Lab staff and student interns to confirm that the conditions were maintained and to discern the optimal organization and job descriptions for scaling the program. As hoped, the atmosphere in the lab has been maintained as a supportive and comfortable environment for the student interns to ask questions and acquire skills by working out problems on their own or collegially. The Peer Mentors proved to be a valuable addition and make the lab more effective for both the interns and Lab Coordinator. Positions seem to be functioning well.

Practices such as the well defined procedures and organized workflow in the small refurbishing lab allow students to work independently and learn skills with access to staff support. The Program Coordinator counsels students through the intake process and explains the student employment procedures, which can seem complicated to students.

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

Student participation in the Campus Lab only versus both the Campus Lab and Industry Internship did not influence persistence or probability of success in coursework. Further, it did not influence the perception of the students on the value of the program.

5. How does the impact of the CompTechS Program vary for different student populations?

The results suggest participants in the program had very similar experiences regardless of their gender, ethnicity and economic status. Low income student interns persisted at a higher rate than those who did not receive Financial Aid. The Non-Target group within CompTechS was statistically more probable to pass a computer related course than those in the Target group (underrepresented minorities, women and low income), though the Target group had similar success rate as the overall student population in De Anza CIS courses. More data is needed to determine patterns in specific ethnic groups, especially African Americans.

Students who rated low on the skills pre-assessments when entering the program did not change their relative order in terms of performance on lab evaluations. However, they were successful in computer related coursework and persisted in the field at the same rate as the rest of the group.

The program has been highly regarded by participating students and has been effective in equipping students with technical skills. Underrepresented groups in the computing fields are persisting and performing successfully in coursework. Practices that make this program effective have been identified and the descriptive model should allow it to be scaled successfully to other environments.

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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 success and 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.

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 – about 300 refurbished computers were given to financial aid recipients, Equal Opportunity Program and Services (EOPS) and CalWORKS (public assistance) recipients in the last year.

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. Findings from the research in the first two years of the ATE project were very promising regarding student persistence in the field and success in computer related courses. In Year 3, the research has benefited from a larger sample size and builds on the previous findings.

Also in Year 3, we attempted to describe the CompTechS model in a way that will allow for successful scaling to other environments. We identified key program features and looked at how these features interact with student characteristics and impact results.

Methodology

The Research Questions

This report presents findings to the research questions posed below. One of our goals in year three has been 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 model hopes to examine and describe the key features of the program that yield positive outcomes.

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

Research Question	Data Sources, Methods
1. What is the impact of the internship experience on student success, persistence in technical coursework and careers?	Institutional databases. National tracking database. Quantitative analysis

Research Question	Data Sources, Methods
2. What features of the program are most valuable to students? What are the key features?	Former student survey; current student surveys and interviews. Program staff and evaluators.
3. What impact do different CompTechS staff positions and practices have on the experience of students?	Evaluator interviews of Lab Coordinators, Peer Mentors and students.
4. What are the differences in the impacts of the industry internship as opposed to the campus internship?	Institutional databases, exit survey, Quantitative analysis
5. How does the impact of the CompTechS Program vary for different student populations?	Past student survey, Interviews, skills assessments, lab evals, employer evals. Quantitative analysis

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

- Pre-assessments of entering students, refurbishing lab evaluations and employer evaluations.
- Completing student exit surveys and interviews conducted by staff.
- Student survey of valuable features conducted online.
- Interviews of students, peer mentors and lab instructional coordinators by the project evaluators.
- Foothill-De Anza CCD institutional data bases and student information systems.
- National Student Clearinghouse, Student Tracker System. A student database of higher education institutions.

Analysis

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.

Most of the group mean differences were tested using a one-factor Analysis of Variance (ANOVA) approach. Thus, the difference between males and females, those in the target group vs. those who were not, etc were all tested with this one factor ANOVA approach. A two-factor ANOVA approach was used to test whether the lab only experience compared to the industry internship plus lab differed by student characteristics such as ethnicity, etc. Finally, testing of differences in persistence rates across three groups of students (students not in the target group, students who were in the Target Ethnic Group but not Black or Hispanic; and, students in the Target Ethnic group who were Black or Hispanic) was conducted by using a One-way Analysis of Variance followed by Post-Hoc comparisons of the three groups, two at a time. Thus, students not in the target group were compared with students in the Target group who were Black or Hispanic, then the students not in the target group were compared with students in the Target Group who were not Black or Hispanic, and finally students in the Target group who were Black or Hispanic were compared with students in the Target group who were not Black or Hispanic.

Demographics

For the purpose of our Year 3 research, we analyzed data collected from students who had been in the CompTechS program for a period of time between June 2007 and December 2009 – a total of 133 students. Within this group, we also focused on target groups of low income, women and underrepresented minorities, including Hispanic, African American, and Pacific Islander based on historical difficulties of these groups documented in the literature. In addition, we continued to look at Southeast Asian groups as part of our target, because 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.

Low income students are defined as those receiving financial aid and public assistance.[2]

Table 2: CompTechS Ethnicity, Gender, Financial Aid/Assistance Status

Ethnicity	Total #	Female	Low Income	Ethnic Group %
African American	5	1	5	4%
Hispanic	13	2	6	10%
Pacific Islander	3	0	1	2%
Cambodian/Vietnamese	19	0	13	14%
Chinese	23	5	16	17%
Japanese/Korean	4	1	1	3%
Asian Indian/Bangladeshi	11	4	3	8%
Other Asian	9	0	3	7%
Middle Eastern	10	2	9	8%
White, Non-Hispanic	35	6	14	26%
Declined to State	1	0	0	1%
Total	133	21	71	100%
Percent		16%	53%	

[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

[2] In California, the community colleges are relatively low cost at $13/quarter unit. Those qualifying for financial aid are categorized as low income and this included public assistance recipients: CalWORKS, a Temporary Assistance to Needy Families program that provides financial support to parents/caregivers; and 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.

Results – Year Three

The research cohort for the year three study was those 133 students who were in the CompTechS program for between June 2007 and December 2009. 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 133 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, and underrepresented minorities) was 92 students, or 69% of the CompTechS student population. Twenty-one students out of the 133 were women, 16%, and most of those females were from ethnic groups not considered underrepresented, i.e., Chinese, White, Asian Indian, etc. Fifty-three percent (53%) of our research cohort were receiving financial aid as compared to only 22% in the overall De Anza College student population.

What is the impact of the internship experience on success and persistence in technical coursework and careers?

A primary data source for retention has been the institutional data on student enrollment and success within Foothill-De Anza Community College District (FHDA). In addition, the institutional researcher at Foothill-De Anza licensed a national student tracking system that allowed for tracking enrollments for students who completed the program and their studies within FHDA and transferred to four-year institutions or other community colleges. For persistence analysis, 132 students who had been in the program from June 2007 through December 2008 were the research cohort for this report, as one student had passed away during the past year.

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. In addition, success data was compared against the overall student population in computer related courses in Foothill-DeAnza CCD.

Persistence

Of the 132 students in the research cohort for persistence, 102 were enrolled in FHDA, in four-year universities, another community college, or had graduated in Fall quarter/semester 2009. So from June 2007 to December 2009, the persistence in academic work is 77%. Additionally, through follow-up with other students not in this group, we learned that an additional eight past students were employed in the field.   Therefore the rate for persisting in the field is 83%, not including a few who were out of work and looking.

Table 3: Persistence in coursework and the field by the research cohort.

CompTechS	Fall 2009	% of cohort	Persistence in the field
132* students, June 2007-Dec 2009	63 enrolled at FHDA, 31 enrolled at universities, 3at other cc's, and 5 grads = 102 total	77% Persistence in coursework	83%persistence in the field
	8 additional CompTechS completers working in the field	6% Working in the field**	

*One of the 133 students in the CompTechS program passed away in the last year.
Only those **not represented as persisting academically were contacted for follow-up self report. Of those who responded, seven had full-time employment in a computer related field and one was an independent contractor. Two others were laid off and looking for work in the field, but were not counted in the persisting group.   The remaining 22 either did not respond or were not working in the field.

There were no statistically significant differences on the rate of persistence for:

- The target group of 92 students (low income students, women and underrepresented minorities) as compared to the non-target group within CompTechS (primarily white and Chinese men).
- Those who had industry internships versus college refurbishing lab experience only.
- Target ethnicities versus non-target ethnicities.   In addition, for a subgroup of African American and Hispanic students in CompTechS, there was no significant difference in persistence compared to other CompTechS students.
- Women vs. men. There was no statistical difference in male and female persistence.

Financial Aid versus No Aid: Those receiving aid persisted at an 89% rate versus a 75% rate for non-aid people ($p=.041$).   We don't know the reason for this, but 61% of the aid recipients were from non-target ethnic groups.

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 accumulated over all of the quarters in the project timeframe for CompTechS students at Foothill-DeAnza, the CompTechS student success rate was 72%, comparable to the 67% for De Anza students in Computer Information Systems courses and 70% success in all computer related courses at both campuses. "Computer-related" courses are courses from Computer Information Systems, Computer Networking & Electronics, Computers on the Internet, Computer Applications, Computer Aided Design & Digital Imaging.

Females in the program did about the same in computer related coursework as their male counterparts, and the number of courses per each female was similar to the number for each male student. The success rate in overall coursework, technical and non-technical, was 78% for the CompTechS student grades.   The success rate of CompTechS students was highest in non-technical courses at 83%.

Table 4: Course Success Rates by Target Groups within CompTechS – accumulated over multiple quarters, 2007-2009.

Comparison Group	# of course grades	Pass	Did Not Pass	Withdrew
CompTechS- All courses	1814	78%	13%	9%
Computer-related Courses*	679	72%	16%	12%
Other Tech**	333	75%	15%	10%
All Other Courses	805	83%	10%	7%
Computer-related, Female	152	75%	13%	12%
Computer-related, Male	940	74%	15%	11%
Financial Aid	1510	78%	12%	9%
Comparison Group	# of course grades	Pass	Did Not Pass	Withdrew
African American	54	54%	32%	14%
Cambodian, Vietnamese	275	80%	12%	8%
Hispanic	197	64%	22%	14%
Pacific Islander	40	83%	5%	12%
White, Non-Hispanic	350	78%	13%	8%
Chinese	309	84%	6%	9%
Other Asian & Non White	282	81%	12%	7%

*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.

Success rates of selected target populations

Targeted ethnic populations in the CompTechS program varied widely in their success rates for coursework within FHDA. African American participants performed significantly lower in computer related courses. However, the African American group accounted for only five (5) students, so one needs to be cautious regarding conclusions based on this data. Hispanics had a lower success rate for computer courses (61%) than the overall De Anza population in CIS (67%) and FHDA overall population in computer related coursework (70%), and significantly lower success in the other technical courses they took than the rest of the CompTechS population.

The target populations for the most part had better success rates in other technical (STEM) courses than in computer-related coursework, and the best success rates in non technical courses. The exception was the Hispanic group, who took only 21 other technical courses over this period with a success rate of 38%, as opposed to having taken 110 computer-related courses with 61% percent success.

Table 5: Selected target populations and course success rate

Target Group	# of students	Computer-related Courses*	Technical courses**	All Other courses
African American	5	35%	63%	93%
Hispanic	13	61%	38%	76%
Pacific Islander	3	87%	86%	85%
Cambodian/Vietnamese	19	77%	78%	87%
Target Group	# of students	Computer-related Courses*	Technical courses**	All Other courses
Female	21	75%	90%	86%
Low income	71	68%	81%	84%

*Computer-related course 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.

Southeast Asian and Pacific Islander groups within CompTechS performed better in computer-related coursework than the overall CompTechS group.

Regarding success, there seem to be two sub groups within the targeted ethnicities in CompTechS: 1) African American and Hispanic, who have a success rate in computer related coursework that is below the overall success rate of FHDA students in these courses, and 2) South East Asian and Pacific Islanders who have a success rate above the overall average. However, when we looked at *persistence* of the African American-Hispanic sub group, we learned that although they are persisting at a slightly lower rate than CompTechS overall, there is no significant difference in the persistence rates.

Plans for education and careers

Data from the 63 completing students and the former student intern survey provided insights into impact of the program on career plans and educational goals.

Plans to continue to take classes were extremely high at 97% for CompTechS completers at the time of their exit questionnaire. In reality, 90% of past students (31 repondents to Former Intern survey who had completed the program before Fall 2009) had taken computer-related courses since completing the program. Those students who planned to complete a four-year degree, or had already completed, was high at 84% of the 63 completers in the research cohort. This was consistent with 84% of the respondents to the former student intern survey who planned to complete a degree, including 32% planning an advanced degree. FHDA Institutional Research has continued to follow CompTechS transfers through a national tracking database after they finished their coursework within Foothill-De Anza Community College District, and these results were reported in the persistence section (83% persisting in coursework or relevant jobs).

In surveys of former interns earlier in the project, clarification of career goals had been a pattern. In this year's survey, open-ended, written responses again confirmed this in response to how the CompTechS program influenced their career and educational goals, "Certainly made me more receptive at the time to looking at an IT path."

Sixty-two percent (62%) of former student interns reported taking a position or advancing in a position in a computer-related field, and an additional 14% in science and technical fields. The poor economy has impacted completers: "…wanted to get entry level networking job, but [I am] going to my old career as a trainer because of current economy and job shortages."

What features of the program are most valuable to students? What are the key features?

Our year one and two data indicated that students gave high ratings to their CompTechS experience and outside evaluators corroborated the data through their independent interviews. Comments from a past student survey confirmed the positive impact the program had on their professional goals. In these years, we had surveyed and interviewed student interns and completers to discern the characteristics and features of the program that are valued by them. This year we took the accumulated list of valued features and asked students to rank them in order of their importance to them. It was thought that this investigation would lead to key features and factors that would contribute to successful replication of the program, when we focus on dissemination. The work of Chris Dede on scaling program improvements and innovations[3] supports our thinking about identifying the key features or essence of the program.

In year three, data was analyzed from:

- Exit surveys and interviews with the 63 students who left/completed the program from June 2007 through December 2009.
- A short pre-survey regarding factors that attracted students to the program, given to new refurbishing lab interns during the application process (72 respondents).
- An online survey requesting a rank order of the features that were most important to them, given to students who had completed the program and to current interns (36 responses).

Consistent with all other previous surveys, the learning of new skills and the hands on experience were the most important features of the program to students.

The paid part-time job was confirmed as highly important by the rank order exercise. We had thought this may not be the case because students consistently mentioned that learning new skills and knowledge was the best aspect of the program in exit surveys and interviews – and in application interviews they down played the paid job as a motivation to apply. However, when past and current students responded to the rank ordering, it was obviously important. "Having a job - even part-time - that ties in with a career direction I'm interested in lets me get additional experience in the area in another setting than a classroom." This has implications for scaling the program to other environments, as the intern salaries impact budget. Indeed it has implications for continuing the program in tight budget conditions even at FHDA.

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[3] Dede, C, Rockman, S, *Lessons Learned from Studying How Innovations Can Achieve Scale,* Threshold, 2009, #4. www.ciconline.org/threshold

Table 6: Rank order of CompTechS program features most valued by former student interns.

Rank	**Former** student interns: Program features that have been most important to you. 1 is highest	Rank average
1	Opportunity to learn new technical skills	3.74
2	Hands-on hardware experience	4.67
3	Possibility of being placed in industry	5.03
4	Paid part-time job	5.84
5	Flexible schedule	6.93
6	Working with a team	7.37
7	Supportive staff	7.47
8	Clarifying my career goals and directions	7.50
9	Career and professional advice	7.79
10	Challenging work	8.37
11	Well-defined lab procedures	8.38
12	Distributing computers to students who need them	8.76
13	Resume builder	8.83
14	Convenient location of refurbishing lab	9.07
15	Support of other students	10.28
16	Preferential enrollment for classes	10.83
17	Academic guidance	11.14

Current Students

Current students in the CompTechS program confirmed that the hands-on experience and the opportunity to learn new skills were most important to them, and the ranked the paid part time job similar to former students. Next, those features that impact their daily work and school experience were most important, as opposed to the possibility of being placed in industry, which was low. This may be because the economy has meant fewer industry internships and thus it has been less a reason to participate. Clarifying career goals was last (ranked 17) on the current student interns list, indicating that it may require completion or perspective to fully appreciate that as an outcome of the experience.

Current students also ranked the support of their fellow students as important to them, possibly because CompTechs formalized the role of peer mentor last year. Consequently, at least one experienced student who has a mentor role is usually available to them in the lab. The evaluators interviewed students and peer mentors to gain other insights about the usefulness of this role. See below. Preferential enrollment gained importance to current students likely because so many classes have been cut because of budget shortfalls that it is hard to get classes.

Table 7: Rank order of CompTechS program features most valued by current student interns.

Rank	**Current** student interns: Features that have been most important to you. 1 is highest	Rank average
1	Hands-on hardware experience	2.80
2	Opportunity to learn new technical skills	3.60
3	Paid part-time job	5.80
	Supportive staff	5.80
4	Working with a team	6.20
5	Well-defined Lab procedures	6.60
	Support of other students	6.60
	Preferential enrollment for classes	6.60
6	Flexible schedule	8.00

The pre-program survey given during the intake process asked about what attracted students to the program from seven possible features that overlapped with the survey items above. The 72 responses are consistent with the rank order in that "working with computers" and "learning new technical skills" were the most frequent responses at 90% and 89%. The next were "Flexible schedule" (81%) and "part-time job" (78%), indicating that part-time work in the field that accommodated their student status was important to them.

Analysis of the Differential Attractiveness of Program Features for Target Groups

A series of analyses (one-way Analysis of Variance) were conducted to see if there was evidence that the program features were differentially attractive to members of the target groups versus members who were not part of the target groups. Analyses focused on the mean ratings for the program features for people in the target versus non-target group. Four different analyses were conducted testing differences between:

- Males vs Females. The tests on Gender produced a single statistically significant result. Females viewed *Academic Guidance* much more highly than their male counterparts.
- Recipients of Financial Aid vs those who did not receive aid. The contrast on Financial Aid produced no statistically significant differences, even on the importance of a paid part-time job. There was a single difference that approached statistical significance ($p=.06$) that indicated that those on Financial Aid viewed *Supportive Staff* as more important than those not receiving aid.
- Members of the target ethnic group vs members from other ethnic groups. There were no statistical differences on any of the factors for people in the target ethnic groups vs those not in such ethnic groups.
- Student interns with one or more of the target characteristics vs those with none. When comparing people with one or more target characteristic (female, low income, underrepresented minority) with those who had none, two statistically significant differences became apparent. In both cases people in the Target group viewed the following features as more important: *Supportive Staff and Acquiring Skills*.

These results suggest that some program features may be viewed more positively by different subgroups of participants and may suggest that outreach and marketing could be targeted by these characteristics. It also suggests that features such as supportive staff and academic guidance may play a role in retaining subgroups of interest to us.

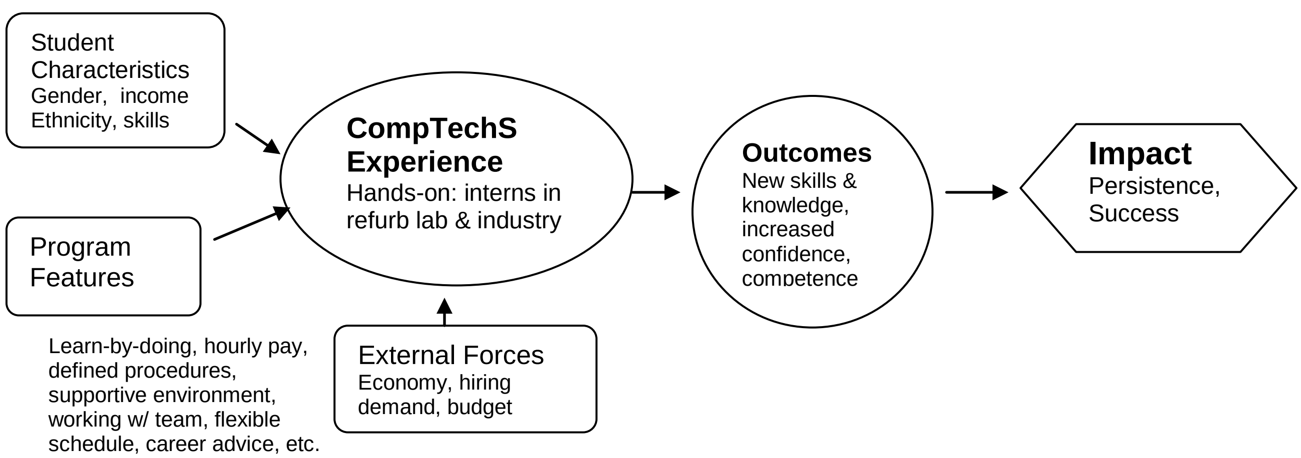
Increased Confidence and Technical Competence

Surveyed completing students indicated a significant growth in feelings of confidence and technical competence.   In interviews conducted by the evaluators in year one, *all* of the interviewees had said their experience in the program increased their level of self confidence. They felt more confident technically and more ready for the workplace.

The CompTechS Program Model

We have made progress in documenting the practices and key features that make this program effective. Our intention has been to develop a model that describes the program allowing it to be scaled successfully to other environments.

CompTechS Program Model



Early in the project, we focused on identifying the student characteristics, describing the experience, outcomes and impact.   The demographics have been relatively stable and we have begun to look at incoming student skills and the affect on the experience and outcomes. See more below.   In the last year we focused on program features that describe the program and influence student experience and outcomes.

The external economic forces interacted with the experience this year by limiting the opportunity for industry internships. The state and district budgets led to experimenting with staffing changes, including peer mentors as a support to the lab coordinator role, and possibly a partial alternative.

Student Motivation to Continue

The survey items reported in tables 6-7 (valuable program features) are indicators of which program features motivated students to continue. As indicated previously, learning and improving skills, relevant hands-on experience, coaching, advice and support were valued by students, thus motivating students to continue. The well-organized, structured refurbishing lab emerged in year two as a key motivational feature, as well as the fact they were distributing computers to needy students.

In the interviews conducted by evaluators in year one, students mentioned the low key atmosphere of the lab as motivating them to continue. 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 contributed to their success and persistence in the field.

What impact do different CompTechS staff positions and practices have on the experience of students?

Last year, investigation focused on the Lab Coordinator and the Peer Mentor roles in order to discern the optimal organization and job descriptions for scaling the program. Co-incidentally, the person in the Lab Coordinator position changed. We took the opportunity to investigate if the positive effects of the program were specific to the individuals who developed the program originally. In addition, budget implications have meant staffing decisions may need to be based on minimum staffing requirements for effectiveness.

Data came from:

- Interviews with peer mentors, lab coordinators and students about lab staffing, roles and effectiveness. These ten (10) interviews were done by our evaluators.
- PI interview with founding lab coordinator to described responsibilities and practices.

Refurbishing Lab staffing, roles and effectiveness

The project evaluators interviewed both past and current Lab Coordinators, two Peer Mentors, and six student interns. The past Lab Coordinator had been promoted to a Network & Communications Administrator within the District. Since supportive staff has been a consistently valued characteristic of the CompTechS program, and the atmosphere in the lab may be unique for an academic institution, we wanted to confirm that the conditions could be maintained with a new coordinator.

From the evaluator notes, we learned that the interviews supported the following:

1. Both Lab Coordinators are good and effective. As per student intern interviews, "both were trying to grow/coach/mentor people."
2. Each was the right person at the right time. The first was entrepreneurial and able to create an effective program with available resources. The second is more detail and process oriented. He has taken the refurbishing lab to next level of maturity: professionalism (as per the growth model for programs and organizations described by PF McClure in *New Entrepreneur Guidebook*[4]). The first coordinator may have been more like a 'friend' to the Interns. The second acts more like a corporate coach.

[4] McClure, P.F., *New Entrepreneur Guidebook, Menlo Park, CA: Crisp Management Library, 1998.*

3. The atmosphere in the lab has been maintained as a supportive and comfortable environment for the student interns to ask questions and acquire skills by working out problems on their own or collegially.
4. The Peer Mentors are a valuable addition and make the lab more effective for the interns. The peer mentors liked both Lab Coordinators and saw them as enjoying their work. Positions seem to be functioning well.
5. Interviews with interns were consistent with earlier data on the supportive atmosphere in the lab and the coaching role of the lab coordinators. At least one wished there was more modern equipment, also consistent with earlier comments.

Refurbishing Lab

The refurbishing lab has six work stations, which allows for a maximum of six interns scheduled at a time. The lab coordinator has moved his desk from his office into the lab and treats this as his office. Comments from the exit survey were consistent with the supportive lab atmosphere being an important feature: "Very laid-back atmosphere, great learning environment," "I got to work with some really nice people in a small friendly environment." "Your excepted [sic] as you are." All were responses to a question about best aspects of the program.

An interview with the lab instructional coordinator supported the results on valued program features (Table 7), in which students highly valued the well defined procedures and organized workflow in the refurbishing lab. The lab coordinator yielded some other points that are relevant here.

- Start students on day one on the work that needs to be done… immediately engage them, rather than putting them through an observation period.
- Provide an organized production environment. Have a pre-set series of steps. Having a really well defined structure allows them to know the step they are working on and to concentrate on just that procedure until completion.
- An important first step for an instructor is to set up the procedures, breaking the refurbishing steps into sequential parts. The nature of computer troubleshooting allows for you to break it down into smaller steps.
- Maintain small groups of 4-6 interns in the lab at a time. Assessing personal needs necessitates having a smaller environment. Also, they can feel comfortable speaking up and getting support.
- Don't hesitate to give students a task that they may think is above their skill level. It may be intimidating to them, but also it is a confidence booster. Pair them with a student that may be more competent.

Lab Processes:

- In the "production environment" the students do a step in the process, but will rotate over the course of their internship. When they come into the lab, they do the job that needs to be done. Listed on the white board are systems in testing, in progress and those to be picked up, plus special notes about projects.

- An intern is directed to start on systems that are “in testing” because they are closest to completion and you want to get them off the board. The next priority is “in progress”: hardware repair, or the software installation/configuration checklist.
- However, the systems for “pick-up” supersede all. This is when a needy student comes into the lab to pick up their refurbished computer. The team needs to understand that this is the public face of all the work they’ve done. So the system must be ready by the time scheduled on the board, which may require the team to scramble to get it completed, prepared/set up for demo/orientation, paperwork ready, etc. It’s good to include the interns in distribution of the free computer to needy students – they like to know that their work benefits others.

Peer Mentors

This last year, two past interns with significant technical experience were identified as Peer Mentors. Each works about 15-20 hours a week to support student interns. Students consider them “junior” lab coordinators. The Peer Mentors get support from the Coordinator, debrief daily and get advice on how to support students in the refurbishing process (“with your hands in your pockets”).

Interviews with Lab Coordinators confirmed that the Peer Mentors “pretty much solved” any problems that students brought to them. The coordinator and mentors frequently discuss how to best solve problems. “Peer Mentors came to me if they were stumped.” “We never ran into anything that as a group we couldn't solve. It's not the amount of knowledge one has that is important – it’s knowing where to look for the answer.”

Interviews with students regarding the Peer Mentors illustrated their competence in the role: “Both really knew what they were talking about.” “Whenever I couldn't solve a problem, I'd ask them.”

Peer mentors and interns are given responsibilities that stretch them. For instance, one Peer Mentor represented the program at the ATE Principal Investigators conference in Washington DC, and the other was part of a presentation for the Mid-Pacific Information & Communication Technology Conference in San Francisco. A student intern was encouraged to call Microsoft in order to solve a problem in the lab. These opportunities for growth have become integrated into the program.

CompTechS Program Coordinator

The Program Coordinator is essentially the director of the program and also is part of the equation when students refer to *supportive staff*. She does student recruitment and intake, marketing to industry for internships and computer donations, data collection and the business management of the program. She is part of relevant college outreach events for prospective students and parents, as well as county public assistance staff. She makes arrangements with instructors to visit Engineering, Computer Science and Networking classes to make a short presentation to students about the program and steps they must take to apply. The coordinator counsels students through the intake process and explains the student employment procedures, which can seem complicated to students. She is the point of contact for any problems with industry internships. Since she has 30 years of industry experience, she has relevant information for students about the range of careers in IT.

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

The industry internship was highly valued by those who experienced it, and we were interested in whether this experience would differently impact student persistence and success, as opposed to those who only had the campus refurbishing lab experience. As we had earlier in the project, we investigated whether there were any differences resulting from the type of internship experience that a student had by comparing 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:

- Rate of persistence in the field
- Probability of Success (grade of C or better) in a Computer Class
- Probability of Success in a Technical Class
- Probability of Success in any Other Class

Additionally for the 63 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 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 students who participated 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.

This finding is significant, because the economy has impacted the number of industry internships available to students. In the third year of the project, students have far fewer industry internship opportunities. For those who came into the CompTechS program from July through December 2009 had only four new industry placements, nine including continuing internships, as opposed to 30 industry internships in year one of the project. The important implication is that the on-campus computer refurbishing lab is 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.

Differences across student populations

We also investigated a sub question concerning the differential effects across different student populations for the lab only experience as compared with the industry internship. For example, does the industry internship have a different impact for males than females? Or, does it work better for individuals receiving financial aid than it does for those for are not receiving such aid.

In Year One, we addressed this issue by performing single factor comparisons on a variety of performance metrics. We compared males versus females, those receiving financial aid versus those who did not, and those in a target ethnic group versus those who were not in a target ethnic group. Theses analyses really only answered part of the question as it shows differential performance across specific groups of interest but not whether the methodology differed across such groups. However, the small sample size in Year One made it impossible to reliably perform the appropriate two factor analyses.

In Year Two with the larger sample size it was possible to perform a two-factor comparison (for example, male vs. female and learn-by-doing vs. internship) of the mean performance on:

- Probability of Passing a Computer Class
- Probability of Passing an Other Tech Class
- Probability of Passing an Other Class

The two-factor analysis tests main effects for the two factors and, most importantly for this research issue, the interaction of the two factors. It is the interaction effect that would show that the two experiences are acting differently across the groups of the second factor (such as gender).

Year Three

We repeated this analysis in Year Three with the overall larger sample size. In addition, we examined the Persistence outcome variable along with the three Success variables. The results of the two factor analyses mirrored those reported for Year Two and for the Year Three one-factor comparisons. *The analyses produced no statistically significant interactions for type of internship by Gender on any of the four outcome variables.* Two notes of caution about this finding: first, there were only 7 females with Internships who took Computer or Other classes, and only 2 females had taken an Other Tech class.

In sum, the two factor analyses appear to support the previous findings that the type of internship is not differentially effective across target groups of interest to us.

How does the impact of the CompTechS program 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:

- Persistence in the field
- Probability of Success (grade of C or better) in a Computer Class
- Probability of Success in a Technical Class
- Probability of Success in any Other Class
- Working status on entering the program

There were no statistically significant differences found between the two gender groups on any measures. The same was the case for the target ethnicities as a composite group. *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.

Persistence and Success

Females and the target ethnic minorities persisted in coursework and in the field at about the same rate as non-target groups. The only statistically significant difference on Persistence was on the comparison of student interns receiving Financial Aid vs those not receiving Aid (p=.041).

Student interns who received Aid persisted at an 89% rate vs 75% for those who did not receive Aid. As stated earlier in the report, the overall CompTechS intern persistence in FHDA coursework was 77%.

Regarding Success in coursework, a statistically significant difference occurred on a probability of passing a course: The Non-Target group within CompTechS was statistically more probable (p=.027) to pass a Computer Class, 83% vs 67% of the Target group (underrepresented minorities, women and low income). The point should be made that the overall student population in De Anza CIS courses is at a 67% success rate as well.

The incidence of target underrepresented Ethnicities was slightly lower in year three compared to year one (29% vs 33%) and the incidence of the overall Target Group (low income, women and underrepresented minorities) was lower in year three, 57% vs 75% for year one. We are not sure why, and would need to investigate further to determine if this is a reflection of recruitment, or another factor within or outside of CompTechS. The populations for each of the three years did not differ in a statistically significant way, however, on Gender or Target Ethnicities.

Overall, the CompTechs program is still functioning well for various groups regardless of student characteristics. We need larger numbers of targeted underrepresented minority students, especially African American, to look for any significant variance in their rates of persistence.

Skill Level on Entering the CompTechS Program and Impact

Two skill assessments are given to entrants to the CompTechS program, a Hardware Quiz and a Hardware Identification test. These two assessments provide a reading of the skill level of new program participants prior to any programmatic intervention. Students also are evaluated throughout their time in the program by the Lab Instructional Coordinator and, and for those placed in industry, by their industry supervisor.

Students who rated low on the pre-assessments tended to stay lower on the lab evaluations relative to those who started higher – they did not change their relative order in terms of performance. However, there were *no statistically significant correlations between scores on the pre-assessments and persistence in the field or with student academic success.* Thus, students who rated low in skills upon entering the program were as successful in coursework and persisted at the same rate as the others in the program.

There were some statistically significant correlations between the Hardware Quiz score and the Hardware ID score and the Lab evaluation scores and Employer Evaluations. For the Lab scores there was a positive correlation with the Hardware Quiz score and the lab scores on Documented procedures, Completing Paperwork, Delegated Tasks, Troubleshooting Initiative and all nine-skill areas:

- Identify PC components
- Install internal PC components
- Download and install BIOS upgrade
- Install Windows operating system
- Install Hardware drivers

- Install & Configure applications
- Configure and Test networking setting
- Give demo to student awarded a computer
- Assess system status regarding specifications

The score on the Hardware ID task also correlated significantly and positively with all lab scores and skills scores.

The employer rating of cooperation had a positive relationship with persistence. Thus students who rated higher in this area had higher rates of persistence. There were no significant correlations between the employer evaluations and academic course success. There were no statistically significant correlations between lab scores and persistence. However, lab measures (almost all of them) had a positive correlation with academic success in computer classes.

The comparisons on the Employer Evaluations were complicated by the fact that only a subset of program participants had industry internships. The comparisons were done with three groups for the Quiz and two groups for the Hardware Identification test. All groups were defined as described in the appendix. The results for both the Hardware Quiz and Hardware Identification test were consistent. No statistically significant differences were found for people who initially differed on the Hardware Quiz and or for people who differed on the Hardware Identification test. *These results suggest that initial differences can be overcome and are not reflected in subsequent job performance in an industry setting.*

In summary, the results are consistent with those from Year Two that suggested the existence of a threshold. This evidence of a threshold found in both years suggest that a programmatic intervention may need to be made depending upon whether a person is above or below certain values on the two initial measures. The results also show that participation in the program can overcome initial differences and produce consistent quality performance in the areas of academic course performance, performance in industry setting and on certain lab performance measures.

Conclusions

The CompTechS program has been highly valued by students and they have persisted in coursework, and the field, at a high rate. CompTechS student success in computer related coursework, even for the women, ethnic minorities and low income students, has been about at the same rate as the overall population of students taking similar courses at Foothill and De Anza Colleges. These findings are promising. However, sub groups, such as African American students may need additional interventions to improve success in coursework, although they are persisting at a similar rate as others. Additional data and a larger sample size for ethnic sub groups would help clarify CompTechS affects.

The project has identified key program features and affects on the student experience, persistence and success. Feelings of being comfortable in the environment, that they were learning technical skills and that the experience was relevant to the workplace made students more engaged – likely contributing to their persistence in the field. Features such as supportive staff and academic guidance may play a role in retaining underrepresented subgroups. The program model that describes key features and interactions that make this program effective will better allow the program to be scaled to other environments.

The paid intern experience was attractive to the research cohort, and would be to other student groups. Economically disadvantaged people are drawn to job training programs because they are compelled to work and these training opportunities are more accessible than degree programs. However, long term opportunities are more limited. The use of this program as an attraction to traditional academic degrees may be very promising.

CompTechS staff and practices contribute to a supportive environment for the student interns to seek solutions independently and acquire skills by working out problems on their own or collegially. The focus of the Lab Coordinator is to grow, coach and mentor interns. Peer mentors are a valuable addition and make the lab more effective for the interns.

Generally student success and persistence are the same for the students regardless of their characteristics of gender, ethnicity and low income. Incoming IT skills of students vary widely, but there is no significant difference in their persistence and success in coursework. Nor were significant differences found on employer evaluations for people who initially differed on the pre-program skills measures. These results suggest that initial differences can be overcome and are not reflected in subsequent job performance in an industry setting.

Student perceptions of the benefits of their internship in the CompTechS program were very positive, whether they were in the campus-based refurbishing lab, or also in an industry internship. 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. Campuses can provide the benefits of tech support internships to their students regardless of the surrounding employer base.

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. Additional interventions for specific underrepresented groups could be studied in the future.

Appendices

Former Intern Survey, Valuable Features

Impact on Career and Education – Student Comments

Exit survey

Skills Pre-assessment:

Hardware Skills Quiz

Hardware Identification

Skill Level Analysis

Lab Assessment

Employer Assessment

Lab Workflow Chart

Lab Coordinator Interview

2010 Former Intern Survey

CompTechS -- Former Intern Survey

Please answer the following items with the response that best reflects your experience with the CompTechS Internship Program.

1. Which parts of the CompTechS Internship program did you participate in?

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

2. How did the CompTechS program influence your career goals or your educational goals?

3. What are your current educational goals? (Select all that apply)

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

4. What is your current career goal?

- Career in Computer Science field
- Career in Computer related field
- Career in Science or technical field
- Career in non-technical field
- Not Sure
- Other (please specify)

5. Since exiting 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

6. Please rank in order which features of the CompTechs Program have been most important to you with 1 being the most important feature and 17 being least important.

Academic guidance	☐
Career and professional advice	☐
Challenging work	☐
Clarifying my career goals and directions	☐
Convenient location of lab	☐
Distributing computers to students who need them	☐
Flexible schedule	☐
Hands-on hardware experience	☐
Opportunity to learn new technical skills	☐
Paid part-time job	☐
Possibility of being placed in the industry	☐
Preferential enrollment for classes	☐
Resume building	☐
Support of other students	☐
Supportive staff	☐
Well-defined lab procedures	☐
Working with a team	☐

7. Is there any other feature of the program that was important to you?

If so, please specify: ____________

From above, what ranking would you give it? ____________

8. For the feature that you rank most important (1) please tell us why it was most important to you and how it affected you.

9. Which key features or elements of the program had the biggest impact on you? How?

10. 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 (please specify)

11. Gender?

☐ Male ☐ Female

12. Mark the one that best applies to you:

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

Optional: Name, Employer, Position

Former Intern Survey: Comments

How did the CompTechS program influence your career goals or your educational goals?

1. Its made me want to work harder in school and get certified.
2. Certainly made me more receptive at the time to looking at an IT path, by
3. It reaffirmed that this kind of work is what I really want to be doing.
4. Gave me real work experience and taught me new skills amongst working in the lab with my peers
5. It got me interested in the computer field. Possibly, I will continue in IT.
6. through the CompTechS program I was able to get hands on experience and once i got an internship with Roche pharmaceutical i got to experience the real world of technology wich influenced my career decision
7. It reinforced my interest in computer science and IT.
8. Experience is #1 thing to step up ahead.
9. CompTechS program gave me the hands on experience that adds weight to my work experience. It was my first internship in the industry and I learned and gained experience that will go a long way.
10. IT made me understand that I almost all engineering fields require computer knowledge
11. It helped me get my foot in the door of the IT industry.
12. I received some training on computer hardware and software operating system.
13. It allowed me to get internship experience that eventually led to a full time position.
14. It helped find placement to gain job experience.
15. I learned about the kind of IT positions that are available in the industry. I also came to know to figure from job description what skills to acquire
16. I have always liked computers and it was very clear to me early that I wanted to be an electrical/computer engineer. The CompTechS program helped me nurture that passion and the practical experience I gained was invaluable to my career development.
17. It very much influence my carrer goals
18. I got hands on experience on both computer hardware and software repairs, time management skills through completion of sub-tasks under the major-task of refurbishing a computer. Also, I highly improved my book-keep or records-keeping skills due to the style of records-kipping I learned from working there.
19. It provided me with a view into the world of IT services and computer systems. It sparked my interest to get an internship with an external company.
20. The hand-on experience skills gained in this program include interpersonal and intercultural communication, individual and group decision-making, teamwork, innovation, troubleshooting, and customer sevices skiills for IT Professional.
21. It helped to solidify my career goals as a software engineer.
22. It provided me with very valuable working experience, helping me with my job search down the road.
23. It gives hands-on knowledge which I can't find in a regular classroom. I was able to build the system by myself.
24. Guided me into a position which I have held for 3 1/2 years as contractor and then FTE.
25. It gave me practical hands-on experience in the world of pc repair and helpdesk operations. Whereas before I would have been relegated to minimum wage dead-end jobs, I came out a person with bright job potential. I am also living proof that one can succeed without a degree (albeit with a steeper climb).

Computer Technical Support

...it works.

CompTechS Program Exit 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 Lowest**	6	5	4	3	2	1	NA
Paid Internship	**Highest Lowest**	6	5	4	3	2	1	NA
Academic guidance	**Highest Lowest**	6	5	4	3	2	1	NA
Preferential enrollment	**Highest Lowest**	6	5	4	3	2	1	NA
Supportive staff	**Highest Lowest**	6	5	4	3	2	1	NA
Resume building	**Highest Lowest**	6	5	4	3	2	1	NA
Acquiring skills	**Highest Lowest**	6	5	4	3	2	1	NA

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	______	______________________________

8. To what degree did the program have an impact on:

	Yes	Some	Neutral	Not Really	No
A. Your self-confidence?	5	4	3	2	1
B. Your feelings of technical competence?	5	4	3	2	1
C. Your feelings of being ready to be in the workplace?	5	4	3	2	1

D. What workplace you are interested in?

____

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

CompTechS
Computer Technical Support

Hardware Skills Quiz

1. A system has 3 hard drives, a CD ROM, and a tape drive, all connected to a single internal ribbon cable. The ribbon cable is attached to a 50-pin connector on the motherboard. On what type of bus are these storage devices operating?

    a) IDE
    b) SCSI
    c) FireWire

2. A system passes POST and boots successfully, but both the BIOS and the operating system report an incorrect processor speed. Of the following possible causes, which should you assume and investigate first?

    a) Faulty or damaged motherboard
    b) Incorrect frequency and/or multiplier setting in BIOS
    c) Faulty or damaged CPU

3. When you turn on a system, the power LED lights up and you hear the drives spin up, but no video at all is displayed. The monitor and cable are known to be functioning reliably. Which is a good approach to begin troubleshooting this problem?

    a) Check the video settings in the BIOS
    b) Check the motherboard manufacturer's website to make sure that the monitor is on the hardware compatibility list
    c) Make sure the video adapter card is properly seated in its slot

4. An older system is functioning correctly, but is low on disk space. You add a new 10,000-RPM hard drive for additional space. The drive has been tested, the jumpers are set correctly, and it is detected by Windows without a problem, however, the system is now suffering from sporadic freeze-ups, memory errors, and other unpredictable behavior. What is a likely cause of this problem?

    a) The largest, fastest, drive must always be the "C" drive
    b) The power supply cannot provide enough additional power for the new drive
    c) In adding the new drive, you have exceeded the total amount of disk space that Windows can address

5. You are installing a new CPU in a system. The CPU comes with a heat-sink, and a small tube of white paste. What is the paste used for?

    a) It provides for good thermal transfer between the CPU and heat-sink
    b) It is a lubricant to keep the heat-sink from becoming stuck to the CPU
    c) It simply provides a means to adhere the heat-sink to the CPU before the heat-sink is locked in place, and is rarely used by experienced technicians

6. You are adding an additional hard drive to a Windows system to increase available disk storage. The drive is identical to the current drive in the system. How could you also increase system performance without any other upgrades?

    a) Move the Windows system directory to the new drive
    b) Move the “Program Files” directory to the new drive
    c) Move the page file to the new drive

7. You try to boot a system, but the boot process fails after a series of beeps. Where is the best place to investigate the meaning of the error beeps?

    a) The Microsoft Windows Knowledge Base website
    b) The BIOS manufacturer’s website
    c) The sound card manufacturer’s website

8. Which motherboard component determines the built-in feature set of a computer system?

    a) CPU
    b) The math co-processor
    c) The chipset

9. You want to test the performance effects of a memory upgrade. You remove a 128MB DIMM memory module from a working system to double the RAM in an identical working system. After removing the module and walking across the room to the other system, you install the memory, but encounter a POST failure. You re-install the module in the original system, but now have a POST failure on that system as well. What is the most likely cause of this problem?

    a) Memory “registers” itself to the first system it is installed in, and should never be moved to another system
    b) One or more of the chips on the module have been destroyed by static electricity
    c) DIMMs must always be installed in pairs

10. You notice that when running multiple applications, a system exhibits an unusually high amount of disk activity, as well as slow performance. The hard drive is likely being kept busy by a process called ________, and performance could likely be improved by ________.

    a) Dynamic Data Exchange, upgrading to a faster hard drive
    b) Paging, adding more RAM
    c) Symmetric Multi Processing, upgrading to a faster processor

Hardware Identification

Choose one answer for each component:

Component #1: a) Modem b) Memory (RAM) c) Video card d) Processor (CPU) e) Network card f) SCSI card g) Motherboard	**Component #2:** a) Modem b) Memory (RAM) c) Video card d) Processor (CPU) e) Network card f) SCSI card g) Motherboard
Component #3: a) Modem b) Memory (RAM) c) Video card d) Processor (CPU) e) Network card f) SCSI card g) Motherboard	**Component #4:** a) Modem b) Memory (RAM) c) Video card d) Processor (CPU) e) Network card f) SCSI card g) Motherboard
Component #5: a) Modem b) Memory (RAM) c) Video card d) Processor (CPU) e) Network card f) SCSI card g) Motherboard	

Skill Level on Entering the CompTechS Program and Impact

Analysis of Non-linear Relationships between Pre-program Measures and Outcomes:

To investigate whether the two "pre-program" measures predicted (in a non-linear fashion) later performance a series of analysis of variance (ANOVA) tests were conducted. These ANOVAs tested whether initial group differences on the two Hardware assessments were maintained on later measures of performance, specifically the Lab performance Measures, Academic Course performance, Persistence, and Employer Evaluations for those individuals who had an industry Internship.

Comparison groups were created on each of the two Hardware assessments. For the Hardware Quiz, four groups were created, each representing approximately 25% of the participants. The individuals were categorized based on their total score as follows:

Low	Scores 1 through 4
2	Scores 5 and 6
3	Scores 7 and 8
High	Scores 9 and 10

In a later analysis of the Employer Evaluation, combining the groups with scores of 6 or less created three groups. This was done because the Low group had only a single individual on the Employer Evaluations.

For the Hardware Identification assessment, three groups were created, each representing approximately 33% of the participants. The individuals were categorized based on their total score as follows:

Low	Scores 1 through 2
Medium	Scores 3 and 4
High	Scores 5 and above

In a later analysis of the Employer Evaluation, combining the groups with scores of 4 or less created two groups. This was done because the Low group had only a single individual on the Employer Evaluations.

Results of the ANOVA procedures were consistent across the two assessments. First, there were no statistical differences in course performance (probability of passing) for computer courses, other technical courses or other courses. Thus performance differences on the two Hardware assessments did not show any relationship to the probability of passing academic courses.

Second, there were no significant differences in Persistence for the Hardware Quiz groups, so performance on the Hardware Quiz was unrelated to persistence in the computer field. However, there was a statistically significant result for the Hardware identification task groups ($p<.05$). The low scoring group on the Hardware ID task (scores of 0-2) had a much lower persistence rate than the other two groups. Specifically the low group persisted at a rate of .63 while the higher two groups had persistence rates of .88 and .86 respectively.

The comparisons on the lab measures did show statistically significant differences based on both the Hardware Quiz and the Hardware Identification test. Students who had higher initial scores on the Hardware Quiz or the Hardware Identification test generally performed better on all the measures below. It is interesting to note however that the differences were not linear and that usually there was a large performance ‘jump’ between the lowest initial group and the rest of the groups. This suggests that there may be a threshold operating and that students below the threshold stay low on later measures while students above the threshold start to perform very similarly on subsequent measures.

The following are the lab evaluation measures:

- Identify PC components
- Install internal PC components
- Download and install BIOS upgrade
- Install Windows operating system
- Install Hardware drivers
- Install & Configure applications
- Configure and Test networking setting
- Give demo to student awarded a computer
- Assess system status regarding specifications

In addition, for the Hardware ID task groups, all the lab measures other than attendance showed statistically significant differences.

The comparisons on the Employer Evaluations were complicated by the fact that only a subset of program participants had industry internships. The impact of this selection was that the lowest group on both the Hardware Quiz and the Hardware Identification task had only a single individual in it. As a result, two sets of ANOVAs were conducted one, with four groups for the Hardware Quiz and three groups for the Hardware Identification test, and a second set with three groups for the Quiz and two groups for the Hardware Identification test. All groups were defined as described above.

The results for both the Hardware Quiz and Hardware Identification test were consistent. In the cases were there were more groups (with the lowest group containing a single individual) statistically significant differences were found on a large number of the Employer Evaluation measures. These differences were clearly due to the poor performance of a single individual and were not reflective of the entire group of people with internships. Therefore the second set of analyses was conducted with the single individual combined with the people on the next highest performance group on Hardware Quiz and Hardware identification. When these analyses were conducted, no statistically significant differences were found for people who initially differed on the Hardware Quiz and or for people who differed on the Hardware Identification test.

These results again suggest that a threshold may be operating (although it could also be due to one individual). They also suggest that initial differences can be overcome and are not reflected in subsequent job performance in an industry setting.

In summary, the results are consistent with those from Year Two that suggested the existence of a threshold. This evidence of a threshold found in both years suggest that a programmatic intervention may need to be made depending upon whether a person is above or below certain values on the two initial measures. The results also show that participation in the program can overcome initial differences and produce consistent quality performance in the areas of academic course performance, performance in industry setting and on certain lab performance measures.

CompTechs intern skills evaluation **Name:**______________________

Behavior and general work skills	unacceptable		adequate		exceptional
Attendance and punctuality	O	O	O	O	O
Follow inventory management procedures	O	O	O	O	O
Follow documented technical procedures	O	O	O	O	O
Document work and complete paperwork	O	O	O	O	O
Observe personal/equipment safety procedures	O	O	O	O	O
Work cooperatively with coworkers	O	O	O	O	O
Responsibly complete delegated tasks	O	O	O	O	O
Shows initiative in troubleshooting	O	O	O	O	O

Technical skills	no skill / new to skill		functional knowledge		mastery of skill
Identify internal and external PC components	O	O	O	O	O
Physically install internal PC components	O	O	O	O	O
Download and install system BIOS upgrades	O	O	O	O	O
Install Windows operating system	O	O	O	O	O
Install component hardware drivers	O	O	O	O	O
Install and configure application software	O	O	O	O	O
Configure and test network settings	O	O	O	O	O
Assess system status according to specification	O	O	O	O	O

Instructional Laboratory Coordinator:______________________________

Signature:_______________________________

Date:____________

CompTechS intern skills evaluation

Name:______________________

Employer:

Supervisor:

Behavior and general work skills	unacceptable		adequate		exceptional
Attendance and punctuality	O	O	O	O	O
Follow inventory management procedures	O	O	O	O	O
Follow documented technical procedures	O	O	O	O	O
Document work and complete paperwork	O	O	O	O	O
Observe personal/equipment safety procedures	O	O	O	O	O
Work cooperatively with coworkers	O	O	O	O	O
Responsibly complete delegated tasks	O	O	O	O	O
Shows initiative in troubleshooting	O	O	O	O	O

Intern Supervisor:_____________________________

Signature:______________________________

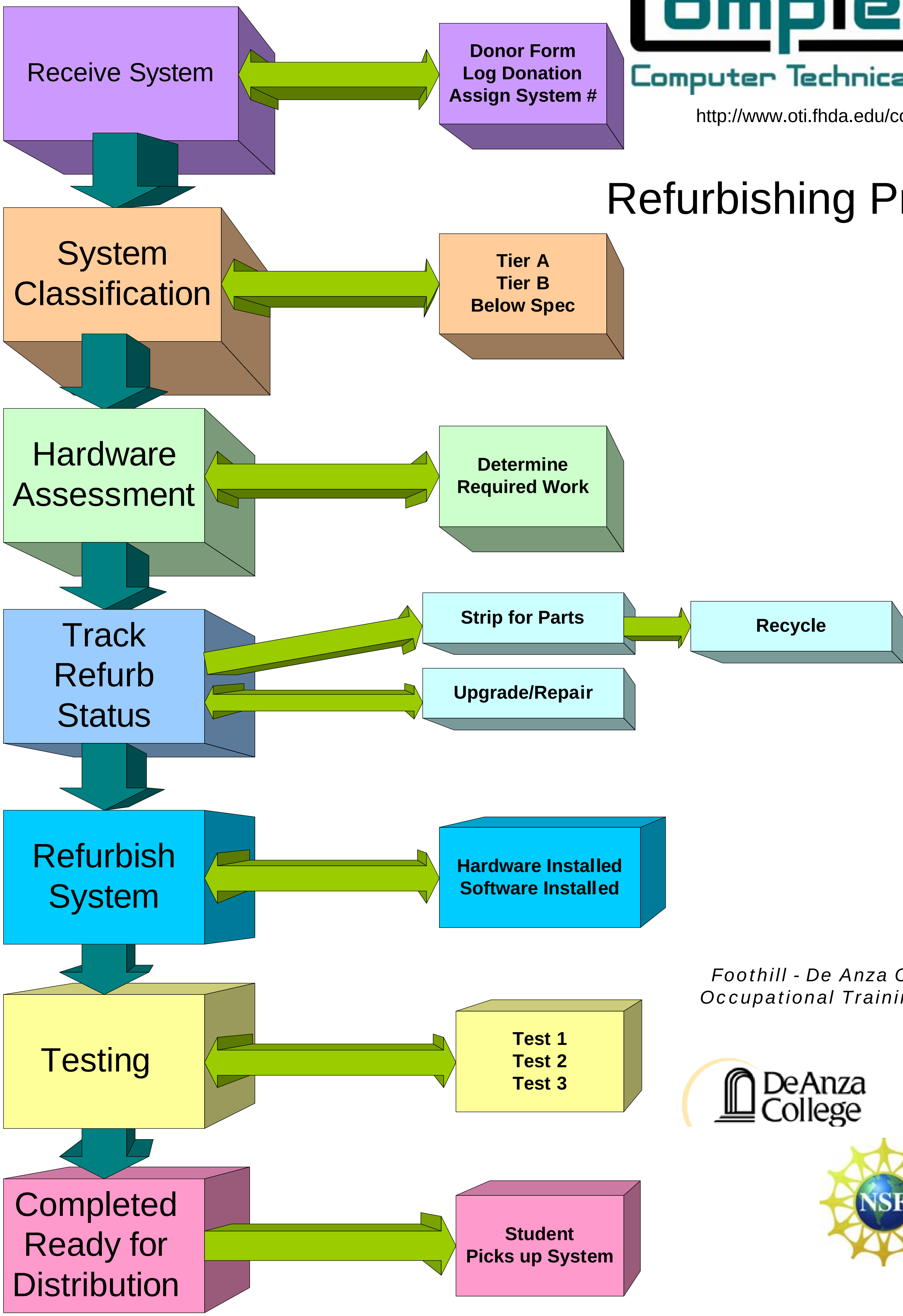
Date:____________

CompTechS

Computer Technical Support

http://www.oti.fhda.edu/com ptechs.html

Refurbishing Process



Foothill - De Anza CC District
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Refurbishing Lab, Instructional Coordinator

Best Practices in the position

Mentoring – How to mentor and coach students.

Technical skills: Don't hesitate to give students a task that they may think is above their skill level. Give them the job that needs to be done. It may be intimidating to them, but also it is a confidence booster.

Then help them. Pair them with a student that may be more competent.

Have a pre-set series of steps. Having a really well defined structure allows them to know the step they are working on and to concentrate on just that procedure until completion.

An important first step for an instructor is to set up the procedures, breaking the refurbishing steps into sequential parts. That helps all levels of courage and confidence – there is a step by step process. The nature of computer troubleshooting allows for you to break it down into smaller steps.

Assess what a person needs – gage the student and how proactive they are. Some need more hand holding than others. Some are perfectionists and afraid to make mistakes. You probably will have to go through the procedure with them the first time – or have another more advanced student do that. The peer mentor role is an official one, a combination of experienced student and instructional role. (This is a new position made possible by NSF funding).

If students are enthusiastically pursuing the first thing they are given, great. But some are self conscious and this isn't always related to skill level.

Assessing personal needs necessitates having a smaller environment of 4-6 interns in the lab at a time. Also, they can feel comfortable speaking up and getting support.

Frequently it's helping them learn where to find answers, because the instructor or fellow students don't know the answer either. Have a computer set up in the lab that is a resource system – where students can research problems. They may need to start from scratch. It may be that they need to download the motherboard schematic and manual. Some are good at digging right in and investigating every detail.

Academic advisement: Students need to know that a Bachelor's degree may be a gate keeper in tough economic times in the industry, but that they also need industry certifications and hands-on vocational classes.

The advisement is prompted by a student asking, "Where is there a class that teaches this stuff?" The community colleges are good for the voc training they need.

It helps that Joseph has taken most of the related courses in the district himself. At the least, an instructor needs to be very familiar with the courses in order to refer students.

Other: Advise students to volunteer for a challenge. For example, if they are in software engineering join an open source project.

Assessing a Student's readiness for an industry internship

Depending on the employer specifications, assessing readiness is case by case. Some employers want to train interns themselves. But generally the questions and issues are:

- Are they enthusiastic and reliable?
- Can they self initiate, be a self starter? (as opposed to needing hand holding)
- How well do they interact with others?
- How well can they follow direction?
- How organized are they?
- How quickly do they learn?

Of course, there is a threshold of technical skill. But given that, the above are the important considerations.

Starting a new student in the lab

Treat them all the same and expect them to hit the ground running. Give them the job that is there. If they need it, the new student will be walked through the task. But having all the systems documented and available to them allows some to just get to work.

Organization of lab

Organization is important. Make sure students know where things are (parts organized, instructions organized) so that interns can concentrate on completing the step.

Steps:

- Take in the system,
- Classification,
- Initial assessment,
- Out going configuration.

See the directions and forms in this packet.

Structured atmosphere is important. "Problem" students often work well in a structured environment. Example: Young gamer, guy, can channel his energy into productivity. The team can motivate because each step in the production lab is dependent on the step before. They can focus on the flow. Seeing the student pick up the refurbished computer, the product of their work, is motivating.

Another example: An older student, set in his ways, critical of how things are done. He may challenge, but if he sees that methods are well thought out, tested and documented, he may relax. However, let him recommend change ("we're constantly evolving.") Sometimes the perfectionist needs to do some trial and error. Also, this personality (critical or meticulous) can be used productively for testing. They will have success in this position.

The Coordinator – setting the tone.

Respect the students. Students are individuals; be mindful of why they are there. Some profiles are:
- Very experienced student who wants to get out to industry.
- Student who will transfer but wants to do "real" work.
- Displaced worker who wants to retool.
- Career changer, i.e., from software to networking.

The instructional coordinator is in the lab as a facilitator, to help them succeed, or they may miss their potential.

The lab instructional coordinator needs people skills, as well as technical skills. Personally, he/she needs to be committed to improving his/her own technical skills along the way. Given that, people skills are the most important in selecting a coordinator.

The coordinator should have an interest in the important environmental aspects of refurbishing and reuse of computers/ewaste, and communicate that.

Lab processes

The lab does contribute to the soft/professional skills of students, especially teamwork. Everything they do will affect someone downstream in production.

In the "production environment" the students do a step in the process, but will rotate over the course of their internship. When they come into the lab, they do the job that needs to be done. Listed on the white board are systems in testing, in progress and those to be picked up, plus special notes about projects.

An intern is directed to start on systems that are "in testing" because they are closest to completion and you want to get them off the board. The next priority is "in progress": hardware repair, or the software installation/configuration checklist.

However, the systems for "pick-up" supersede all. This is when a student comes into the lab to pick up their computer. The team needs to understand that this is the public face of all the work they've done. So the system needs to be ready by the time scheduled on the board, and may require the team to scramble to get it completed, prepared/set up for demo/orientation, paperwork ready, etc. It's good to include the interns in distribution of the free computer to needy students – they like to know that their work helps others.