

# DEVELOPING STUDENTS THROUGH INTERNSHIPS: BEST PRACTICES OF A UNIVERSITY SUMMER INTERNSHIP PROGRAM

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**Abstract** - Looking to infuse context into theoretical coursework? Are you interested in providing your students with real-life working experiences? If so, you may want to consider implementing an internship program in your department. This document aims to convey the collective wisdom of the staff that has managed the Berkeley Electrical Engineering & Computer Sciences (EECS) Internship Program over the last 10 years. We also hope to help you avoid some pitfalls that we have encountered along the way.

In the following pages we will discuss: career impacts and benefits of internships for students, benefits for departments, institutional support, advice on how to run an internship program, and our evaluation practices. Advice for orienting students, assisting students after they have commenced their internships, as well as tips for dealing with employers will also be provided.

## HISTORY & MISSION

The EECS Internship Program, established in 1989, was modeled after MIT's 6A Internship Program. The program's aim is to develop professionally our strongest students before they go on to graduate study. We propose to achieve this by providing them with challenging internships, which are as closely aligned to research activities as possible. Our intern program is a joint effort between our industrial representatives and departmental staff and faculty. Participating intern companies have been hand-selected from amongst employers who have established relationships in our department.

## BENEFITS FOR STUDENTS

The number of internship positions available through our program varied significantly over the last few years. For the summer of 2002 our intern program will place approximately 25 students at 8 leading research-oriented sites. Last summer, our program placed over 50 students. In the booming economic climate of 2000, the intern program peaked with 74 students.

Interns are compensated at current industry pay scales, and summer salaries can help offset tuition and fees. Savvy students will want to gain work experience that will make them more attractive to employers after graduation. In

addition, you may be surprised to discover the variety of other ways summer internships can impact students' professional development.

At the end of each summer we ask our interns to complete a survey about their experiences. When questioned about the most valuable aspect of their summer, the most common response was simply that students were glad to gain experience in the workplace. Students were able to professionally develop through: networking; working as part of a team; they were able to improve their communication skills; and they were glad to be able to develop other professional skills in an "apprentice-like" environment.

Exposure to research helps to develop student's critical thinking and academic skills [2]. Our interns were able to: work with cutting-edge technologies; alongside well-known researchers who have made significant contributions to the field; engage in research that couldn't be performed in classroom; and apply theoretical concepts in real work situations. A handful of students were compensated to travel to conferences to present their work, and a few were listed as co-authors on papers or named co-authors on patents. Nearly all interns were required by their company to present a formal talk at the end of their internship.

Matthew Faye, EECS senior, comments on his experience at AMD, "It may seem like these short summer internships would not get you involved with the company. But on the contrary, I worked on the latest products and got to know the people there and the company. It was a great experience since I actually got the chance to use what I learned in school. All of the studying and late night projects finally paid off. I would highly recommend others to participate in these internships because not only do you learn a lot, but also get to know how it is in the real world working on real projects, (instead of) just working for some letter grade."

Other students reported: gaining recognition for their contributions; working on a project of 'significance' (for example, creating a computer program that translates text into verbal commands, or working on the next version of Microsoft Office); and having the opportunity to see the results of their work.

For many students the seemingly endless hours of studying and lack of role models during the college years can be an isolating experience. Working, socializing and networking with mentors, supervisors and coworkers can

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provide a social structure that may be lacking in the college environment. Studies have shown that professional mentoring can have a positive impact on retention [3]. Mentors can provide curriculum and career advice, letters of recommendation, and moral support. Senior Derek Ho comments on his experience: *“The work environment was also one that I will never forget. Everyone was a pleasure to work with, and I keep in contact with them until this day.”*

Our program involves faculty members in the internship program. Each company is assigned a faculty liaison that pays a visit to the industry site each summer, meets with the interns and evaluates the quality of their work assignments. If students engage in research, they are then eligible to receive research credit for their work by enrolling in Supervised Independent Study. Faculty liaisons often serve as the sponsor for this research course, or assist the interns in finding appropriate faculty sponsors for the course. Some of these students continue to work with their faculty liaisons after the summer. Coming from a large department, we are eager to further develop relations between our undergraduates and faculty members, which can lead to improved retention [4].

Internships help to improve students' confidence in their abilities. Evaluation data collected over the past two years (2000 N=57/79; 2001 N=30/49) demonstrates that the vast majority (92%) of interns reported an increase in their confidence in their abilities. Students report feeling re-invigorated at the end of the summer, and often possess connections to professionals who can play a substantial role in their future careers.

Technical experience, mentoring, and networking are invaluable to our students as they chart their early careers. Internship experiences greatly assisted students in determining their future vocation (90%). For some, the experience sparked an interest in obtaining a graduate degree (43%). Nearly all participants (95%) reported gaining a better sense of the working world. Internships can help to contextualize theoretical engineering and science coursework. As one intern said, *“I got to independently research (in my field)... (The experience) gave me freedom to learn in-depth many applications of electrical engineering.”*

Internships can provide students with reaffirming social relationships. Other perks of summer internships may include: travel or access to the internal resources of a leading company (such as extensive libraries, invitations to talks by industry leaders, and the opportunity to use specialized equipment). For a handful of students, the best part of the summer was meeting legendary figures in the field – John Chambers of Cisco or Microsoft's Bill Gates.

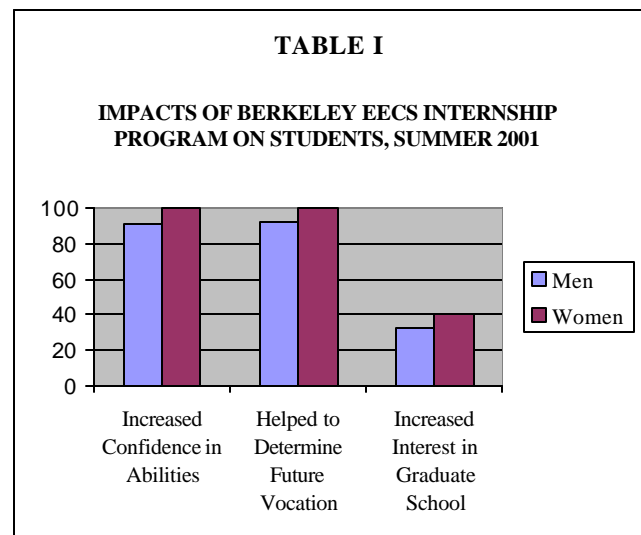
While it may seem like a lot of work to run an Internship program for the benefit of a few companies and a few select students, bear in mind that the internship program benefits students other than just those ultimately matched with companies. Students gain valuable experience speaking with potential employers at an “Open House” event

or even simply preparing or updating their resume. A large number of students participate in our Interview Days, which prepare them well for their post-graduate job search. The internship process prompts participants to start thinking about their future beyond the classroom. Intern programs encourage students to seek out employment opportunities in their field, and to consider which types of positions will fit well with their interests.

## TARGETING WOMEN AND MINORITY STUDENTS

We make extra efforts to recruit women and minority students to the program. While women make up more than half of our population, in information technology women represent less than 20% of the workforce. Furthermore, the numbers of women gaining undergraduate degrees in computer science has been shrinking almost every year since 1990 [1]. Our recruitment efforts include emailing our underrepresented student groups, advertising at social events targeted to underrepresented students, and targeting other venues such as the Women in Science & Engineering residential Theme Program. Internship companies also welcome efforts made to recruit underrepresented students to the program, as it often aligns with their hiring goals.

Internships provide strong mentoring opportunities, which can be particularly important for women (see Table I) and other underrepresented groups, who may feel alienated



in their cohort. Ruth Wang, who participated in our intern program comments:

*“I have rarely been treated with as much respect as I was this summer as an intern at Compaq, Tandem Division. My co-workers and fellow interns were some of the most welcoming and open people I have encountered. My supervisor was friendly, generous, and available when I needed help. He also made an effort to get to know me beyond the scope of my work, which I appreciated.... I had my own office and nameplate above the door (!), and there*

*were multiple social events every week for the interns. I have to say overall it was a rewarding experience (and) that I learned a tremendous amount from it."*

## **BENEFITS FOR EMPLOYERS**

Employers who participate in our internship program enjoy widespread publicity within the department, gain early access to potential employees, and are able to select from our highest achieving students. Students placed through our program have consistently placed in the top 10% of their class. The Intern program also offers employers the chance to develop stronger relationships within the department, with possibilities for extensive faculty/industry collaboration. Students are encouraged to return to their intern company for a second summer, and some students opt to extend their summer internships into 6-month co-operative positions.

*"We were pleased with everyone's performance, and we were astonished a few times by the speed and competence of many of them (the UCB interns),"* comments a manager from IBM Almaden.

## **BENEFITS FOR DEPARTMENTS**

A well-run internship program allows academic institutions to develop deeper connections leading employers and encourages collaboration between industry and the academic community. Relationships formed through our Intern program have led to: targeted scholarship programs, airline tickets for recruitment of prospective students, funds for tutoring, prizes for departmental competitions, and other targeted student programming.

## **STUDENT PROJECTS**

Our students participate in internships that are at the forefront of the information technology field. An example of a project was the design a pair of eyeglasses for the hearing-impaired community. The glasses contained a tiny microphone that converted words to text and displayed the text along the bottom rim of the lens. Another student worked with a company to create a 3-dimensional virtual reality program that would allow soldiers at different points on a battlefield to communicate with each other. A third student helped to build a massive telescope that will be deployed into space in an upcoming shuttle launch. While our department works closely with the high-tech industry, potential employers could include non-profit or governmental agencies.

## **SELECTING INDUSTRIAL PARTNERS**

When selecting industrial partners you will probably want to choose employers with which you already have established relationships. Our internship companies include: Agilent

Laboratories, Advanced Micro Devices, Cisco Systems, Compaq (Tandem Division), Ford Motor Company, Hewlett-Packard Labs, IBM Almaden Research Center, Lawrence Berkeley Laboratories, Lockheed Martin, Microsoft, Motorola, and (Xerox) PARC. Many of these companies have been members of the program for nearly a decade.

As the last three years have demonstrated, economic conditions can fluctuate quickly! Therefore you will want to select stable workgroups at more established companies. Interns quickly perceive low morale due to staff turnover, layoffs, or other factors. Students will bring word of their experiences back to campus, and these experiences can reflect upon the company's image. During the booming years of the technology industry, we experienced a surge of companies wishing to join the program, followed by a drastic reduction of internship positions for summer 2001 and 2002. Fortunately, several of the larger companies involved with our program were able to continue providing internships (and a few even came up with extra positions) which helped us to cope with the industry's downward cycling.

Nearly any employer can offer internships. But if companies want to recruit your best students, they should be prepared to offer challenging assignments. Your top students will not be motivated by routine tasks like testing software. Even in a large major (ours has approximately 1300 EE and CS students), word spreads quickly about employers offering exciting opportunities, and your students will compete for those positions. A distinctive component of our program is our focus on research. Each of our internship companies has promised to offer at least two interns positions that entail working with PhD researchers. We have been fortunate to establish corporate contacts with cutting-edge research labs, such as (Xerox) PARC, Agilent Labs and IBM Almaden. Our students are eager to 'get their feet wet' in research, and the focus on research is attracts our highest-achieving students.

You will need at least one key contact at each site: preferably someone who has a vested interest in the program like an alumnus. You will interact with this person on a variety of levels: during recruitment, placement, and over the summer. If one of your interns is having difficulty finding time to meet with their supervisor, you can refer the student to your "insider" who has authority and connections to assist in mediating the problem. While I often work with representatives from our participating University Relations or Human Resources offices, I have discovered that many of my best relationships have been with engineers or scientists at the company. University Relations representatives may be well versed in the hiring needs of the company, however, they are often responsible for maintaining contacts at numerous universities. A busy traveling itinerary can render even the most basic coordination difficult. An engineer working on site may have more time to devote to individual student's concerns or programmatic details.

## **INSTITUTIONAL SUPPORT**

If you are just beginning to plan a new internship program, you will want to consider various forms of institutional support. Our program charges a fee for participation: this fee is used to pay for program staff support and to cover expenses for internship events and travel. Each company pays \$5,000 per year, which includes membership in our departmental Industrial Liaison Program. Besides providing companies with interns, companies enjoy extensive publicity within the department as a part of the program. Our Industrial Liaison Program provides corporate participants with perks such as organized recruitment sessions in the department, invitations to departmental conferences and events, and complimentary departmental publications. Depending on the needs of your particular department, administrative support, and size of your proposed internship program, you may wish to adjust or waive the participation fee.

We currently have two staff members and one Faculty Advisor involved with the program. In addition, our department has an Industrial Liaison Program whose staff works closely with our internship companies on in-house recruitment. Last year one staff member, the Internship Director, coordinated the program fairly independently. The Faculty Advisor's role primarily consists of advising the Internship Director on changes in program policy and troubleshooting, and also includes formally welcoming companies at departmental events. The Internship Director runs the program on a day-to-day basis. The Director is very busy during the peak phase of the program (starting in mid-January), with more time freeing up around the beginning of April. In our office, the Internship Program constitutes a 50% full-time employee position.

Faculty Liaisons perform a critical function for the Internship Program by expanding the relationship between faculty and industry, thus opening the field for more collaboration. Our liaisons provide additional support to interns, and provide critical feedback about the program to the internship coordinators. Each company is matched with a faculty liaison. Liaisons are selected from faculty who already maintain relationships with a given company or conduct research in area of particular interest to the company. Our Faculty Liaisons are compensated in the amount of \$1,000 per academic year, and are reimbursed for any travel expenses incurred during the site visit. Specific duties of Faculty Liaisons include: attending EECS Internship Program events; conducting an on-site visit to the internship company per year and completing a site visit report; counseling interns seeking EE/CS199 Independent Study credit; and referring them to appropriate faculty sponsors.

## **THE INTERN SELECTION PROCESS**

Our program follows a strict timeline that includes several events: a series of "Infosessions," the "Open House," and the "Interview Days." In the fall we begin advertising for the program and hold a handful "Information Sessions" – workshops scheduled around the lunch hour or other convenient times for students. At these workshops we give an overview of the program, explain the application procedure and introduce the industrial participants. We typically invite a small panel of former interns to attend and give a brief presentation on their experience. When convenient, we may invite an engineer or other representative from one of the participating companies to provide information about their summer opportunities. The main goal of the information sessions is to encourage our students to start researching summer options. At this time we also encourage students to attend UCB Career Center Resume workshops in preparation for their internship application.

In late January we hold the Open House: an event similar to a career fair, which for many students signals the beginning of the program. Each company participating in the program sends a few representatives (ideally computer scientists or engineers) who discuss potential jobs and qualifications with students. We advertise the Open House extensively by. Our internship companies are often interested in hiring underrepresented students, so we make special efforts to advertise to these groups. Typically, about 400 students turn out over the course of the three-hour event.

After the Open House, students have about one week to apply to the program. The application is available only through our website, which is restricted to Berkeley email accounts. The application requests basic information typically available on a resume (previous experience, honors, organizations, etc.), a copy of the student's transcript, plus an essay. After the application deadline, applications are collected and collated by company. We do not perform any pre-screening of the applications; but leave the selection of students entirely up to the companies. Companies are given a website and password which enables them to access the applications on-line. A nice feature of the online application is that it allows companies to circulate the site and password to multiple hiring managers who can search for interns at their leisure. We require that our key company contact coordinate the process, sending us a comprehensive list of students they would like to interview. Coordinating the applications electronically also allows us to extract key data from the applications (such as name, academic level, GPA and email address) which we can use for statistical and communication purposes.

Interviews are held in late February. In an average year we hold approximately 300 interviews over two days – all on campus. Employers send interviewers to campus to meet with students in order to narrow down their final candidates. Each interview lasts for 30 minutes, with the most competitive students interviewing with a handful of

companies. Prior to the interviews, we counsel students on effective interviewing. We encourage them to prepare for their interviews by conducting further research on the companies, and by attending UCB Career Center Effective Interviewing workshops. This year we were pleased to have Jean Riley, Berkeley alumna and Director of Specialty Engineering at Lockheed Martin, present a talk to intern applicants about issues of professionalism including effective interviewing.

As you may imagine, both the Open House and Interview Days require substantial administrative preparation: communication with students, coordination with company representatives, and logistical concerns such as room and parking reservations, and scheduling of interviews.

Following the interview days, we ask the companies to further narrow their applicant pool, and provide us with a ranked list of prospective interns. Up until this point, students are free to withdraw from the program. But when students submit their rankings to us, we ask that they make a commitment to accept an offer from the company with which they are matched. Both companies and students are informed of the matching results in late March, just prior to spring break. For more details on our timeline and application process, please refer to our website (<http://www.eecs.berkeley.edu/Programs/internship.html>).

Not all interns who make it to the matching process will be placed with companies. In 2001, only one student was not matched. In 2002, with many fewer positions available, nearly 20 students were not matched. We make a special effort to work with these unmatched candidates to inform them of other opportunities still available (including summer research programs and summer school) and encourage them to tap into Career Center events.

## **WORKING WITH COMPANIES & HIRING MANAGERS**

Following the matching, we request that our participating companies send each intern an official offer letter within two weeks. We ask the companies to define: student salary ranges, start and end dates, time off, and basic start-up requirements (including desk space on the first day, telephone and computer by the end of the first week, etc.). We encourage companies to offer a choice of summer projects. Agilent and (Xerox) PARC both offer their interns the opportunity to hear about multiple opportunities and to choose the labs for which they would most like to work.

Ideally, managers should assign one main project to each intern. This encourages “ownership” and responsibility for the project, and can allow them to perform their work more autonomously. Interns who wait long periods for work assignments, or who have received piecemeal assignments from their supervisors, reported being frustrated or bored.

Especially for first-time interns and those living away from home, social interaction is key. Interns whose

companies offered social activities or had close-knit labs reported higher satisfaction with their summers. Interns credited their relations with co-workers as the best part of their summer (as mentors, friends, and professional contacts) in the Internship year-end survey. A strong bond with a lab group is ideal. Encourage work groups to foster this sense of community, even if means only convening once every other week for lunch. Some companies provided “mentors,” younger career employees (someone other than their supervisor), who served as advisors to the interns. Company mentors help to create a stronger and more supportive environment for interns.

## **ORIENTING STUDENTS**

Matched interns are invited to an orientation session to discuss, among other things, what interns should expect the first week. You may want to consider inviting an industry representative to come and speak about professionalism or internship expectations. Many students have never held an internship before and have no clear idea of the paperwork and ‘startup’ issues associated with the first week at a new job. Arriving to find a desk without a telephone, computer, or predefined assignment the first day can be discouraging. Educating the students about job transition issues, and advising them to be flexible, can help them through the transition period.

Our intern companies are primarily located in Silicon Valley, with a few sites located out of state. These necessitate that the students start planning housing and their commute well ahead of time. The orientation is an excellent time to discuss these issues, and for students to network. We were impressed by the number of interns who found summer housing with family or friends; often a much cheaper option than paying for apartments in the area. Each year a few interns who meet at the Internship Orientation form carpools and seek apartments together.

## **OVER THE SUMMER**

Unlike a typical placement program, the Berkeley EECS Internship Program staff and faculty maintain contact with interns over the summer, monitor the quality of internship assignments, and attempt to work out any difficulties that may occur along the way.

Over the summer we check in with each intern by email and/or telephone. Faculty Liaisons pay at least one visit the industry site, meet with each intern, and file a Site Visit Report. Faculty liaisons are encouraged to meet alone with students, as students may be hesitant to speak freely if company representatives are present. Students are usually more than happy to take the time to visit with the professors, and the faculty visits underscore the importance of the project to both interns and company managers. The site

visits also allow time for company engineers and scientists to meet with faculty to exchange thoughts.

We make special efforts to follow up with any interns who miss the faculty site visit. In some cases, we were able to discover: breakdowns in internal communication; incompatibility issues with managers or assignments; and interns who felt isolated in more remote or unsocial labs. (In one instance I was unable to find a student's telephone number. I eventually discovered that the student did not even have access to a telephone!) Overall, students responded extremely positively to check-ins. Again, it is important to pay attention to those interns who are hard to reach: they too may be socially or administratively "out of the loop," unhappy with their internship, or unwilling to put a negative report in writing.

Students' work styles and preferences may vary. Some are happier in an academic environment. We were surprised to discover that some students actually missed the milestones and deadlines associated of the academic year. Many students enjoy the corporate environment and 40-hour workweek, which in comparison with student life can seem laid back. Each lab at each company will have a different culture: sometimes the students will just want to discuss this with you. Active listening can help to determine if a problem exists.

Interns at nearly every company expressed frustration with some aspect of bureaucracy: waiting for suppliers, payroll issues, deadlines. On the other hand, a nearly universal comment that was that students appreciated the opportunity to see "how a real corporation works." Our internship companies were able to offer other perks to summer interns: training classes, visiting lecturers, presentations by upper management, social opportunities. These opportunities can go a long way in offsetting negativity in the workplace.

## PROGRAM EVALUATION AND ASSESSMENT

At the end of the summer students are encouraged to complete an online questionnaire. Data gleaned from the survey are aggregated and combined with information from the faculty site visits and telephone and email assessments. Common themes and trouble spots are investigated and reported to faculty liaisons and industry representatives. Evaluation results are disseminated to program staff, Faculty Liaisons, Industry Representatives, and are used in future InfoSessions for prospective interns. Evaluation data is analyzed in order to make improvements to the program. For example, at a new internship company, several students mentioned that their summer assignments were less than challenging. Concerned about these students' experiences and implications for the employer, we worked closely with the industry representatives to assign more complex and exciting projects for the following year. To review a copy of our year-end survey questions, please refer to our website

(<http://www.eecs.berkeley.edu/Programs/ugrad/Internship/evaluation.html>).

## CONCLUSION

Internships provide students with a range of academic and professional benefits including increased confidence in their abilities and a better understanding of the workplace. Internships helped students to determine their future career path, provided context for theoretical coursework, and allowed students to gain recognition and a sense of "ownership" for their work. Valuable social and mentoring experiences can be gained through internships. These benefits can be of special importance to women and other underrepresented students at your institution. As one female summer 2001 intern summarized, "*(I was able to) work with fun and interesting people, got a good feel for research, and did work that my group found important.*" Internship Programs benefit not only the students placed through the program, but can help to professionally develop much larger numbers of students in your department. Furthermore, both academic institutions and employers stand to benefit from closer collaboration.

Ultimately, there is no substitute for knowing that your program helped a student uncover their true passion... As one intern at the end of this summer commented, "*I learned a great deal about what doing research as a career is like – it's exciting!*"

## ACKNOWLEDGMENT

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