"The Only Person Who Cares"

Misperceptions of Mentoring among Faculty and Students

In IT Programs

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Studies of women in education have long presumed a strong positive correlation between mentoring and the recruitment and retention of women in non-traditional fields. Within the information technology fields in particular, mentoring of young women who might have interest in IT has often been cited as critical to exposing women to the discipline, nurturing the budding interest in the field and supporting that interest as the women face obstacles that might deter them from completing degrees or seeking work in IT after graduation.

However, it is not at all clear, despite the sizeable amount of research that has been conducted on this subject, that the mere provision of mentors to students will assist in the recruitment and retention of women in information technology. Our question here is to what extent mentoring plays a positive role in increasing the number of women in IT fields. We answer this question by examining students' and professors' perspectives on mentoring. Our study was conducted at several major research universities in units where information technology is taught. Some of those units represent the discipline of traditional computer science where women's numbers have dwindled since their peak in the early 1980s. The other units represent more applied fields, where computer science principles and courses have been combined with a more professional perspective, as in information systems in business schools, information science in schools which formerly focused only on library science; instructional systems technology in schools of education, and informatics, the newcomer discipline.

This study is part of a larger project that hypothesizes that academic units taking an applied or professional approach will be more successful at recruiting and retaining women than computer science programs because they are more "woman friendly" in a

number of ways. One of those ways relates to mentoring. We expected to find more women faculty who might serve as role models for women students in these units. We also expected to find a climate that was more receptive and perhaps more nurturing to women students than in the predominantly male domain of computer science.

In this article we report on the responses of faculty related to their own experiences of being mentored and their perceptions of how they now mentor others. We compare that with what the students in those same units say about the mentoring process. In many cases the perceptions differ on how well existing mentoring relationships are working. We also compare faculty and student mentoring experiences by gender to determine whether different expectations emerge. Our findings are noteworthy in that they suggest a major disconnect between the perceptions of faculty many of whom believe they are mentoring effectively and the perceptions of students who do not identify faculty as mentoring them. If this disconnect is valid, then we have reason to go back to the drawing table to develop more effective communication and mechanisms for mentoring undergraduate and graduate students.

The Literature on Mentoring in IT

Mentoring programs have been singled out as an area where some real benefits might accrue in the recruitment and retention of women students. In the often cited success story at Carnegie Mellon, in which the computer science department increased significantly following important changes made in the departmental practices, Margolis et al. (2000) argued for the importance of mentoring in turning women on to computer science:

> From our interviews with female undergraduate computer science students, we concur that faculty relationships and support for women students are extremely

> important. Women students describe how they got turned on to computer science and began to consider it as a major because of a high school programming class they enjoyed and were good at, and a teacher who worked with them and encouraged them. They also talk about the importance of the support, advice, and guidance they get from the faculty members at Carnegie Mellon who teach and advise first-year students.

Though there is much reported about the nature and circumstance related to the mentoring process in the literature, much less research is directed to the particular issue of women studying in information technology programs. The literature reveals a mixture of studies that focus on mentoring in the professional world and in academia. The results of these studies, though mutually cited, may not directly apply to mentoring in the specific information technology education environments we examined. In the first place, there are so few women in tenure-track positions in several of the units we studied that there are not sufficient bodies to function as mentors. Because of the paucity of women academics, women students aren't usually in a position to select the gender of their academic mentor, even if it were discovered that having a mentor of the same gender is an important factor.

Kram (1980, 1983, 1985) was one of the first to identify two particular dimensions in mentoring in career development and psychosocial support. The career functions included sponsorship, exposure-and-visibility, coaching, protection and providing challenging assignments. The psychosocial functions included role modeling, acceptance-and-confirmation, counseling and friendship (1983, p. 614; Kram and Isabella, 1985, p. 117). Noe (1988) found support for the two major functions. Providing access to resources has been added to the list of career development functions by some scholars (Lindbo and Schultz, 1998; Missirian, 1982). When researchers evaluated the

functions by gender, the mentors reported that their female protégés received more psychosocial mentoring than did the male protégés (Burke et al., 1993). There were no reported gender differences for career functions. Allen and Eby (2004) also studied the influence of gender on mentoring relationships. The authors surveyed women in a professional women's business association employed in accounting-related occupations and members of a professional association for engineers who said they had been involved in mentoring relationships. They found that mentors reported providing more psychosocial mentoring to female protégés than to male protégés, and that female mentors reported providing more psychosocial mentoring than did male mentors. Male mentors, on the other hand, reported providing more career mentoring than did the females (pp. 134, 135).

When protégés have been asked about the kind of mentoring they received, females have reported receiving more psychosocial mentoring than male protégés reported (Burke, 1984). In a study of career-related mentoring among professional and managerial hospital employees, Koberg et al. (1994) found that men were more likely to experience more frequent mentoring than women. In another study by some of the same authors, however, no gender differences were reported related to psychosocial mentoring, however (Koberg et al.,1998). No study has compared the reports of the mentors on the type and frequency of mentoring provided with the protégés' views of the mentoring received. And while this article does so only indirectly, it provides important comparisons.

Most of the mentoring studies have focused on career mentoring in organizations or businesses. A review of that literature related to gender in the information technology

professions proposes that a lack of mentors negatively influences women's career advancement in the field (Ahuja, 2002). When viewed from the top, male and female elite politicians and business executives have reported different experiences in being mentored. Both groups of leaders reported having more male than female mentors but women leaders, especially those in politics, said they had more female mentors than the men reported (Palgi and Moore, 2004, p. 464). Overall, however, between 83 and 94% of the men and women business and political leaders in three different countries said they never having had a female mentor (p. 467). The type of mentoring used by the men and women in this study differed, especially among political leaders, where women look to mentors for grooming (similar to psychosocial mentoring) while men are seeking networking mentoring (p. 475).

Mentoring in IT/ Science/Mathematics academic environments.

Very little literature empirically examines the mentoring issues in information technology fields. In 2000, Dryburgh undertook a comprehensive review of a full decade of empirically based published literature that explored the reasons for the under-representation of girls and women in computer science. On the subject of role models and mentoring, she called for increased work to "discover what specifically increases women's interest in computing. . . . and to what extent mentor and peer encouragement affect women's motivation to study computing at the post-secondary stage" (2000, p. 192). Dryburgh identified the confusion between a role model and a mentor in the literature as a problem, but she noted that women are often encouraged to enter computing because of a positive secondary school experience. It is not clear, however, whether that related to an experience with a teacher who mentored the student (2000, p.

197). Gurer and Camp's review of the literature on women in computing in 2002 also evaluated the literature on mentoring. However, their review did not turn up any empirical studies. A number of essays and analyses recommended more and better mentoring to improve the retention of women.

Because the study of science, mathematics and engineering are at least somewhat related to computer science, and since these fields also have difficulties recruiting and retaining women, studies of mentoring in these disciplines might provide interesting insights. The study of mentoring of scientists and engineers conducted by Lyon et al. (2004) does not include students. Instead they surveyed a group of protégés in high technology occupations in 22 organizations across four countries. Drawing on Kram's mentoring functions (1980, 1988), the authors examined the relationship between mentoring activities and dyad makeup (mentor-protégé) and evaluated the mentoring roles most beneficial to protégés. The authors found that only a few mentor roles proved to be significantly related. Male protégés reported more dyad activity with male mentors in the areas of providing challenging assignments and in friendship. However when the dyads were not of the same gender, the effectiveness of the mentoring was lower (2004, p. 22). The authors acknowledge that the relationship between dyad structure and degree of the two functions of mentoring activity was weak, as "only one of the six career development roles, and one of the five psychosocial roles was affected by gender homogeneity of the dyad" (p. 24). Both male and female protégés (29% of the total in the survey) reported that "the most important function a mentor serves is to assign responsibilities that increase the protégé's contact with people in the organization who may judge the protégé's potential for future advancement" (p. 23). Other top vote-getters

were "providing assignments that present opportunities to learn new skills" and "provides assignments that increase written and personal contact with higher levels of the organization" (p. 23).

The most comprehensive and detailed work on the mentoring of students in computer science has been done by Cohoon, et al. (2004). This study focused on the nature and outcomes of faculty mentoring at 117 U.S. undergraduate computer science programs. The authors modified the Kram mentoring functions somewhat to evaluate "research mentoring and support mentoring." (p. 202). Support mentoring was more "guidance oriented," and included helping students learn the academic guidelines, encourage shy students, and provide positive feedback to students (p. 202). Research mentoring was measured as the inclusion of undergraduates in the conduct and publishing of faculty research and the supervision of those students in their own independent research as well as passing on information about research opportunities. Faculty were also questioned about the degree to which they went the extra mile in trying to mentor undergraduates. Outcomes in this study were measured by enrollment data from the participating institutions broken down by sex, year in school and GPA. Wherever possible, program attrition rates were also calculated. Overall, the authors found positive outcomes for mentoring, whether accomplished by male or female faculty. The major gender differences in the findings were that support mentoring was more frequently reported by women than men; the initiation of a mentoring relationship with a student was more often reported by women; and female faculty were more likely to mentor female students. A major reason women faculty gave for initiating a particular mentoring relationship was to "overcome under-representation" (p. 205). A positive finding in the

Cohoon et al. study was that in departments where mentoring programs were in place, more undergraduates went on to graduate school and to highly ranked graduate programs than was the case in departments where mentoring was not the norm. In a second analysis focused on diversity mentoring (defined as mentoring conducted to overcome under-representation), women undergraduates were more likely to persist to graduation than in other programs where diversity mentoring did not exist (Cohoon, 2006).

In the allied field of mathematics, women students make up a sizeable portion of the undergraduate population but do not receive a percentage of master's and particularly doctorate degrees (Herzig, 2004) according to their distribution in the population. In a case study of doctoral students in one mathematics department, the female students reported "feeling invisible, needing guidance, wanting better teaching, lacking moral support and wishing to be mentored" (2004, p. 384). In the department, students were assigned an initial adviser who continued to advise that student through the qualifying exam stage of the student's degree program. Women students in this study reported that they had no personal relationship with the adviser, that they got little encouragement and that in general, they received no mentoring in mathematical thinking. This was true even for the women who were close to graduation. The women entered the program with an expectation of a positive experience of being mentored, however (p. 388). Herzig described the situation as one of "benign neglect" (p. 389) and viewed it as damaging to the students' future in graduate education in mathematics.

Following on studies which stressed that high quality mentoring was the key to successful graduate education (Katz and Hartnett, 1976; Luna and Cullen, 1998) and work that found that the best mentors for graduate students may not be the formal

advisers in the program (Luna and Cullen, 1998), Rose (2005) used the Ideal Mentor Scale she developed to study the relationship between doctoral student demographic and academic characteristics and preferred mentoring style (2005, 2000). The Ideal Mentor Scale measures three dimensions (as identified through factor analysis) of integrity, guidance and relationship. Her study found that students' age, gender and citizenship were determinants in conceptualizations of the ideal mentor but academic discipline and stage of persistence to degree were not (2005, p. 76). The specific finding related to gender was that female graduate students placed more importance on the Integrity scale (that included role modeling and professional ethics) than male students did (p. 74). Gender was not a factor in evaluation of either the guidance or the relationship subscales. International students preferred mentors who were involved in their lives interpersonally, while domestic students did not seek such a relationship (p. 74).

Method

Our study of mentoring at universities where information technology is part of a larger project examining the recruitment and retention of women in IT higher education. Those units include computer science (CS), management information systems (MIS), informatics (I), instructional systems technology (IST) and information science/studies (IS)] in five Research 1 public U.S. universities. We conducted a web-based survey of all male and female undergraduate and graduate students in the IT units as well as a telephone survey of faculty and selected staff in the same units. These public institutions were selected based on the minimum requirement of having a computer science unit and at least two other IT-related units. We also gave preference to institutions with programs in instructional technology and/or informatics, as these are relatively less common.

The student survey, written by the research team, was conducted in March and April 2004 by a research center at the investigators' university. A web-based format was selected because it seemed an efficient way to reach information technology students who, we believed, would be comfortable with this format. The risk was that students would not respond, however previous studies suggest that response rates have been found to be roughly equal for Web-based surveys and mail surveys (Truell, Bartlett, and Alexander, 2002). The majority of students responding to our survey were contacted directly through their university e-mail accounts. In three units, in order to further protect student privacy, students were contacted through an administrator in their unit via e-mail. Regardless of how they were contacted, all students were asked to answer one hundred questions about their attitudes and behaviors regarding use of computers, their experience with mentoring, stress and burnout, and their demographic information. For this article, only part of the data from the survey will be analyzed. It was not possible to determine total response rate for the web survey as we were not informed of the number of students in the units where the administrator made first contact with the students. Response rates for the rest of the students ranged from 32% to 85% by academic unit.[1] Though the total number of respondents was 1768, the number we will use to report the results for this article is 1469. The remainder of the respondents did not provide their gender in the demographic questions so we could not use that data for analysis here.

[1] [1] Though these response rates are lower than we would have liked, they are not unusual for web-based surveys. Because we did not conduct a random sample survey, however, we make no claims of representativeness of this study. We present the results of the survey for what it is—responses from students in information technology programs at five research universities in the United States. We believe, however, that these responses are not atypical for most students studying in information technology programs in the United States.

Students were assured anonymity, and all were provided with documentation of the approval by the Institutional Review Board at the authors' university as well as at their own university.

The faculty and staff telephone survey was also conducted by the Center for Survey Research, a few months later from June to October 2004. The response rate for that survey varied from 40% for computer science units to 71% for information science units, with an overall average of 51.8%. The total number of respondents was 280. This total included staff such as advisors and support staff, as well as teaching and research faculty and departmental and school administrators. For the purposes of this article, only the responses of 170 tenure track faculty have been analyzed . Since we were interested in making comparisons between computer science and the more applied fields of information systems, informatics, information science and instructional systems technology, we divided the sample into those two groups. The 170 faculty responding to the survey included 65 (38.5%) from computer science and 104 (61.5%) from the combined applied units.

The data that we use in this article draws on questions related to mentoring and demographic information. We can make no one-on-one comparisons between students and faculty who may have mentored them because of the way data were gathered and because of the anonymous nature of both surveys, but we do make general comparisons on the nature and quality of mentoring based on the mentors' and the students' answers to questions in the surveys.

Since this study was not based on random samples from schools or IT programs, we chose to ask research questions rather than to test hypotheses. The questions are

drawn from the research literature on mentoring as described above. The research questions for this study were as follows:

1. What were the undergraduate, master's and doctoral students' experiences in being mentored according to the career and psychosocial dimensions?
2. What were the faculty's experiences in networking and mentoring?
3. How did the experiences of students vary by their unit (computer science or applied)?
4. How did the experiences of students vary by gender?
5. How did the faculty's experiences in networking and mentoring vary by their unit (computer science or applied)?
6. How did the faculty's experiences in networking and mentoring vary by their gender?
7. How did the reported experiences in being mentored match with the reported mentoring activities of the faculty?

Descriptive Results From Faculty Survey

Despite striking gender differences, most faculty report generally similar patterns of mentoring and networking, and, like most university faculty, the faculty in our study reported satisfaction in their jobs as well as a continuing search for balance in their personal and professional lives.

As expected, many fewer of the faculty in the IT units were female. In computer science, only eight of the 65 faculty responding were female, while in the applied units, 37 of the 104 respondents were women. Overall, the faculty seem to be content in their jobs as 83.8% report that the morale in their units is somewhat or very high. They look for a balance in their work and personal lives (66.9%), but experience a moderate to severe degree of strain (78.5%) in trying to maintain that balance. A very large number of these faculty (87.1%) say they have a personal network to turn to for support, and 66.2% of them say that this network is located both on and off campus. About half of the group (52.7%) say the gender of their network is made up of both men and women, while

14.9% say it is mostly female and 32.4% say it is mostly male. There is, however, a significant relationship between the gender of the faculty member and the gender of the network (r=.29; p=.000)[2]. Almost the same percent of the male faculty (41.5 %) as female faculty (42.9%) say their network is made up of people of the same gender. Notably and predictably most of those men and women faculty who report that their networks are mostly female have been in the unit less than 10 years. Faculty are almost unanimous in saying their networks have been somewhat or very helpful (91.9%) in furthering their careers and about the same number (90.5%) say that their mentors were helpful in that process. The longer the faculty have been employed in a unit, the less likely they are to say they have a network to rely on (r=.16; p=.01). Of course as faculty age and gain seniority they are more likely to be at the center of a network rather than still seeking support from others. Thus only 39.1% of faculty say they have someone they currently consider their mentor. This can be explained by examining the age of the faculty respondents: about half the faculty in our survey are age 50 or older. Indeed there is a strong relationship between the age of the faculty and whether they claim to still have a mentor (r=.27; p=.000). Women are more likely to say they currently have a mentor than men (phi=.22; p=.01) but they identify that mentor less frequently as someone of the same gender (phi=.36; p=.003).

Of those who say they currently have a mentor, the largest portion identify that mentor as someone who is both inside the university (72.7%) and inside the unit (62.1%).

[2] Significance levels are included here only to provide an indication of difference. Because the study did not draw on random samples, statistical significance does not carry the usual meaning.

The gender of the mentor is most likely to be the same as that of the faculty member (75.8%). The same is true of race similarity (73.8%).

About half of the faculty said that as undergraduates, they had at least one person who mentored them (50.3%) and 82.9% of the faculty confirmed that as graduate students they were mentored. The mentor in their graduate experience was almost as likely to be their adviser (38.3%) as one of their professors (46.8%) and more likely to be of the same gender (69.3%--phi=.39; p=.000) and the same race (81.2%).

Currently, almost all of the faculty say they are mentoring students (93.5%); the median number of students mentored per faculty is six. Faculty report being conscious of being a role model for their students with one third saying they always think about themselves as role models and 52.4% reporting they sometimes think about it. No gender differences were reported.

Although in general we did not discover major differences between computer science and applied field faculty, a few differences did emerge. Faculty in applied fields were more likely to report currently having mentors (phi=.21; p=.006) and having had mentors as graduate students (phi=-.17; p=.03), but less likely to be currently mentoring students (phi=-.16; p=.04). The networks of applied faculty were more often reported to be off campus (Cramer's V=.21; p=.04). Faculty in applied fields more often reported having values similar to those in their field (Tau c=.18; p=.02) than did computer science faculty. Though there were no overall gender differences in whether the faculty member's values were perceived to be close to those of their field, the longer women had been in the field, the closer their values were reported to be like those of the field (r=.19; p.05). However, no similar relationship was found for men.

Though socializing with colleagues may only occasionally provide an opportunity for mentoring others and being mentored, some interesting gender differences appeared when we asked about the frequency of such contact. The men in this survey reported significantly more socializing than did the women (Cramer's V=.25; p=.03), thereby possibly leading to more opportunities to network or to be mentored. Though men and women did not differ on their sense of whether there was an "in group" and an "out group" in their unit, the longer women had been in the field, the more likely they were to reject the concept of in group/out group (Cramer's V=.36; p=.01). Men's perceptions of in groups and out groups did not vary by length of time in the field. Gender was not a factor in whether the respondents thought they belonged to the in group, however.

In terms of colleagues' appreciation of their research contribution, no gender or type of unit differences appeared when responding to the question. However, women were more likely to say that their teaching contributions were appreciated by their colleagues than were those of the men (tau C=.17; p=.03). Such differences may affect the ways in which women mentor graduate students or how much time they spend working with undergraduates.

Types of Reported Faculty Mentoring Experiences

We asked several questions related to the information and support provided to faculty from their mentors. There were no significant differences between the responses of computer science and applied field faculty. More than half (64.7% of C.S. and 55.3% of applied) of the faculty said that their mentor informs them about work environment, An even larger percentage (70.6% C.S. and 59.6% applied) of faculty said their mentor informs them about campus conditions and opportunities for new projects (70.6% of C.S.

and 76.6% of applied). Psychological support was provided by mentors for 52.9% of C.S. faculty and 52.1% of applied faculty. The first three of these questions could be classified as career support and the last one classified as psychosocial support according to Kram's categories. The only reported difference by gender was in the psychological support provided, with women saying they received such help more frequently (68% vs. 42.5% for men) (phi=.25; p=.05). Since such small numbers reported that they were currently being mentored, it is difficult to make much more of this information.

How Faculty say They Mentor and their Perceptions of Student Needs

Faculty were asked about the activities they generally engage in as mentors. They provided open-ended responses to this question that were later content analyzed. For purposes of the quantitative analysis here, we selected the first answer given by each respondent for coding. Though respondents sometimes provided more than one answer, more often they elaborated on the way they executed a particular type of mentoring. We categorized 24 different mentoring activities and later collapsed them into six categories (being available, holding regularly scheduled formal and informal meetings, general advice, collaboration in teaching and research, expanding social and personal relations). No significant differences by gender or type of unit (C.S. or Applied) were found. Perhaps because the question was asked from a positive perspective ("Could you tell me about the ways you do mentoring?"), all of the respondents gave positive examples of the ways they provide mentoring services. Here are some typical examples:

> A. I have an open door policy; the students can see me whenever they need to. I am very prompt in responding to their emails. I am very careful in going over their work to give them positive feedback as well as negative criticism. I network them with other students and other faculty who are interested in the same areas of work. I encourage them to publish, go to conferences and help them do that. Make extensions for them.

> B. I have different groups of students in different phases of their academic careers. In general I make my office a place where they can feel comfortable coming to discuss their ideas even when their ideas are not fully developed. I try and give them advice when they ask and sometimes even give them advice before they ask if I see that they are headed down a path that might have some adverse consequences. I also look for opportunities that arise in my own network that might be appropriate for one of my students.
>
> C. I collaborate with them. I publish with them. I discuss work with them. I advise them on career development strategies.
>
> D. Weekly meetings. Students I directly supervise and also students who are supervised by others but interested in the area I conduct research in.

From the majority of open-ended responses it was fairly clear that the faculty were most often referring to the mentoring of graduate students given the references to dissertations, formal research opportunities, conferences and the like. Nobody referred to difficulties they had in assisting students.

Somewhat related to the faculty mentoring process is the perceptions faculty have of student morale in their unit and the climate they believe that exists for particular groups of students (by gender, race, nationality). Of the faculty who are employed in units with undergraduate programs, 97.2% say they think those students are somewhat or very satisfied with the IT program in their unit, while 96.4% expressed a similar perception of the master's program in their unit. About the same number, 86.3%, said they thought the doctoral students were somewhat or very satisfied with the program. There were no differences in perceived satisfaction between C. S. and Applied units for undergraduate and master's students but the Applied unit faculty reported significantly more dissatisfaction among PhD students than did the computer science faculty ($r=.33$; $p=.000$). Despite the generally high percentages for all groups, the faculty did provide a

number of concerns that each group had about the programs. More than half of those concerns related to employment anxiety on the part of students at the undergraduate and master's levels, but faculty said the PhD students had many concerns related to classes and faculty (including quality of instruction, advising, facilities, and relevance of the curriculum and currency of the skills taught in the program). Despite the positive description faculty provided concerning their mentoring activities, they also admitted that students complained about their lack of availability and lack of interaction with them.

In summary, both C.S. and applied faculty claim to have been mentored in their undergraduate and graduate careers, report involvement in networks and systems of support both within and outside their academic units. These faculty, both males and females, believe that holding office hours and providing support to students is part of the mentoring they offer students. Furthermore faculty report mentoring students in terms of both career issues and psychosocial support. Our data do not provide evidence for making claims about significant differences between C.S. and applied field, nor about male and female differences, except in terms of teaching support and psychosocial mentoring received by women faculty

How the Students Viewed their Experiences

The students in the various units across the five universities represent undergraduate, master's and doctoral student populations in computer science and applied IT fields. In the various questions we asked related to career support and psychosocial support, what is striking is the pattern of lack of support from faculty reported by the various groups of students and across the various types of support we investigated. Because of the small numbers in each category, we shall report general

findings for each group and place the frequencies and percentages of respondents in each group in tables. Among the computer science undergraduates, 283 males and 64 females completed the survey; 63 males and 13 females from the master's students; and 144 males and 37 females from the doctoral students. In the applied units, 141 males and 57 females completed the survey in the undergraduate population, 206 males and 357 females in the master's group and 54 males and 46 females in the PhD student group. IT Applied fields tend to offer a professional master's degree program that would attract a large number of students, while graduate students in computer science are more often focusing on a doctoral degree.

In the several questions related to mentoring, we first asked the student respondents to identify the person who most encouraged them to study information technology. A very small percentage of the students at each educational level (undergraduate, master's or doctoral) in both computer science and applied technology fields mentioned either a male or female faculty member as that individual (See Tables 1, 2, and 3). It is more understandable that undergraduates would say that a parent or a high school teacher was influential in the decision process, but both master's and doctoral students also responded that "nobody" or a parent most encouraged them. This was surprising since the literature and common knowledge suggests that it is faculty who spur good undergraduates on to graduate education. Four percent or fewer of students in C.S. or one of the applied disciplines at any level said a faculty member had most encouraged them. At the doctoral level, about half of C.S. students and more than 60% of students from the applied disciplines said that nobody "most encouraged" them to study information technology.

While the overwhelming majority of faculty had reported thinking about serving as role models "all of the time" or "some of the time" for their students, surprisingly few students viewed them in this way. When asked for the position of the person computer science students most associated with "serving as a role model" in their program, 82.7% of undergraduates, 88.0% of master's students and 64.0% of doctoral students did not identify either a male or female faculty member (See Tables 1,2, and 3 for percentages of students identifying a male or female faculty member for any of the mentoring functions). A related question asked to identify the person who most represented a person in their program who had "gone out of his/her way to promote your career interests," 86.5% of undergraduates, 95.3% of master's students and 66.8% of doctoral students did not identify a single faculty member in their computer science programs.

In the applied units, the answers were similar. About the same percentage of undergraduates said they could not identify a role model (87.6%), while 62.0% of the master's students and 76.7% of the doctoral students said that was the case. On the issue of promotion of career interests, 84.7% of undergraduates, 68.4% of master's students, and 79.5% of doctoral students identified no faculty member. It needs to be said, however, that some students at all levels identified other people in their programs who may have helped them out or served as role models. Those people could have been academic advisers or other staff in the units. But since this paper is about faculty mentoring, we lumped those individuals with the "nobody" category.

For the series of questions related to mentoring, we adapted the mentoring scale developed by Noe (1988) (See Appendix I for the list of questions). Several of the questions in this series were designed to tap the career development dimension (Nos. 1-8)

and others were aimed at reaching the psychosocial support dimension of mentoring (9-15). The responses to the series of questions by students at all levels reveal a disturbing pattern. For most of the 15 questions about half or more of the students at the undergraduate and master's levels responded that no male or female faculty member had performed the specific functions of mentors! Many more of the doctoral students identified male or female faculty who helped them with their careers, empathized with their situations, and nominated them for fellowships or internships. Overall it was surprising how many students at all levels perceived that few of the mentoring functions had been performed by their mentors (Tables 1-3 provides the detailed information).

We need to recognize that the student responses were self reported and based on personal perceptions, as were the faculty responses. It is entirely possible that faculty believe they offer and give assistance to students that students didn't consider or recall. But perceptions are very important. If students perceive that they are not wanted or cared for in their units, they may change majors or seek careers elsewhere even if they complete degrees in the discipline. If students do not perceive faculty support or encouragement, or did not feel they get either career or psychosocial support from their faculty, they are likely going to be less willing to continue with the program of study or to go onto the next level of education.

Our study was premised on an interest in determining what factors led to student satisfaction with their discipline. In order to delve further into the issue of student satisfaction, we further analyze data from undergraduate responses, rather than graduate or combined responses. The group of undergraduate students was the largest and this

larger number of responses makes it possible to engage in some additional statistical analyses.

Individual variables were meant to tap the career and psychosocial functions, but a factor analysis we conducted produced an additional factor. First we recoded the 15 mentoring variables into dummy variables to differentiate faculty mentoring from that provided by other individuals (0=other mentors or no mentor and 1=male or female faculty mentors). Since we intended to extract the maximum variance from these variables, we ran a principle component analysis on the 15 variables using Varimax rotation. Three factors emerged from the analysis. One of these was career mentoring. A second that included variables identified as career mentoring by Noe (1988), Kram (1983), and Kram and Isabella, 1985) we labeled "assignment mentoring." The third factor was psychosocial mentoring (See Table 4). Next we created scales from those factors and tested for reliability. Cronbach's alpha was .786 for career mentoring, .770 for assignment mentoring and .770 for psychosocial mentoring.

We then conducted a factor analysis on variables that tapped two constructs, satisfaction with the major and sense of belonging to the unit. Nine variables that were highly correlated with satisfaction with the major and sense of belonging to the unit were factor analyzed through a principle component analysis using Varimax rotation. One scale was computed based on the factor loadings for five variables tapping satisfaction with the major (Cronbach's alpha=.796)[3]. However, though other variables loaded on a

[3] Variables included in the scale included satisfaction with decision to major in IT, belief that the responded chose the best of all possible subjects to study, enjoyment with the school work in the major, the degree to which the major inspires the respondent to do his/her best and holding similar values to those in the selected field.

sense of belonging dimension, the alpha was too low to make a scale, keeping "sense of belonging" to the unit as a single variable to be used in a regression analysis.

As further support for the finding that mentoring may not be contributing to the students' sense of satisfaction with the major at the undergraduate level, we conducted multiple regression analyses to attempt to identify the variables that might predict to student satisfaction with their major. Using the satisfaction scale as the dependent variable, we used several demographic variables, the mentoring scales, the individual's sense of belonging to the unit and the number of close friends the individual reported in his/her unit as the independent variables. The regression model revealed standardized betas at a significant level ($p<.05$) for all mentoring variables, year in school, and sense of belonging (See Table 5). However, sense of belonging was far and away the most significant predictor of satisfaction (beta=.45). Further, assignment mentoring and career mentoring, though significant, revealed rather low-level betas (.099 and .131), and psychosocial mentoring was negatively related to satisfaction.

Because sense of belonging was such a strong predictor for satisfaction with the major, we conducted a regression analysis with that variable as dependent. We entered the three mentoring scales as independent variables along with demographic variables and number of close friends. In this case, the strongest predictor was the number of close friends in the unit (beta=.46), and the only other significant predictors were being in an applied IT discipline (beta=.144) (as opposed to being in computer science), and the career mentoring scale (beta=.13) (See Table 6). Though the beta is relatively small, compared to the number of close friends in the unit, the significance of the course of study of the student (applied IT) is in the direction hypothesized by the overall study.

Conclusion

In this study of faculty and student attitudes and experiences related to mentoring behavior and experiences, we were disappointed to find that undergraduate and graduate students do not perceive that faculty provide the mentoring services we might expect. And even though career mentoring and assignment mentoring were significant predictors of undergraduate student satisfaction in the major, their impact was minimal when compared with their sense of belonging in the unit which was largely dependent on the number of friends they had made in the program. Psychosocial mentoring was negatively related to satisfaction with the major. We don't know what is driving that relationship, but it could be that students who have problems seek out faculty for emotional support and despite that support, they continue to be dissatisfied with the major. We believe that all mentoring factors would have been much stronger predictors of both belonging and satisfaction if students had indeed really experienced mentoring to a greater extent. Clearly, those who do have such experiences value those experiences. Interestingly, gender was not a significant predictor of either satisfaction nor of sense of belonging, but since being in an applied discipline was a positive predictor of sense of belonging, our hypothesis that applied IT units are more women friendly is supported. In fact, they are more "student friendly, overall, which is good for everyone. But before those units begin congratulating themselves, they need to look at the low Beta levels and focus more on boosting mentoring programs. It is likely then that strong mentoring experiences are useful to both male and female students.

Faculty in this study reported having positive experiences with their own mentors in both undergraduate and graduate education. We believe that the reward system in

research one institutions does not adequately value faculty mentoring today—particularly when it comes to undergraduate students. Instead, faculty research productivity is the primary track to promotion and tenure. So when faculty need to make decisions about how to spend their time outside of the classroom, they may be forced to choose between providing more time to their students or their research. Perhaps the findings of this study will encourage deans and department chairs in IT disciplines to rethink their priorities. The discussion of the importance of mentoring—whether of men or women and whether in computer science or applied IT fields—needs to take place at a national level so that all programs agree to place more importance on time spent with students in their programs. Recruiting more students to study IT is only part of the process. We need also to retain them so they persist to graduation.

At the end of the student survey we provided a space for additional comments. As a final note to this analysis, we provide a few of those comments that illustrate the student frustration with the educational environment at their universities. An undergraduate CS major writes: "Most computer science classes are so large that there is little (if any at all) teacher-student interaction, which is unfortunate. Everyone is treated fairly, but learning is very impersonal." A student at another institution in the study said, "I found the faculty in computer science very unhelpful. I am switching my major to mathematics because of that." On the importance mentoring can provide, one student headed for graduate school in bioinformatics said, "If it wasn't for a certain faculty member, I would not be where I am today or even headed in the direction I am today." Another student commented that the department of informatics at his/her school "tries to hard to make a name for itself" and in doing so is "biased towards the top students." And

finally, two different students comment that completing the survey was depressing because “I realized that going to a big ten school and majoring in computer science makes personal interactions with professors just about impossible. It turns out personalityless programmers.” The second said “My school doesn’t have mentorship programs as far as I know. Reading those questions made me realize that the only person who cares about me getting a decent education is me.”

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Table 1
Percentage of undergraduates who identified male or female faculty mentoring (N=554)

	CS		Applied	
	Male faculty identified	**Female faculty identified**	**Male faculty identified**	**Female faculty identified**
Recommended you for challenging assignments that present opportunities to learn new skills.	19.1	2.2	14.4	3.8
Recommended you for assignments that helped you meet other students in your department or school.	11.4	4.5	12.3	4.3
Recommended you for assignments that involved personal contact with professors in other department.	7.8	1.8	7.0	3.8
Helped you finish assignments/tasks or meet deadlines that otherwise would have been difficult to complete.	14.6	2.2	13.5	3.4
Gone out of his/her way to promote your career interest.	10.6	2.9	10.8	4.5
Informed you about what is going on at higher levels in the schools or how external conditions are influencing the school.	17.3	2.7	13.2	4.7
Conveyed feelings of respect for you as an individual.	18.1	6.4	16.6	5.6
Conveyed empathy for the concerns and feelings you have discussed with him/her.	11.6	5.1	11.6	5.8
Encourage you to talk openly about anxiety and fears that detract from your studies.	5.2	4.5	6.3	4.0
Shared personal experiences relevant to your problems.	10.8	3.4	8.8	3.8
Shared history of his/her career with you.	22.9	4.7	17.9	2.9
Encouraged you to think about graduate school.	17.5	3.8	8.5	3.2
Served as a role model.	14.4	2.9	9.2	3.2
Displayed attitudes and values about the field similar to your own.	17.9	2.9	14.4	2.5
Recommended you for fellowships, scholarships or internships.	10.3	3.4	7.9	3.8

Table 2

Percentage of Master-level students who identified male or female faculty mentoring (N=642)

	CS		Applied	
	Male faculty identified	**Female faculty identified**	**Male faculty identified**	**Female faculty identified**
Recommended you for challenging assignments that present opportunities to learn new skills.	6.5	1.7	22.0	18.5
Recommended you for assignments that helped you meet other students in your department or school.	3.9	1.4	14.8	15.7
Recommended you for assignments that involved personal contact with professors in other department.	3.1	0.3	12.0	10.4
Helped you finish assignments/tasks or meet deadlines that otherwise would have been difficult to complete.	3.7	0.9	15.0	13.6
Gone out of his/her way to promote your career interest.	3.6	1.1	13.7	17.9
Informed you about what is going on at higher levels in the schools or how external conditions are influencing the school.	4.5	1.1	20.6	18.8
Conveyed feelings of respect for you as an individual.	6.5	0.8	24.8	31.8
Conveyed empathy for the concerns and feelings you have discussed with him/her.	3.6	1.2	15.4	29.0
Encourage you to talk openly about anxiety and fears that detract from your studies.	1.7	0.5	9.3	12.9
Shared personal experiences relevant to your problems.	3.6	0.8	12.6	18.8
Shared history of his/her career with you.	5.1	1.4	24.9	26.8
Encouraged you to think about graduate school.	4.2	1.1	16.4	10.9
Served as a role model.	5.1	0.9	16.7	21.3
Displayed attitudes and values about the field similar to your own.	5.3	1.2	19.8	22.0
Recommended you for fellowships, scholarships or internships.	5.1	0.9	14.2	15.1

Table 3
Percentage of Ph.D.-level students who identified male or female faculty mentoring (N=283)

	CS		Applied	
	Male faculty identified	**Female faculty identified**	**Male faculty identified**	**Female faculty identified**
Recommended you for challenging assignments that present opportunities to learn new skills.	44.2	6.7	19.8	6.7
Recommended you for assignments that helped you meet other students in your department or school.	26.9	4.59	13.8	7.1
Recommended you for assignments that involved personal contact with professors in other department.	24.0	4.9	13.1	5.7
Helped you finish assignments/tasks or meet deadlines that otherwise would have been difficult to complete.	25.4	4.2	11.7	4.9
Gone out of his/her way to promote your career interest.	28.6	4.6	12.7	7.8
Informed you about what is going on at higher levels in the schools or how external conditions are influencing the school.	39.6	4.6	13.4	7.8
Conveyed feelings of respect for you as an individual.	39.2	6.7	17.3	11.0
Conveyed empathy for the concerns and feelings you have discussed with him/her.	28.6	7.1	16.3	10.2
Encourage you to talk openly about anxiety and fears that detract from your studies.	17.7	2.8	10.6	4.6
Shared personal experiences relevant to your problems.	28.6	5.3	13.8	7.1
Shared history of his/her career with you.	35.0	6.0	18.4	7.1
Encouraged you to think about graduate school.	31.8	3.2	12.4	3.5
Served as a role model.	31.8	4.2	17.3	6.0
Displayed attitudes and values about the field similar to your own.	32.2	3.9	15.5	8.5
Recommended you for fellowships, scholarships or internships.	41.0	5.3	16.3	7.4

Table 4

Mentoring Factors*

Career Mentoring (Alpha=.786)

1. Faculty encouraged you to think about graduate school
2. Faculty served as a role model
3. Faculty displayed similar attitudes and values about the field
4. Faculty recommended you for fellowships, scholarships or internships
5. Faculty shared history of his/her career with you

Assignment Mentoring (Alpha=.770)

1. Faculty recommend you for assignments that help you meet other students
2. Faculty recommend you for challenging assignments
3. Faculty recommend you for assignments that help you make contact with other professors.
4. Faculty helped you finish difficult assignments/tasks

Psychosocial Mentoring (Alpha=.770)

1. Faculty encouraged you to talk about your anxiety and fears
2. Faculty shared personal experiences relevant to your problems.
3. Faculty displayed empathy ford your concerns and feelings.

*Other variables listed in the appendix loaded more equally across the three factors and were not included in the three types of mentoring listed here.

Table 5

Regression Analysis For Predicting Undergraduate Student Satisfaction with IT Major

Independent Variables	Standardized Beta	Significance
Gender	-.020	ns
Year in School	-.142*	.000
C.S. or Applied	.025	ns
Career Mentoring by Faculty	.131	.007
Assignment Mentoring by Faculty	.099	.042
Psychosocial Mentoring by Faculty	-.107**	.027
Sense of Belonging	.451	.000
Number of Close Friends	-.012	.000

Adj. R^2=.261

*Negative sign means that students closer to graduation are less likely to be satisfied with their major

**Negative sign means that satisfaction with the major is negatively related to receiving psychosocial mentoring from a faculty member

Table 6

Regression Analysis Predicting Undergraduate Students' Sense of Belonging

Independent Variables	**Standardized Betas**	**Significance**
Gender	.033	ns
Year in School	-.032	ns
CS or Applied IT	.144*	.000
Career Mentoring by Faculty	.125	.010
Assignment Mentoring by Faculty	.045	ns
Psychosocial Mentoring by Faculty	-.013	ns
Number of Close Friends in Unit	.461	.000

Adj R^2 =.275

***This means that being in an applied discipline, such as informatics or information systems is a positive predictor of satisfaction with the major

Appendix

Mentoring Questions From Web-based Survey of Students

*The next set of questions asks about mentors. Select the person most associated with the situation in your current program of studies:

1. Recommended you for challenging assignments that present opportunities to learn new skills
2. Recommended you for assignments that helped you meet other students in your department or school.
3. Recommended you for assignments that involved personal contact with professors in other departments.
4. Helped you finish assignments/tasks or meet deadlines that otherwise would have been difficult to complete.
5. Gone out of his/her way to promote your career interests.
6. Informed you about what is going on at higher levels in the school or how external conditions are influencing the school.
7. Encouraged you to think about graduate school.
8. Recommended you for fellowships, scholarships or internships
9. Conveyed feelings of respect for you as an individual.
10. Conveyed empathy for the concerns and feelings you have discussed with him/her.
11. Encouraged you to talk openly about anxiety and fears that detract from your studies.
12. Shared personal experiences relevant to your problems.
13. Shared history of his/her career with you.
14. Served as a role model.
15. Displayed attitudes and values about the field similar to your own.

*For each of the questions, respondents were asked to select a male faculty member, a female faculty member, another male (they defined), another female (they defined) or "not applicable" (meaning that no person fit the description).